THE DEVELOPMENT AND POLICY ANALYSIS OF LOW- CARBON STRATEGIES FOR THE SUB-SAHARAN AFRICAN AUTOMOTIVE SECTOR.

A dissertation approved by the Faculty of Environmental Sciences and Process Engineering at the Brandenburg University of Technology Cottbus, Germany in partial fulfillment of the requirement for the award of the academic degree of Doctor of Philosophy (Ph.D)
in Environmental and Resource Management

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DECLARATION

I hereby declare that this dissertation represents my original work, except where due reference is made, and that it has not been previously submitted in whole or in part at the Brandenburg University of Technology Cottbus (BTU) or to any other institution for degree, diploma or other qualifications.

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Anderson Gwanyebit Kehbila

DEDICATIONS

This work is dedicated to:

- My dear Father: Daniel Buma Gwanyebit
- My beloved Mother: Florence Odla Gwanyebit
- My fervent Brothers: Fofung Finlay Gwanyebit, and Dinga Eric Gwanyebit
- My lovely Sisters: Gein Misida Gwanyebit, Muni Collette Gwanyebit, and Kadoh Rita Gwanyebit.

May this be an appreciation for all the restless and selfless sacrifices you bestowed on me throughout my studies.

- My dear wife: Atenkeng Viola Gwanyebit

Your continuous support outside the university was very fundamental to the successful realisation of this work.

- All my Aunts, Uncles and other relatives who gave me the necessary support to go ahead.

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Paper II. Kehbila, A.G., Ertel, J., Brent, A.C. (2009) Strategic corporate environmental management within the South African automotive industry: Motivations, Benefits, Hurdles. Corporate Social Responsibility and Environmental Management, 16(6): 310-323.

Paper III. Kehbila, A.G., Ertel, J., Brent, A.C. (2009) Uptake of voluntary environmental management system initiatives by South African automotive industries. Journal of Corporate Citizenship, 35:54-66.

Paper IV. Kehbila, A.G., Ertel, J., Brent, A.C. (2009) Environmental Management, ecological modernisation and the policy process in the South African automotive industry. Business Strategy and Environment. DOI: 10.1002/bse.669

Paper V. Kehbila, A.G., Ertel, J., Brent, A.C. (2010) Auditing and communicating business sustainability: A South African perspective. Submitted to Sustainable Development.

Paper VI. Kehbila, A.G., Ertel, J., Brent, A.C. (2010) Scenario analyses and decision support tools for road transport in sub-Sahara Africa. In Press. The Africa-Berlin Conference.

Paper VII. Kehbila, A.G., Ertel, J., Brent, A.C. (2010) A Conceptual Stakeholder-Assisted representation and policy design framework for road transport in sub-Sahara Africa. Submitted to the Journal of Environmental Assessment Policy and Management.

ACRONYMS AND ABBREVIATIONS

AREED	African Rural Energy Enterprise Development
AU	African Union
AUC	African Union Commission
BS	British Standard
BSI	British standard Institute
CAN	Climate Action Network
CBU	Completely built-up Light Motor Vehicle
CERES	Coalition for Environmentally Responsible Economics
CC	Cylinder Capacity
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CEPS	Customs, Exercise and Prevention Service
CEM	Corporate Environmental Management
CIF	Cost, Insurance and Freight
CNG	Compressed Natural Gas
DEAT	Department of Environmental Affairs and Tourism
DME	Di-methyl Ether
EMAS	Eco-management and Audit Scheme
EM	Environmental Management
EMS	Environmental Management System
EMT	Environmental Management Tool
EU	European Union
GDP	Gross Domestic Product
GHG	Green House Gas
IAF	International Accreditation Forum
ICE	Internal Combustion Engine
IEA	International Energy Agency
ILAC	International Laboratory Accreditation Cooperation
IMS	Integrated Management Systems
IPCC	Intergovernmental Panel on Climate Change
IPP	Integrated Product Policy
IRCC	Import Rebate Credit Certificate
ISO	International Organisation of Standardisation
LCA	Life-cycle Analysis
LLC	Landlocked Country
LPG	Liquefied Petroleum Gas
MIDP	Motor Industry Development Programme
NAAMSA	National Association of Automobile Manufacturers of South Africa
NAACAM	National Association of Automotive Component & Allied Manufacturers
NDEMS	National Database on Environmental Management System
NGO	Non Governmental Organisation
OECD	Organisation of Economic Co-operation and Development
OEM	Original Equipment Manufacturer
OE	Original Equipment

PAC	Port of Cotonou
QMS	Quality Management System
TISA	Trade and Investment South Africa
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
UNESDD	United Nations Environment and Sustainable Development Division
WBCSD	World Business Council for Sustainable Development
R&D	Research and Development
RW	Release Warrant
SAM-PF	Stakeholder-Assisted Modelling and Policy Framework
SABS	South African Bureau of Standards
SADC	Southern African Development Community
SANAS	South African National Accreditation System
SANS	South African National Standard
SD	Sustainable Development
SGS	Société Générale de Surveillance
SME	Small and Medium-sized Enterprise
TC	Transit Country
TISA	Trade and Investment South Africa
WCED	World Summit on Sustainable Development
WTO	World Trade Organisation

ABSTRACT

This dissertation examines the structure of current vehicle mitigation initiatives of leading domestic trade policy proposals (emission reduction actions) of four major countries along the Gulf of Guinea after lead gasoline phase out in sub-Sahara Africa. The dissertation assesses these proposals based on establishing criteria for assessing domestic trade policy performance in curbing used vehicle emissions simultaneously with core sustainable development priorities. The dissertation argues that a more pronounced dilemma of synergies exist between vehicle emissions reduction and core development concerns as the major players target emissions too narrowly.

The dissertation seeks to bridge this major gap by proposing a stakeholder-assisted representation and a policy design framework for sustainable road transport in sub-Sahara Africa. This was achieved by extracting individual stakeholders' underlying concerns, interests, values, local knowledge and technical expertise through publicly available documentation and interviews and then constructing a conceptual systems model based on the inputs and best available science.

In order to cope with the uncertain developments in road transport energy system and climate in sub-Sahara Africa, the dissertation employs a scenario approach by constructing sets of desirable and undesirable characteristics to explore possible future developments of road transport in sub-Sahara Africa with technological change, policies, attitudes and preferences playing a pivotal role.

Next, the dissertation analyses and compares the levels of voluntary environmental management initiatives within the South African automotive Industry. It provides an insight into the behavioural patterns - drivers, barriers and benefits - of Small and medium-sized enterprises (SMEs) and larger South African automotive companies in their quests to engage in environmental change and determine if these patterns are similar to previous studies, as given in the literature, or if they differ, in what ways. Moreover, the dissertation assesses how external South African environmental auditors interpret and apply the central

requirements of ISO 14001 and their views about the efforts of certified organisations and the different models that could be used to ease EMS implementation and certification.

Finally, low-carbon strategies resulting from impact modelling have been provided within this dissertation but, in addition, the acceptance of recommended strategies is crucial towards a real added value for a stabilisation target.

Zusammenfassung

Diese Dissertation untersucht die Struktur der gegenwärtig durchgeführten Initiativen bezüglich einer Fahrzeugverringerung tonangebender Vorschläge im Bereich der Binnenhandelspolitik (Maßnahmen zur Emissionsreduzierung) von vier wichtigen Ländern entlang des Golfs von Guinea, nachdem Bleibenzin in Afrika südlich der Sahara eingestellt worden war. Die Dissertation bewertet diese Vorschläge, basierend auf der Festlegung von Kriterien, um die Ergebnisse der Binnenhandelspolitik bezüglich einer Senkung der Emissionen verwendeter Fahrzeuge einzuschätzen, wobei gleichzeitig entscheidende Prioritäten einer nachhaltigen Entwicklung bewertet werden. Die Dissertation argumentiert, dass ein ausgeprägteres Dilemma der Synergien zwischen der Reduzierung von Fahrzeugemissionen und den Anliegen einer grundlegenden Entwicklung besteht, da die Hauptakteure die Emissionen zu eng sehen.

Die Dissertation versucht, diese wesentliche Lücke zu überbrücken, indem eine, von Interessengruppen unterstützte Vertretung und ein Rahmen der Gestaltung im Hinblick auf Verfahrensweisen für einen nachhaltigen Straßentransport in Afrika südlich der Sahara vorgeschlagen werden. Dies wurde erreicht, indem zugrundeliegende Belange, Interessen, Werte, Ortswissen und technische Fachkenntnisse der einzelnen Interessengruppen durch öffentlich verfügbare Dokumentation und Interviews gewonnen und dann ein konzeptionelles Systemmodell auf Grundlage der Eingaben und der am besten verfügbaren Wissenschaft erstellt wurden.

Um mit den ungewissen Entwicklungen im Energiesystem des Straßentransports und mit dem Klima in Afrika südlich der Sahara zurechtzukommen, verwendet die Dissertation ein Herangehen in Form eines Szenariums, indem Zusammenstellungen wünschenswerter und nicht wünschenswerter Charakteristika erstellt werden, um mögliche, künftige Entwicklungen des Straßentransports in Afrika südlich der Sahara mit technologischen Veränderungen, Verfahrensweisen, Haltungen und Vorzügen, die eine entscheidende Rolle spielen, zu untersuchen.

Als Nächstes analysiert und vergleicht die Dissertation die Stufen der Initiativen hinsichtlich eines freiwilligen Umweltmanagements innerhalb der südafrikanischen Automobilindustrie. Sie gibt einen Einblick in die Verhaltensmuster – Einflussgrößen, Hindernisse und Vorteile – kleiner und mittlerer Unternehmen (KMU) sowie größerer Firmen auf ihrer Suche, sich in Umweltveränderungen einzubringen und zu bestimmen, ob diese Muster gegenüber früheren Studien ähnlich sind, wie in der Literatur angegeben oder ob sie sich unterscheiden und in welcher Art und Weise sie unterschiedlich sind. Weiterhin bewertet die Dissertation, wie die externen südafrikanischen Umweltprüfer die zentralen Forderungen von ISO 14001 interpretieren und anwenden, sowie ihre Ansichten über die zertifizierten Organisationen und die unterschiedlichen Modelle, die verwendet werden könnten, um die EMS-Durchführung und Zertifizierung zu erleichtern.

Schließlich sind innerhalb der Dissertation Strategien für einen niedrigen Kohlenstoffanteil, die aus einer Modellierung der Auswirkungen resultieren, vorgestellt worden. Zusätzlich jedoch ist die Akzeptanz der empfohlenen Strategien hinsichtlich einer wirklichen Wertschöpfung, die auf eine Stabilisierung zielt, entscheidend.

Section I

Background, Problem definition, Objectives and Dissertation Structure

CHAPTER ONE

Background

This chapter describes the necessary background information about sub-Sahara Africa and its automotive sector. In addition, background information of the Republic of South Africa from a purely ecological, social and economic perspective is provided. Finally, the fundamental importance of the South African Automotive industry is briefly presented.

1.1 Justification of Study Areas

This dissertation seeks to improve the environmental performance of used vehicle trade and the manufacturing industry in sub-Sahara Africa. From this premise, the dissertation is focused primarily on the integration of low-carbon strategies into used vehicle trade and the manufacturing of vehicles where adaptation strategies can provide greatest improvements in environmental performance at least cost.

In assessing the sustainability of used vehicle trade in sub-Sahara Africa, the dissertation examines the policy framework and other initiatives of four major countries along the Gulf of Guinea: Ghana, Nigeria, Cameroon and Benin. These countries were selected because they constitute the major transit countries (TC) for overseas exports and imports of landlocked countries (LLCs) in sub-Sahara Africa (Rebelo, 1992).

In our study of the importance of corporate sustainability within the sub-Saharan African vehicle manufacturing sector, the dissertation focuses primarily on the South African automotive industry. This is attributed to the fact that South Africa produced over 87% of Africa's vehicle output in 2005 (NAAMSA, 2006) and is made up of all the major multinational automobile manufacturers (TISA, 2003). Moreover, the industry is ranked 21st in terms of vehicle production in 2005 ahead of countries such as Indonesia, Taiwan, Australia, Sweden and Argentina (International Organisation of Motor Vehicle Manufacturers, 2006).

1.2 Overview of sub-Sahara Africa

Sub-Sahara Africa is the area of the African continent south of the Sahara. Contrary to North Africa – Algeria, Egypt, Libya, Morocco, Tunisia, Western Sahara - which is part of the Arab world, sub-Sahara Africa consists of 48 countries covering an area of 24.3 million square kilometres (The world Bank group, 2006), with 93% of its land area lying between the tropics of cancer and the tropics of Capricorn (Bloom and Sachs, 1998) (figure 1.1). With a human population of 800 million in 2007 and a growth rate of about 2.4% (World Development Indicators database, 2008) sub-Sahara Africa is the poorest region in the world, suffering from the effects of economic mismanagement, local corruption and inter-ethnic conflict (Bloom and Sachs, 1998). Unless there is a substantial decline in the staggering birth rates, human population growth for the region will peak 1.5 billion by 2050 (World Population Prospects, 2006)

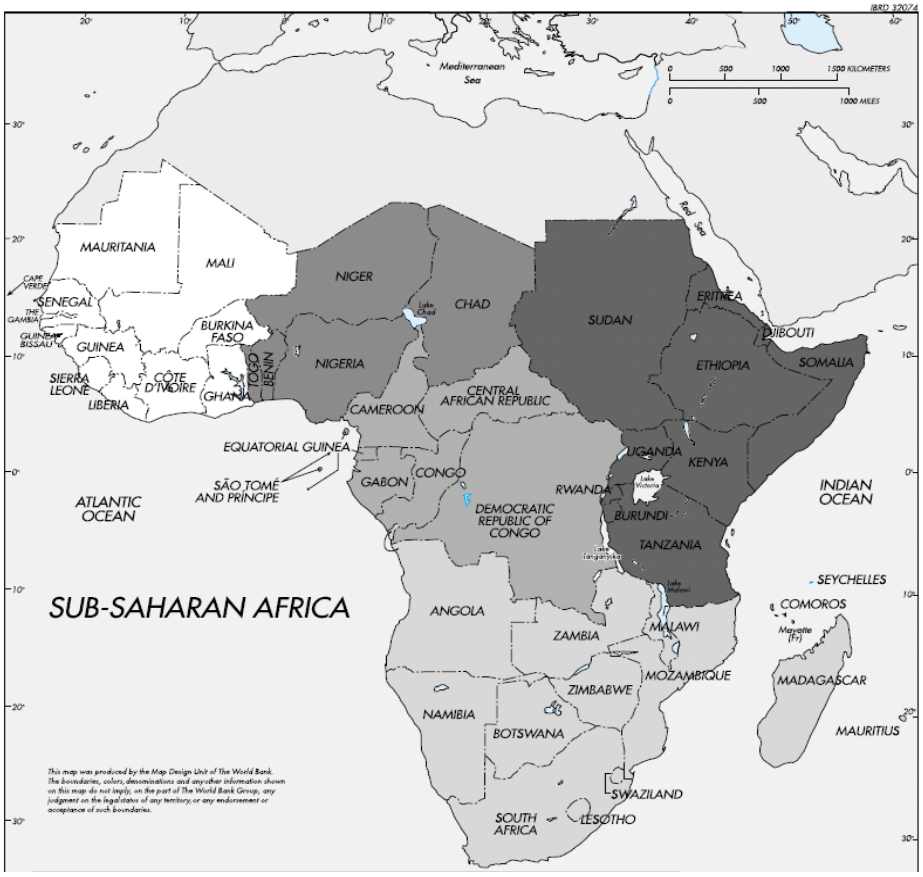


Figure 1.1 Map of sub-Sahara Africa
(Source: World Bank group, 2006).

1.2.1 The sub-Saharan African Automotive Sector

In 2005, the estimated vehicles in use in Africa amounted to 905,818,884 (NAAMSA, 2007). Apart from a handful of sub-Saharan African countries that have an indigenous motor vehicle industry, most of the countries in the region depend on the industrialised nations for supply of motor vehicles and accessories (Faiz et al. 1990) This is attributed to low-income solutions to daily commuting combined with the fast pace of urbanisation and motorisation (Ndoke and Jimoh, 2005). With most of this growth in vehicle holdings with an average fleet age of 12 to 15 years in many sub-Saharan African countries, compared with 6 to 8 years in the OECD, emissions per kilometre travelled tend to be high in this region, both because older fleets mean that more vehicles were built to lower design standards and because vehicle emissions tend to increase with vehicle age (Harrington and McConnell, 2003).

1.3 Overview of South Africa

South Africa is located at the southern tip of the African continent with a total surface area of 1,219,912 sq km along a coastline that stretches more than 2,798 kilometres. The country is bordered to the west by the Atlantic Ocean and to the east by the Indian Ocean. To the north lie Namibia, Botswana, Zimbabwe, Mozambique and Swaziland, while the Kingdom of Lesotho is an independent enclave surrounded by South African territory (CIA, 2009) (figure 1.2).

Figure 1.2 Map of the Republic of South Africa
(Source: CIA, 2009)

According to statistics South Africa (2008), South Africa is a nation of diversity, with a demographic population of 48,687,000 in 2008 and a variety of cultures, languages and religious beliefs (figure 1.3).

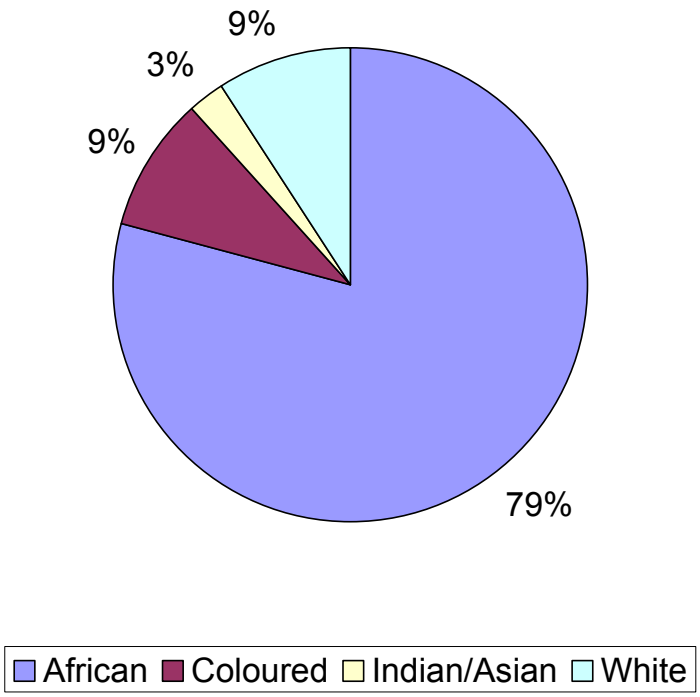


Figure 1.3 Mid-year estimates for South African by population and group
(Source: Statistics South Africa, 2008)

The country consists of 9 provinces of which Gauteng generates 37% of the country's GDP with Johannesburg rated the cheapest major city in the world (Trade and Investment South Africa, 2003).

1.3.1 The South African Automotive Industry

The South African automotive industry dates back to the 1920s when Ford and General Motors established assembly plants in the country, in 1924 and 1926 respectively (Hartzenberg and Muradzikwa, 2002). The industry, which operates as multinational companies, incorporates the manufacture, distribution, servicing and maintenance of motor vehicles and components with original equipment manufacturers (OEMs) being the critical role players (Smink et at. 2006). As Africa's premier automotive market, the automotive industry is the leading

manufacturing sector in the South African economy contributing during 2005 to 28% of manufacturing output (NAAMSA, 2006). Recently, the automotive industry has grown into one of the most successful in the post-apartheid era, contributing in 2005 an excess of Rand 201,7 billion to the nation's income, which amounts to 7,64% of the country's Rand 523 billion Gross Domestic Product after mining and financial services. Although the industry is responsible for only 0.8% of the world's vehicle production, it produced over 87% of Africa's vehicle output in 2005 (NAAMSA, 2006). The industry is made up of all major multinational automobile manufacturers (TISA, 2003) and is ranked 21st in terms of vehicle production in 2005 - ahead of countries such as Indonesia, Taiwan, Australia, Sweden and Argentina (International Organisation of Motor Vehicle Manufacturers, 2006). It employs more than 322 570 people, accounts for nearly 20% of the nation's total industrial investment in 2006 and provides high quality, affordable vehicles and components to domestic and international markets (NAAMSA, 2006).

1.3.1.1 Location of the Industry

The South African automotive industry is located in three geographic clusters - Port Elizabeth/East London, Durban/Pinetown and Pretoria/Johannesburg – with geographic proximity facilitating inter-firm interaction between vehicle assemblers and components manufacturers (figure 1.4) (Hartzenberg and Muradzikwa, 2002).

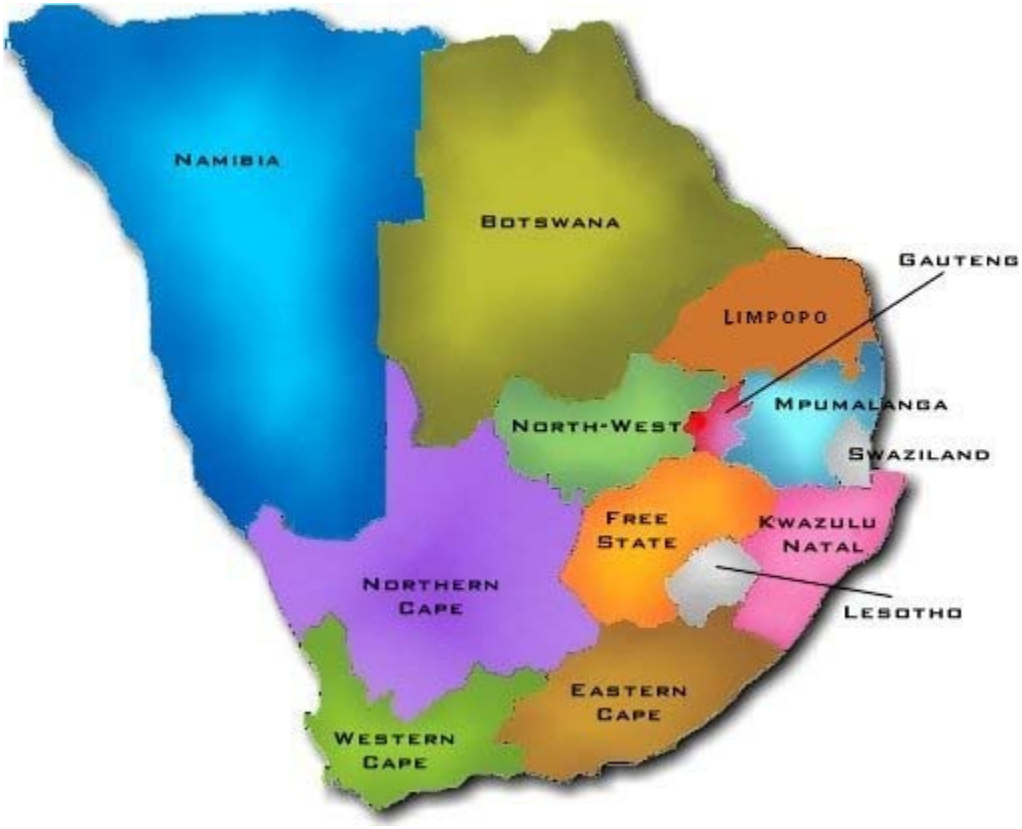


Figure 1.4 Manufacturer/Importer locations (Source: NAAMSA, 2008)

WESTERN CAPE	NORTHERN CAPE	KWAZULU NATAL
AFRICAR	ASIAWING	FORCE MOTORS
FERRARI	DFM	MAN
MASERATI	FUDI	SOYAT
		TOYOTA

EASTERN CAPE		
AUDI	MERCEDES	VOLKSWAGEN
CADILLAC	MITSUBISHI	ISUZU
CHEVROLET	OPEL	HUMMER
FUSO	SAAB	SEAT

GAUTENG

- ALFA ROMEO
- ASTON MARTIN
- BENTLEY
- BMC
- BMW
- CAM
- CHANA
- CHERY
- CHRYSLER
- CITROEN
- CMC
- DAF
- DAIHATSU
- DODGE
- ERF
- FAW
- FIAT
- FORD
- FOTON
- FREIGHTLINER
- FUSO
- GEELY
- JAGUAR
- JEEP
- KIA
- LAMBORGHINI
- LAND ROVER
- LEXUS
- LOTUS
- MAHINDRA
- MAN
- MAYBACH
- MAZDA
- MEIYA
- MERCEDES
- MG
- MINI
- MITSUBISHI
- MORGAN
- NISSAN
- NISSAN DIESEL
- PEUGEOT
- POLARSUN
- PORSCHE
- HONDA
- HYUNDAI
- INTERNATIONAL
- IVECO
- ROLLSS-ROYCE
- ROVER
- SCANIA
- SMART
- SSANGYONG
- SUBARU
- SUZUKI
- TATA
- TOYOTA
- TVR
- VDL
- VOLVO
- WESTERN STAR
- RENAULT
- PROTON
- GWM
- HAFEI
- GONOW

1.3.1.2 The Motor Industry Development Programme (MIDP)

The MIDP was first introduced in 1995 in an attempt to ease the transition from a highly protected automotive industry to one that is re-integrated into a globally competitive environment (Bell and Madula, 2003). Previous strategies were aimed at developing the domestic industry by imposing local content requirements and placing high tariffs on imports**.** The MIDP was the next stage in this process and was aimed at developing an internationally more competitive and growing automotive industry which would be able to (Trade and Investment South Africa, 2003):

- provide high quality and affordable vehicles and components to the domestic and international markets by encouraging the modernisation and upgrading of the automotive industry
- provide sustainable employment through increased production;
- make a greater contribution to the economic growth of the country by increasing production and achieving a significant increase in the balance of trade of the motor industry.

According to Flatters (2005) and Trade and Investment South Africa (2003), the provision of the MIDP policy framework is buttressed by five core elements:

- The gradual reduction in the Rates of import duties on completely built-up light motor vehicles (CBU) and original equipment components (OEM) so as to expose the industry to greater international competition;
- An export-import scheme enabling vehicle and components exporters to earn tradable import rebate credit certificates (IRCCs), against which they can offset duties on imported vehicles and components;
- Access to duty rebates for exporters, making it possible to rebate all import duties paid on components and intermediate inputs used in exported vehicles;
- A duty-free allowance on imported components of 27% of the value of vehicles produced for the South African market and, the abolition of local content requirements expressed as a proportion of the component weight and value of the vehicle which had to be produced in South Africa.

The phase-out of local content requirements led to substantial decline in the share of locally sourced OE components in total OE component usage, with virtually all the decline occurring between 1999 and 2001. On that score, subsidising foreign competition against import-competing domestic producers undeniably had a negative impact on the demand for locally produced OE components in the 1990s, and hence on the state of the components manufacturing sector (Bell and Madula, 2003).

1.4 The Johannesburg World Summit on Sustainable Development

The Johannesburg declaration on Sustainable Development heightened a systems approach to integrating renewable energy and end-use energy efficiency in transportation systems (United Nations, 2002). Responding to this declaration, the South African government introduced a Biofuels Draft Strategy that seeks to achieve a biofuels average market penetration of 4.5 % of liquid road transport fuels (petrol and diesel) by 2013, which will contribute 75 % to the national Renewable Energy target (Department of Minerals and Energy, 2006).

A central aspect of the 2002 Johannesburg world summit included technology exhibition on power train and fuel technologies that make efficient use of energy and reduce pollutant emissions. Exhibits such as the Lupo 3L-TDI and Audi A2 TDI cars, which consume only 3 litres of fuel per 100 km, fuel-cell propulsions systems as in the Bora HY.POWER and, as a particular highlight, the 'one-litre car', were part of Volkswagen's innovative technological research and development work. Technology exhibition equally featured Toyota's Estima Hybrid minivan - gasoline/electric - and the hydrogen-powered FCHV-4 prototype .Featuring as well was the BMW’s zero litre car: a hydrogen powered car with clean emissions; one that does not require gasoline or diesel fuel (Automotive Intelligence News, 2002).

1.5 Chapter Summary

This chapter provided the necessary background information about the sub-Saharan African automotive sector and described the fundamental importance of South Africa, its automotive industry and the World summit on sustainability. In the next chapter, the rationale, objectives and dissertation structure are presented.

CHAPTER TWO

The Rationale, Objectives and Dissertation Structure

In this chapter, the rationale, objectives and the outline of the dissertation are presented. The chapter commences with the rationale of the dissertation, which is aimed at supporting the significance of the study. The chapter ends with the objectives and the outline of the dissertation.

2.1 Rationale of Dissertation

The transportation sector is increasingly being recognised as the highest polluter in key African cities (UNEP, 2005). This is attributed to the rapid pace of urbanisation and the growing sizes of motor vehicle fleets (Ndoke and Jimoh, 2005; Figueroa et al. 2004) coupled with the use of less efficient fuel-burning technologies (IPCC, 1995). With most of this growth in vehicle holdings with an average fleet age of 12 to 15 years in many African countries, compared with 6 to 8 years in the OECD, emissions per kilometre travelled tend to be high in this region, both because older fleets mean that more vehicles were built to lower design standards and because vehicle emissions tend to increase with vehicle age (Harrington and McConnell, 2003). From this premise, total emissions emanating from the region are projected to surpass those of their industrialised counterparts (Western Europe and North America, Japan) within a decade or two (Watson et al. 2005) (figure 2.1).

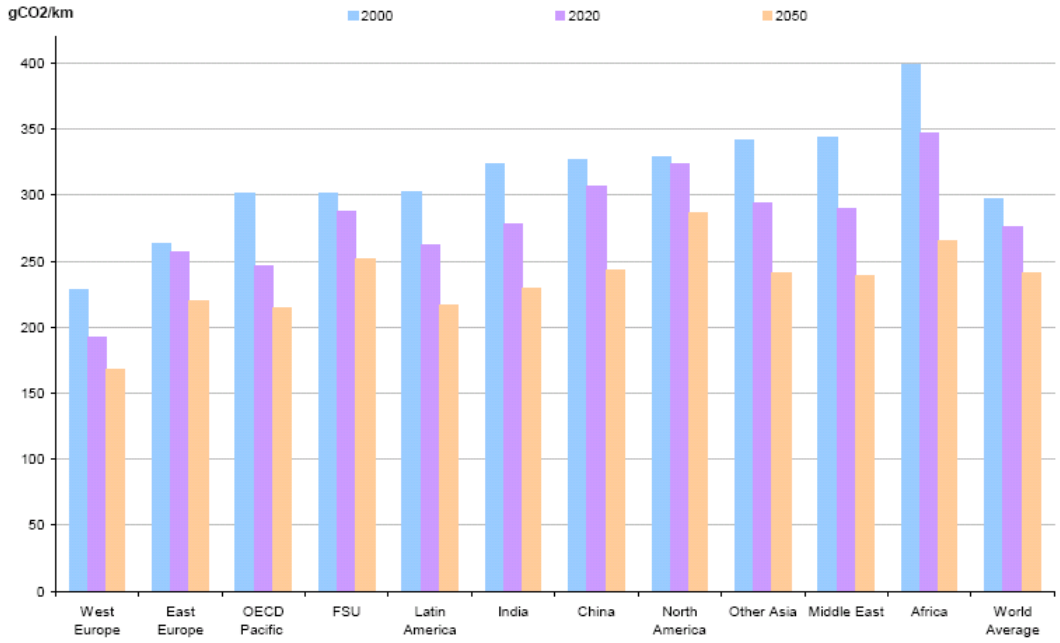


Figure 2.1 GHG emissions intensity of automobile stock by region (Source: WBCSD, 2004).

This growth in vehicle emissions has, to a large extent, diminished Africa's carrying capacity posing a significant threat to human health, ecosystems on which livelihoods depend, materials and infrastructure, climate change and biodiversity (UNEP, 2005; Janischweski et al. 2003). In spite of this, the sector has produced relatively few mitigation projects within the mechanisms of the Kyoto Protocol. While the European Union (EU) has implemented stringent vehicle emissions reduction targets as well as a robust compliance system under the Kyoto protocol, sub-Saharan African countries see climate change mitigation (vehicle emissions reduction technologies) to be in competition with economic growth and poverty alleviation: money invested in climate change mitigation is money diverted from economic growth and poverty alleviation (Heller and Shukla, 2003). Consequently, sub-Saharan African governments have continued to focus overwhelmingly on a few priority concerns such as food security and poverty alleviation, which are threatened by many factors including, at the margin, climate change and increased capacity and efficiency in the energy and transport services that underpin economic growth (Heller and Shukla, 2003).

To intervene against these impacts in sub-Sahara Africa, various interested stakeholders have pursued many initiatives aimed at reducing or eliminating atmospheric emission (UNEP, 2005) in order to avert the gravest potential consequences of climate change and to prepare for adverse effects that cannot be avoided (Byers and Snowe, 2005; Climate Action Network, 2003). Despite these initiatives, vehicle emissions in the region will continue to grow steadily in the future. Besides, the overall effectiveness and efficiency of the leading vehicle trade policy options adopted independently after lead gasoline phase out in the region has not been properly addressed in the relevant literature. Present paradigms are indeed stalemate. Thus questions concerning the causes and the effects of used vehicle trade and the potential influence of environmental policies lack tangible answers, as the environmental success of various import policies in this region is largely unknown (Janischweski et al. 2003). On that score, the major questions regarding sustainable vehicle distribution and use arise:

- Is the current used vehicle trade model proposed by key players sustainable? If not, what instruments/tools/approaches need to be integrated to achieve sustainable development?
- How best to orient stakeholders' action to the ultimate objective of stabilising road transport emissions in sub-Sahara Africa and how best can agreements be arrived at that are fair?
- How could future routes of road transport and its environmental implications in sub-Sahara Africa look like?

In recent times, the confines of regulatory and economic instruments have facilitated the development of voluntary initiatives for environmental management within the corporate arena. To this end, the last decade of the 20th century witnessed rapid growth in the adoption of voluntary environmental management (EM) initiatives by industries worldwide with the publication of ISO 14001 environmental management system (EMS) in 1996. However, the adoption of the standard, in developing countries, especially in Africa has been rather slow and differs greatly across the continent due to extensive and incomprehensive

legislation, a lack of clear government policy, support and encouragement (Smink et at. 2006; Studer et al. 2005).

In South Africa, the automobile manufacturing industry forms the backbone of the economy (NAAMSA, 2006) and has a considerable cumulative propensity to pose a significant threat to the natural environment, health and safety (Department of Environmental Affairs and Tourism, 2002). This sector, like any other manufacturing sector has recently developed to be a highly regulated industry and attracts a high level of public interest, so much so that the South African government is keen to encourage the adoption of voluntary environmental management initiatives such as ISO 14001.

In responding to this agenda, some automobile manufacturing companies have now implemented the ISO 14001 environmental management system, making use of third-party auditing and conformity certification of environmental management systems. While a wealth of EMS studies abounds in the literature, the lack of sector specific material for EMS implementation as well as third-party auditing within the African context has been a setback. On this score, the dearth of baseline data on EMSs formulated by South African automotive companies as well as the challenges of the auditing community in evaluating the certification system raises the following questions:

- What are the current compliance-plus environmental initiatives, certification trends and mentorship programmes embedded within the South African Automotive Industry?
- What are the drivers, barriers and benefits accrued in implementing a certified EMS by South African Automotive companies?
- What are the experiences of external environmental Auditors and their opinions on different models used to ease implementation and certification of EMS especially in SMEs?
- What are the average costs of certification for SMEs and large corporations?

Examining the implementation process in the South African automotive milieu therefore offers real-time opportunities to determine:

- Approaches in setting goals and measuring progress in environmental performance.
- The factors that have contributed, or will contribute, to improved industrial environmental performance.
- The relative successes and shortcomings of current methods of measuring industrial environmental performance.
- External environmental auditors' experiences in evaluating the South African certification system as it continues to grow and evolve.

The above core problems and their sub-elements are brought together and are depicted in figure 2.2. These problems fall within five major categories, which include: unsustainable used vehicle trade (study 1), high regional vehicle emissions (study 2), uncertainty in future road transport energy system development (study 3), dearth of EMS literature in the energy intensive South African automotive industry (studies 4 and 5), and a lack of third party auditing literature from a South African perspective (study 6).

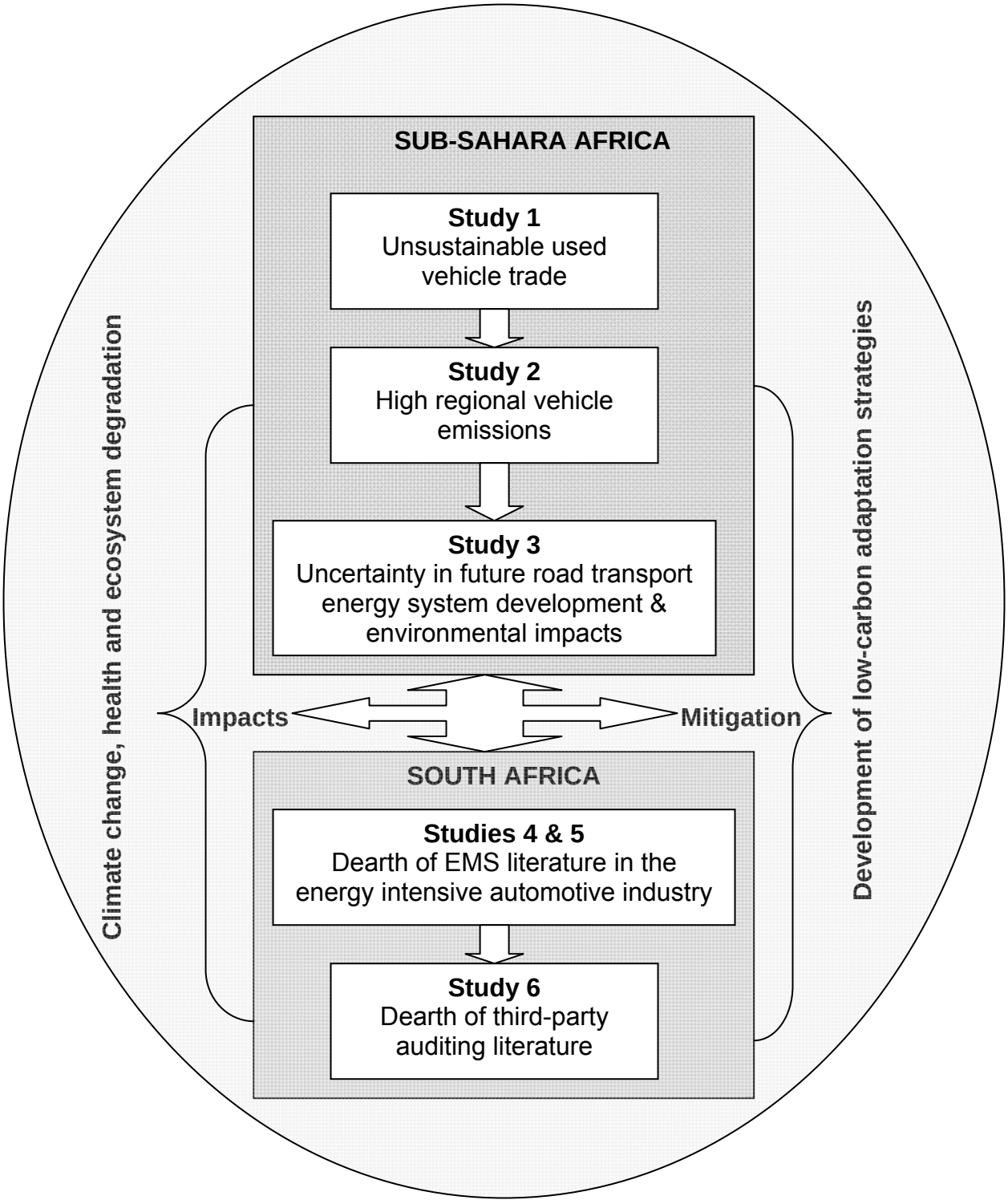


Figure 2.2 An integrated schematic representation of the problem structure

2.2 Dissertation Objectives

This study seeks to analyse adaptation strategies embedded within the sub-Saharan African Automotive sector and to develop target strategies/decision support tools to improve acceptance of low-carbon strategies thus expanding efforts and participation. On this score, the study aims at collecting data and statistics to improve the environmental performance of used vehicle trade and the manufacturing industry in the region. However, instead of applying a life-cycle analysis (LCA) approach to identify and assess the impacts of producing and disposing of vehicles, this research is focused primarily on the integration of low-carbon strategies into distribution, use and manufacturing of vehicles where adaptation and mitigation strategies can provide greatest improvement in environmental performance at least cost. To this end, the research seeks to examine the policy framework and other initiatives of four major countries along the Gulf of Guinea in as much as used vehicle trade is concerned. Moreover, the study considers the potential role of EMSs and third party-auditing in enhancing the environmental performance of the South African automotive industry. To this end, the specific considerations and objectives of this dissertation are:

- To critically assess used vehicle trade policy options adopted by five key players along the Gulf of Guinea and to assess each option against assessment criteria that makes the link between used vehicle trade and broader political objectives.
- To analyse and develop low-carbon adaptation and mitigation strategies/decision support tools for reducing regional vehicle emissions in a stakeholder-centered approach.
- To explore possible future routes for road transport in sub-Sahara Africa and their environmental implications over the coming decades.
- To identify and classify the main existing trends and models that are used to facilitate the implementation and certification of ISO 14001 within the South African Automotive Industry.

- To ascertain the main motivating factors, barriers and organisational benefits of EMSs implementation within the South African automotive industry.
- To assess the experiences of external environmental Auditors and their opinions on different models used to ease implementation and certification of EMS especially in SMEs.
- To ascertain the average costs of EMS certification for SMEs and large corporations.

2.3 Dissertation Structure

This dissertation comprises of four major sections subdivided into eleven chapters as illustrated in figure 2.3.

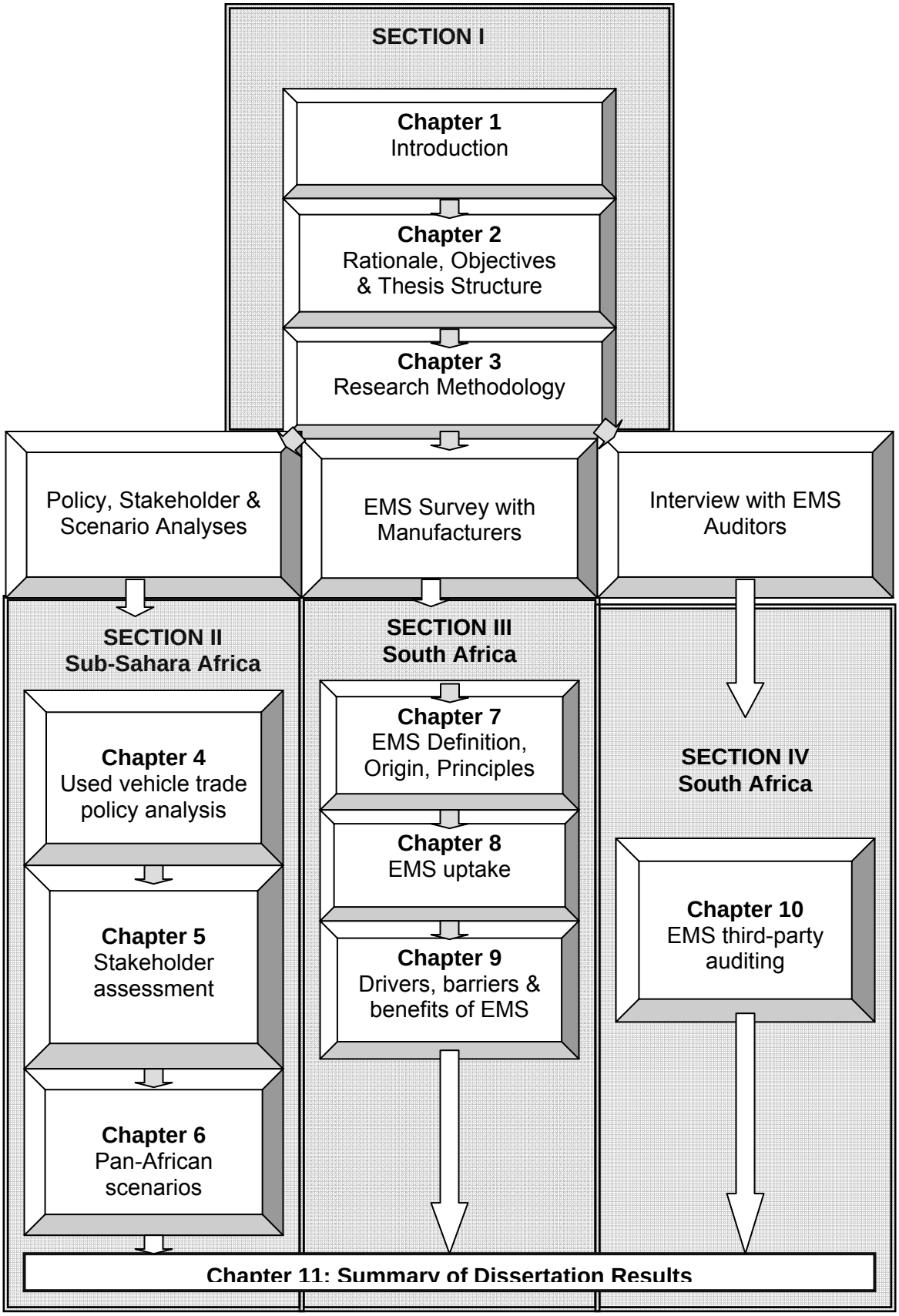


Figure 2.3 Dissertation flow diagram

Section I (Chapters 1, 2 and 3) provides the necessary background information about the sub-Saharan African automotive sector. In this section, the rationale, objectives and methodology employed are equally presented. The section ends with an outline of the dissertation.

In section II (Chapters 4, 5 and 6), the policy framework regulating vehicle distribution and use in sub-Sahara Africa is assessed against assessment criteria that makes the link between sustainable used vehicle trade and broader political objectives. Next, this section proposes a stakeholder-assisted representation and policy design framework for sustainable road transport in sub-Sahara Africa as well as the associated implementation strategies that serve the needs of ongoing regional discussions. The final chapter of this section explores possible future scenarios for road transport in sub-Sahara Africa and their environmental implications over the coming decades.

Section III (Chapters 7, 8, and 9) provides a brief description of the fundamental principles of an EMS. In this section, the uptake of voluntary environmental management (EM) initiatives by South African automotive industries after the publication of ISO 14001 environmental management system (EMS) is equally accounted for. In addition, the drivers, barriers and the organisational benefits of implementing a certified EMS are equally presented. This is followed by section IV (chapter 10), which assesses South African external environmental auditors' experiences in evaluating the ISO 14001 system as certification continues to grow and evolve. Finally, a summary of dissertation results is presented in Chapter 11.

2.4 Chapter Summary

Within this chapter, the research problem, structure, the aim and objectives pursued in order to decipher the problem were presented. Research questions, derived from the literature review, were also presented. The upcoming chapter will present the methodology used when conducting the research and will also explain how the research strategy was applied for this specific study.

CHAPTER THREE

Research Methodology

This chapter aims to provide the reader with the methodology and methods utilised when conducting the research. The nature and objectives of the methods employed will be described.

3.1 Core Methodology

A research methodology is the theory or study of how research ought to be carried out (McIntyre, 2005; Dawson, 2002). It refers to the process, principles and procedures by which researchers approach problems and seek answers (Bogdan and Taylor, 1975). It comprises of data collection, organisation and interpretation (Riley, 1963).

In this study, a cyclical methodology and action research model was employed. According to Frost (2002), action research is a process of systematic reflection, enquiry and action carried out by individuals about their own professional practice. Furthermore, Dick (2003) indicated that systematic reflection is a process used to review the previous action and plan for the next one. In order to provide a better understanding of the action research model, a range of authors (Susman, 1983; MacIsaac, 1995; Bassey, 1998; Cryer, 2000; Dirk, 2002; Robson, 2002) have characterised the model into four processes including: plan, act, observe and reflect. This involves identifying or defining a research problem, planning and executing the activity, observing the outcome, re-assessing the problem and the outcome and deciding on the next activity until the problem is resolved. On this score, the four-tier research methodology employed in this study is illustrated in figure 3.1.

Figure 3.1 The action research model employed in this study

The action research model illustrates that the research process involves multiple cycles of planning, acting, analyzing and reflecting. Such reflections lead to the identification of a particular problem or issues that are missing in the literature and require further research (Dick, 1997). By completing each cycle, findings from the research become the starting point for developing an action plan. The cycle begins again from planning to reflection (Susman, 1983). This method led to six studies within the sub-Saharan African automotive sector. The nature and objectives of the five action plans (Acts 1-5) are discussed below.

3.1.1 Act 1: Impact Assessment of Policy Options

The first action plan of this research assesses the effects of used vehicle trade policy options of four major countries along the Gulf of Guinea according to some fundamental dilemma in sustainable vehicle distribution and use. On that score, the plan employs an integrated modelling framework to assess each option against assessment criteria that incorporates the three pillars of sustainability in a balanced manner: Environmental effectiveness, economic efficiency and the principle of common but differentiated responsibility. Finally, a series of recommendations that in the future could serve to improve environmental performance of road transport in sub-Sahara Africa are prescribed.

3.1.2 Act 2: Indirect Stakeholder Assessment

The second plan seeks to investigate the perception and acceptance of adaptation strategies in a stakeholder-cantered approach by extracting inputs from individual stakeholders through publicly available documentation and interviews and then constructing a systems model based on the inputs, which is then sent to individual stakeholders and an outside “peer review” process for feedback and validation.

3.1.3 Act 3: Scenario Analysis

The third plan was aimed at exploring possible future routes for road transport in sub-Sahara Africa and their environmental implications over the coming decades with the energy system, security of supply, and technological change playing a

pivotal role. On that score, the plan employs a bottom up modelling framework based on scenario planning and modelling (systems modelling) and implementation and organisational learning (systems practice) to examine several different ways in which a stabilisation target might be interpreted.

3.1.4 Act 4: Questionnaire Survey

The fourth plan of this research seeks to identify and classify the main existing trends and models that are used to facilitate the implementation and certification of ISO 14001 within the South African Automotive Industry and see how different actors use the models. A detailed questionnaire was drafted and administered to a selection of South African manufacturing companies. The questionnaire sought to unravel the voluntary environmental management initiatives embedded within the South African automotive industry along with the ongoing challenges involved with participating in these initiatives.

3.1.5 Act 5: In-depth Interviews

The fifth plan explores how external environmental auditors interpret and apply the central requirements of ISO 14001 and their views about the efforts of certified organisations and the different models that could be used to ease EMS implementation and certification. A qualitative approach was taken to interviewing in order to gain a better idea of the interviewee's opinions in order to identify any potential aspects of the research that could be expanded on.

3.2 Chapter Summary

Within this chapter the research methodology employed for this study has been described, looking at the rationale for the cyclical methodology and action research model employed. In the next chapter, the secondary findings of used vehicle trade policy options are discussed according to some fundamental dilemma in sustainable vehicle distribution and use.

SECTION II

POLICY AND REGULATORY FRAMEWORK

CHAPTER FOUR

Sustainability Appraisal of Used Vehicle Trade Policy Options in sub-Saharan African Countries.

This chapter examines the structure of contemporary vehicle mitigation commitments after lead gasoline phase out in sub-Sahara Africa. First the chapter reviews some of the leading domestic trade policy proposals (emission reduction actions) with regard to their expected technology impacts. Next the chapter assesses the options based on establishing benchmarks for measuring policy performance in curbing vehicle emissions simultaneously with core sustainable development priorities. Assessing these options identifies the key variables in designing mitigation commitments, offers criteria for evaluating different approaches, and discusses the implications of the leading alternatives. Finally the chapter proffers strategies that could be employed simultaneously at the regional and domestic levels to enhance sustainable development as trade continues to grow and evolve.

4.1 Introduction

In recent times, there has been increasing concern about urban air pollution in developing countries caused by high emissions from inefficient road transport systems (United Nations Environment and Sustainable Development Division 2004). Ideally road transport contributes 73% of the 13% of carbon dioxide emitted by the transport sector. And unlike the other sectors, 90% of emissions are emitted during the use of automobiles rather than their production (Watson et al. 2005). In spite of this trend, the transfers of second-hand vehicles to developing countries has gradually evolved to become an important business sector almost unnoticed and does not yet play a role of any significance in public debate (Janischweski et al. 2003; Figueroa et al. 2004). While enterprises in developing countries have recognised that second-hand vehicles from industrialised countries represent a low-cost and fast solution to the problem of rapid deterioration of public transport and the replacement of “outdated transport

modes", dealers from industrialised countries have discovered the market gap and are now extremely active in this field (Janischweski et al. 2003). With most of this growth in vehicle holdings with an average fleet age of 12 to 15 years in many developing countries, compared with 6 to 8 years in the OECD, emissions per kilometre travelled tend to be high in these regions, both because older fleets mean that more vehicles were built to lower design standards and because vehicle emissions tend to increase with vehicle age (Harrington and McConnell 2003).

While greenhouse gas emissions from motor vehicles may not be a serious concern for developing countries at present, the rapid pace of urbanisation and even the faster pace of motorisation will change the situation in future (Figueroa et al. 2004). On a per capita basis, vehicle emissions from developing countries will remain far below those of their developed counterparts well into the future but total emissions from developing countries are projected to surpass those of developed countries within a decade or two (Sustainable Mobility Project, 2004) (figure 4.1). Such high emissions rate has to a large extent diminished the carrying capacity of most developing countries posing a significant threat to human health, ecosystems on which livelihoods depend, materials and infrastructure, climate change and biodiversity (UNEP 2005, Janischweski et al. 2003)

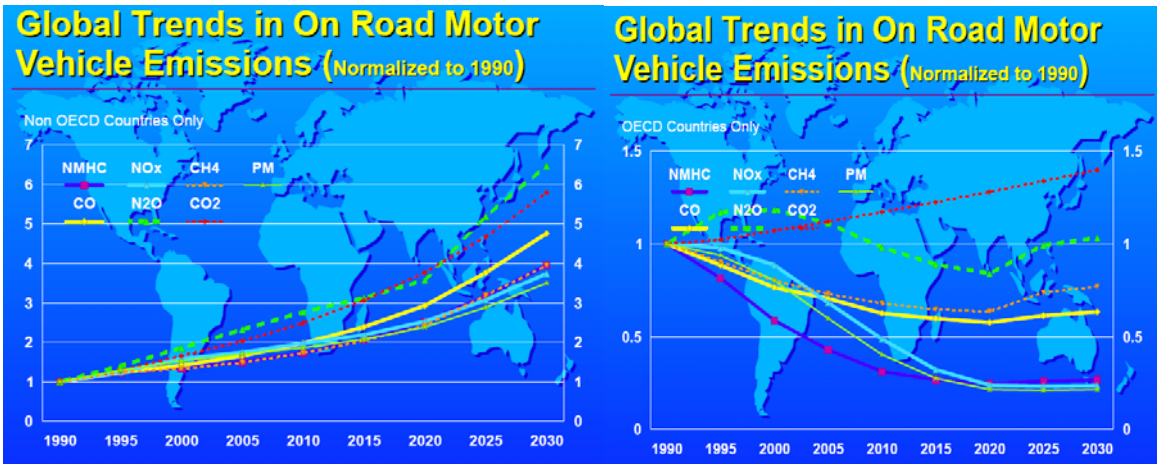


Figure 4.1 Global on road motor vehicle emissions of OECD and non OECD countries
(Source: Walsh, 2000)

Attributed to the above rising trend in vehicle emissions are the growing sizes of motor vehicle fleets and the use of less efficient fuel-burning technologies in developing countries (IPCC, 1995; Ndoke and Jimoh, 2005) contrary to their developed counterparts with stringent emissions reduction targets reinforced by a robust compliance management system (Heller and Shukla, 2003).

However, questions concerning the causes and the effects of used vehicle trade and the potential influence of environmental policies lack tangible answers, as the environmental success of various import policies in developing countries is largely unknown (Janischweski et al. 2003). Yet development politics within the current fractured decision-making context of negotiation in many developing countries continue to focus overwhelmingly on a few priority concerns such as food security and agriculture, which are threatened by many factors including, at the margin, climate change and increased capacity and efficiency in the energy and transport services that underpin economic growth (Heller and Shukla, 2003).

The current “patchwork” scheme of regulatory, financial, and technology incentives that has evolved in various parts of the world is not conducive to a cost-effective and efficient approach to the problem of combating climate change (World Economic Forum, 2005). On that note, bringing developing countries on board is essential for meaningful reductions in green house gas emissions (Jotzo and Pezzey, 2005) especially with regard to the projected high emissions rate of the transport sector (Sustainable Mobility Project, 2004) and the significant impacts on human health, ecosystems on which livelihoods depend, materials and infrastructure, climate change and biodiversity (UNEP, 2005).

To intervene against these impacts in sub-Sahara Africa, various interested stakeholders have pursued many initiatives aimed at reducing or eliminating atmospheric emission all together (UNEP, 2005). However, no proper assessment has been carried out yet to establish the comprehensiveness and the success of the leading vehicle trade policy options adopted independently in sub-Sahara Africa after lead gasoline phase out in the region. Indeed, this issue has so far attracted relatively little research interest within the automotive milieu even though its environmental impacts are not less severe.

Cognizance of this fact and the rapidly changing economic and demographic structures in the region, it is of interest to have regional specific assessments of vehicle emissions reduction policies adopted by key players and their associated environmental implications in the region. On that score, the major questions that have loomed from the start of the regional clean air initiative arise: (i) Is the current used vehicle trade model proposed by key players sustainable? If not, what instruments need to be integrated? (ii) What alternative tools/approaches are needed to achieve sustainable development? To this end, our analysis is motivated by three main objectives: (i) To analyse a plethora of used vehicle trade policy options within the sub-Saharan African Automotive Sector according to some fundamental dilemma in sustainable vehicle distribution and use (ii) To assess each option against assessment criteria that makes the link between used vehicle trade and broader political objectives (iii) To prescribe a series of recommendations that in the future could serve to improve environmental performance of road transport in sub-Sahara Africa.

In achieving these objectives, this chapter is organised around two core issues in which contemporary policy development of key players within the sub-Saharan African Automotive sector is pivotal. The chapter is structured as follows: It begins with the overall method used for analysis. The next section of the chapter presents and discusses the results of the research. This section of the chapter therefore profiles used vehicle trade policy options adopted by five key players along the Gulf of Guinea. Next, this section of the chapter analyses the implications of used vehicle trade policy options of the major players according to some fundamental dilemmas in sustainable vehicle trade and assesses each option against assessment criteria that make the link between used vehicle trade policy and broader political objectives. The chapter concludes by prescribing a series of recommendations that in the future could serve to improve environmental performance of road transport in the region.

4.2 Research Methodology

This study employs an impact assessment methodology based on a case study approach. This has typically been ex post, assessing the effects of a policy already in place, rather than ex ante, anticipating the possible effects of a policy. The assessment integrates the three pillars of sustainability in a balanced manner: Environmental effectiveness, economic efficiency and the principle of common but differentiated responsibility. First the study employs an integrated modelling framework to provide fact sheets as a systematic overview and brief assessment of the extent to which several existing policies affect used vehicle distribution that subsequently leads to emissions in sub-Sahara Africa. The discussion is split into types of policies of four major countries along the Gulf of Guinea as their starting points since their approaches are fundamentally different. The choice of the leading policy proposals stems from Rebelo (1992), who pointed to Ghana, Benin, Nigeria and Cameroon as the major transit countries (TC) for overseas exports and imports of landlocked countries (LLCs) in sub-Sahara Africa.

Data used for this assessment was based on publicly available documentation like relevant literature, indigenous consultancy reports, government documents and the United Nations Statistics database. These data represent the official position of the major players assessed thus enhancing credibility and validity of information obtained during the research. Next the study develops a detailed list of criteria against which selected leading policies can be checked. The starting point for choosing the criteria was the “checklist” in Höhn et al. (2005). The criteria listed in the checklist were modified through a combination of internal deliberations, studies of existing literature and stakeholders’ consultation. By combining answers and eliminating overlaps, a set of 24 criteria that in our view constitutes the most important dimensions of sustainable used vehicle trade emerged. The checklist differentiates between environmental, economic, technical, institutional, and political criteria. These criteria, we argue, ought to be central to any sustainable used vehicle trade policy and the route to get there. They are the key dimensions that sustainable used vehicle trade should perform well on. They also constitute a yardstick against which the effectiveness of selected country approaches will be

measured. Starting from the identified criteria, four selected country perspectives were then assessed.

4.3 Research Findings and Discussion

4.3.1 Used Vehicle Trade Policy Options of Key Players

This section of the chapter presents a systematic assessment of used vehicle trade policy options (emission reduction actions) that are currently being implemented by four major players in sub-Saharan Africa, located along the Gulf of Guinea specifically Ghana, Benin, Nigeria, and Cameroon (figure 4.2). As mentioned earlier, the choice of the leading policy proposals stems from Rebelo (1992), who pointed to Ghana, Benin, Nigeria and Cameroon as the major transit countries (TC) for overseas exports and imports of landlocked countries (LLCs) in sub-Saharan Africa.

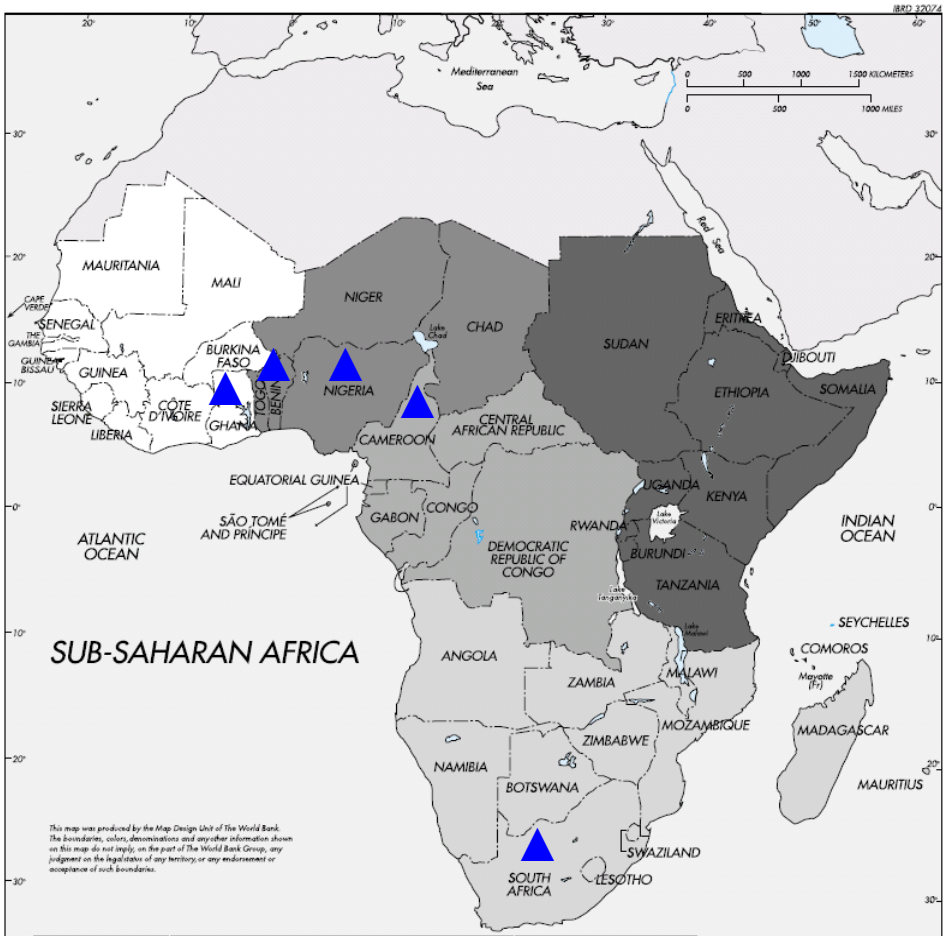


Figure 4.2 Map of sub-Saharan African countries

(Source: The World Bank Group, 2006) ▲ Countries assessed

However, material and examples are sometimes from other countries if deemed necessary. On that score, the differences experienced in South Africa are likely to be rather similar to that of the other key players considered, but differences exist and these have been illustrated. In our study of the importance of strategy shifts among these key players after lead gasoline phase out in sub-Sahara Africa, we start with a distinct introvert approach. More specifically, we focus on domestic vehicle trade and emissions policy development and discuss how domestic politics shape current positions and strategies. Before employing the assessment of how these countries have positioned themselves towards selected criteria - criteria analysis - a closer look was taken to study their implemented used vehicle trade policies and vulnerability as well as their used vehicle profiles. In terms of used vehicle profiles the following observations were made:

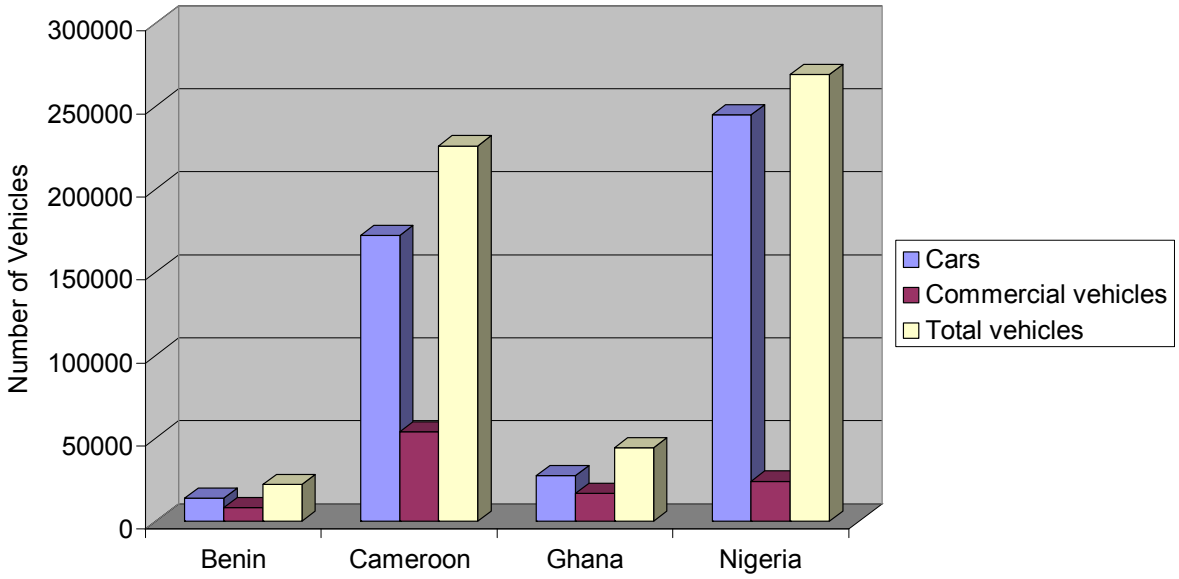


Figure 4.3 Used vehicle profiles of major players
(Data obtained from United Nations Common Database)

The differences in vehicle profiles are reflected on the differences between the numbers of registered cars and commercial vehicles (figure 4.3). While Nigeria has the highest number of registered cars, Cameroon tops the chart with the number of commercial vehicles in use. Ghana is ranked third both for Commercial vehicles and cars followed by Benin. The profiles for cars for all the major players are higher than commercial vehicles with Nigeria having the highest total number

of vehicles followed by Cameroon, Ghana and Benin. These major players impose comparatively high custom duties on used vehicles. Table 4.1 highlights the upper and lower limits of tariff rates on used vehicles of the major players considered.

Table 4.1 Breakdown of upper and lower import duty (%) of used vehicles

Country	Min	Type	Max	Type
Benin	N/A		18	All Vehicles
Cameroon	10	Tourism Car	30	Truck
Ghana	5	Tractor, Bus, Coach, Truck	20	Snow, gulf cars, car > 3000 cc
Nigeria	10	Tractor, Special car, Truck, Bus	35	Cars (luxury)
South Africa	N/A		40	All Motor vehicles

cc: cylinder capacity

In order to boost the market of her domestic automobile industry and seek international competitiveness, South Africa has banned the import of used vehicles and imposed the highest tariff rate exclusively for returning residents and immigrants. Contrary to Cameroon, the other countries impose the highest tariff rate on cars, and the lowest tariff rate on tractors, buses and trucks. These high tariff rates are reflected in the enormous customs revenues from the huge amount of imported vehicles annually (Figure 4.4). This perhaps reflects the limited amount of attention the major players have paid in curbing the import of conventional dirty technologies while maximising revenues derived from used vehicle trade.

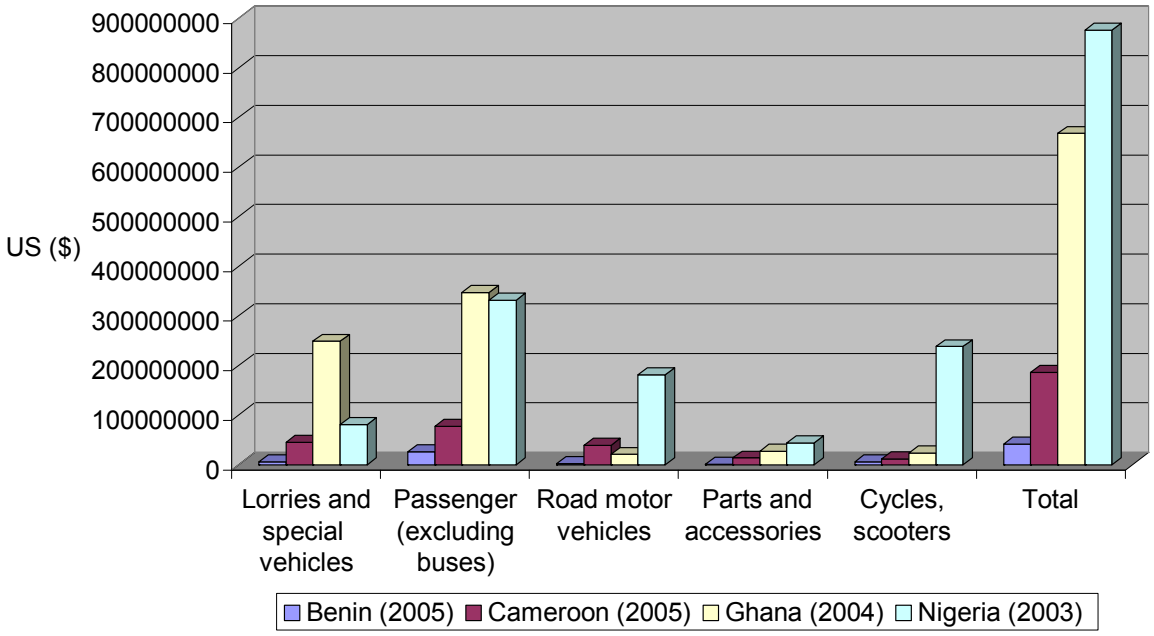


Figure 4.4 Value of Imported Used Vehicles and Accessories (US$)
(Data obtained from United Nations Common Database)

In the quest to curb emissions attributed to the fast pace of used vehicle import along the Gulf of Guinea specifically Benin, Ghana, Cameroon and Nigeria, several existing policies have been put in place by these major players (table 4.2). South Africa has been included to highlight the major policy difference to those of the other players.

Table 4.2 Overview of key players' used vehicle trade policy options

Country	Regulations	Strategies
Ghana	1) Customs, Excise and Preventive Service Amendment Act 634, 2002	❖ Penalties on some category of over-aged vehicles
Benin	1) Customs Code, 2000	❖ Fixed tariff for all second-hand cars ❖ Fixed rate for any aged vehicle in transit to the hinterland
Nigeria	1) Customs and Management Act, 1990	❖ Prohibit used Motor vehicles above eight (8) years ❖ All Imports of Vehicles via land border prohibited
Cameroon	1) Ministerial Direction 03/008/MINFI/DD of January 6, 2003, 2) Memorandum No. 006/MINFI/DD of February 17, 2003	❖ Clearance procedures with no restriction on age ❖ Highly taxed
South Africa	1) International Trade Administration Act, 2002, (Act 71 of 2002) 2) Customs and Excise Act, 1964 Amendment of Schedule No1. (NO.1/1/1051)	❖ All imports of Used Motor vehicles prohibited ❖ Import permits for private Cars only

Ghana imposes several taxes on imported vehicles. According to the United States Department of Commerce (2003), the government of Ghana banned the import of vehicles more than 10 years old as of June 1998. This policy was subsequently revised under the auspices of the Customs, Excise and Preventive Service Amendment Act 634 of 2002 imposing penalties on some category of over aged vehicles exceeding 10 years old, in addition to any applicable duties and taxes (table 4.3).

Table 4.3 Ghanaian penalties on importation of over aged vehicles after manufacture

MOTOR CARS	**PENALTY ON CIF**
Less than 10 years old	NIL
More than 10 years old but not more than 12 years old	5%
More than 12 years old but not more than 15 years old	20%
More than 15 years old	50%
COMMERCIAL VEHICLES - COACHES, BUSES, VANS	**PENALTY ON CIF**
Less than 10 years old	NIL
More than 10 years old but not more than 12 years old	2.5%
More than 12 years old but not more than 15 years old	10%
More than 15 years old but not more than 20 years old	15%
More than 20 years old	50%
COMMERCIAL VEHICLES - TRUCKS, LORRIES	**PENALTY ON CIF**
Less than 10 years old	NIL
More than 10 years old but not more than 12 years old	5%
More than 12 years old but not more than 22 years old	10%
More than 22 years old	30%

CIF: Cost, Insurance and Freight
(Source: Ghana Customs, Exercise and Prevention Service 2006).

Benin Customs code of 2000 provides for a fixed tax for all second-hand cars shipped to Cotonou. This revised custom reform equally imposes a fixed tariff on any aged vehicle in transit via the Port of Cotonou to the hinterland. Further to this, Gourjeon and Houeninvo (2005) noted that the scale of charges, duties, and service-tax applicable to used vehicles in transit at the Port of Cotonou (PAC) has been revised downwards in highly discretionary and non-transparent ways in order to boost used vehicle business and to increase transit trade destined for Nigeria and the land-locked regions of Niger and Burkina Faso. They further argued that these measures are geared towards allowing importers to leave the Port of Lomé in Togo and return to the port of Cotonou in Benin.

Nigerian Customs and Management Act of 1990 amended a ban imposed in 2002 on the importation of cars older than five (5) years to a 2003 Act outlawing the importation of used cars above eight (8) years old in an attempt to protect its own struggling car industry and to minimise congestion and pollution. Further, the Custom and Management Act prohibits the import of Vehicles to Nigeria via land borders. This policy brief, however, has sent many importers shipping their older fleets first, to the ports of the neighbouring countries of Benin and Togo, and then smuggling them into Nigeria apparently with the connivance of customs' escorts (Nagoné and Berger, 2005).

Cameroon's Ministerial Instruction N°0246/MINEFI/DD of July 30, 2001, Ministerial Direction No.03/008/MINFI/DD of January 6, 2003, and Memorandum No. 006/MINFI/DD of February 17, 2003 simply outline new clearance procedures for imported used vehicles into the country (figure 4.5). Suffice to say these set of regulations are without any restrictions except for a certificate of road worthiness to be covered by all second-hand vehicles entering the country. In order to improve customs revenue collection, the Cameroon government contracted with the Swiss company Société Générale de Surveillance (SGS) to assess and collect customs duties.

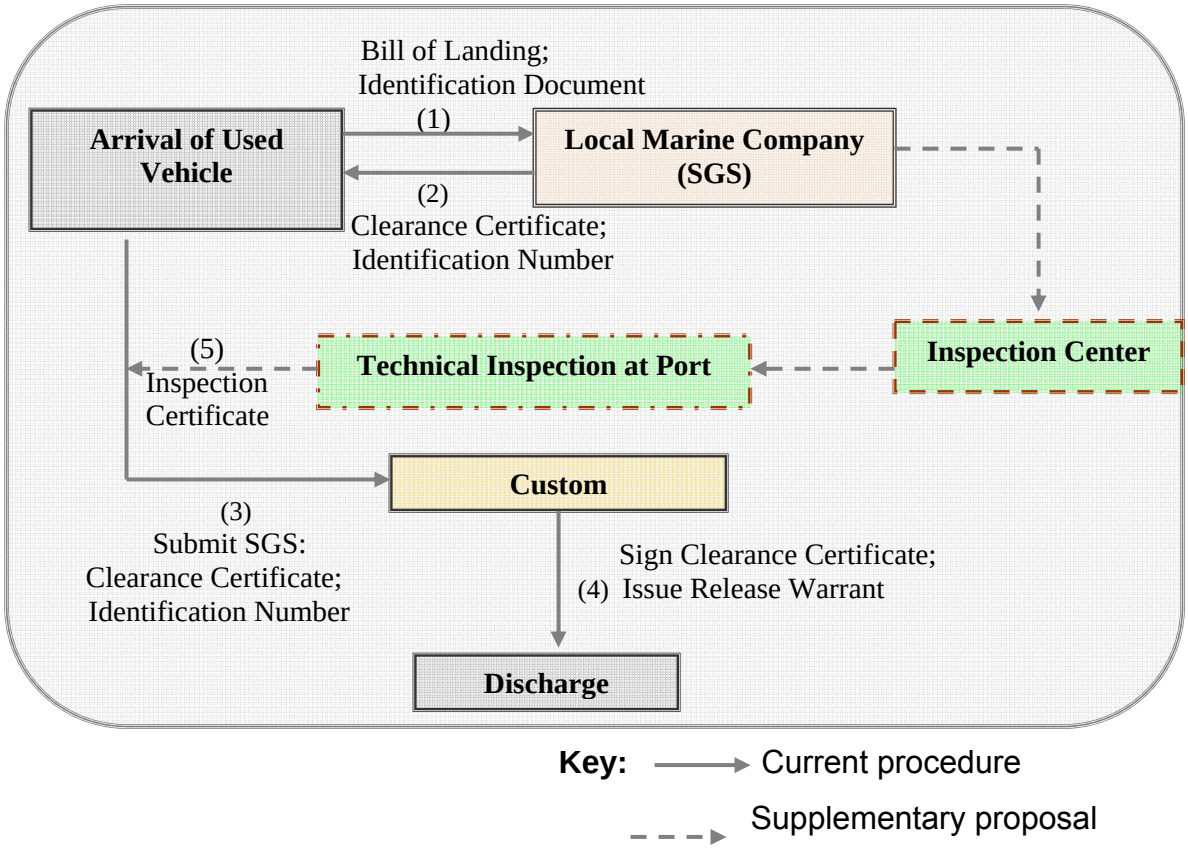


Figure 4.5 Used vehicle import procedure in Cameroon

Figure 4.5 depicts used vehicle import procedure in Cameroon. After arrival of a used vehicle, the owner of the vehicle receives original identification record, a secure clearance certificate and a copy of identification record for customs on presenting a valid identification document and a bill of landing to the local marine company, Société Générale de Surveillance (SGS). The owner has to pay duties and taxes in cash into the treasury as well as SGS identification check paid by certified cheque or cash against receipt serving as acknowledgement of receipt. After paying for the identification check, duties and taxes the owner then proceeds to the customs and presents the SGS Clearance Certificate and Identification Number. Thereafter, a custom officer signs the clearance certificate and issues a Release Warrant (RW) to be presented together with the receipt of customs duties and taxes to a stevedore for removal. Further to this contemporary procedure, a supplementary approach has been proposed, which requires a vehicle to pass technical inspection at the port before proceeding to the customs.

South Africa's International Trade Administration Act of 2002 (Act 71 of 2002) and the Customs and Excise Act of 1964, Amendment of Schedule No1. (NO.1/1/1051) outlaw the imports of Used Motor Vehicles into the country with the underlying principle of competing globally in motor vehicle manufacturing. Exempted from these Acts are private permits for returning residents and immigrants, vintage cars, racing cars, donated vehicles for welfare organisations and adapted vehicles for persons with physical disabilities.

4.3.2 Criteria Analysis of Policy Options

Having reviewed the used vehicle policy options of the key players, this section of the chapter synthesises these options from both a policy and a political perspective and assesses if they satisfy the three criteria of sustainability in a balanced manner: environmental effectiveness, economic efficiency and the principle of common but differentiated responsibility (Pallemaerts et al. 2005):

Environmental effectiveness includes whether these types of commitments ensure that emissions are substantially reduced to make certain global temperature increase is minimised. If the environmental criterion is not met, the impact of the lack of emission reductions will have a significant economic effect through the damages caused by climate change, e.g. extreme weather events. Due to this, and the high risk to society and nature, the environmental criterion is most important.

Economic efficiency includes whether a type of commitment is initiating emission reductions where they can be achieved at the least costs. As drastic reductions are necessary, it seems necessary to find the most efficient way to achieve them. This criterion does not include the aspect of economic damage due to lack of action.

The principle of common but differentiated responsibility would include, whether the selected policy options clearly encourage involvement of the various stakeholders such as vehicle dealers and consumers. This is important for the overall acceptability of any proposed policy framework.

Starting from these fundamental criteria, this section of the chapter proffers conditions that a future vehicle regime must meet to be viewed as sustainable. On that occasion, perspectives of the key players were then summarised in relation to the designed criteria (table 4.4). As most countries in the region rely on imported vehicles, their import policies will be the main focus as oppose to their industrialised counterparts where their policies are based on manufacture. On that score, South Africa has not been considered here in view of the fact that the government has for the past decades focused her efforts entirely on her indigenous motor vehicle manufacturing industry, contrary to the other key players who depend solely on industrialised nations for supply of motor vehicles and accessories. Based on the analysis made, the chapter draws conclusions on which types of selected policies best achieve sustainable used vehicle trade in a balanced manner.

Table 4.4Criteria analysis of approaches adopted by key players

Category of Criteria Sub criteria	Ghana	Benin	Nigeria	Cameroon
Environmental Criteria				
(1) Addressing environmental effectiveness	N	N	Y	N
(2) Controlling leakage of green house gases	N	N	Y	N
(3) Integrating technological change and sustainable development priorities	N	N	N	N
(4) Ensuring stringency	N	N	N	N
(5) Promoting subsidiary benefits	N	N	Y	N
(6) Comprehensiveness of system	N	N	N	N
Economic Criteria				
(1) Minimising negative economic effects	Y	Y	N	N
(2) Generating positive economic side effects	Y	Y	N	N
(3) Providing incentives for technology spill-over	N	N	N	N
(4) Accounting for consumers' social class differences	YY	YY	N	N
(5) Encouraging competitiveness and development	Y	Y	N	N
Participation Criteria				
(1) Building domestic stakeholders' support	Y	Y	N	N
(2) Shifting operations to other countries	N	N	Y	N
(3) Providing flexibility to market participants	Y	Y	N	N
(4) Sufficiently equitable to all participants.	Y	Y	N	N
Technical and Institutional Criteria				
(1) Stimulating long-term technological change	N	N	YY	N
(2) Addressing technical monitoring at ports	N	N	N	N
(3) Stimulating research and diffusion	N	N	N	N
(4) Dynamic flexibility to new scientific data	N	N	Y	N
(5) Accurate, reliable and sufficient data/information	N	N	N	N
Political Criteria				
(1) Guaranteeing government investment	N	N	N	N
(2) Interference with development priorities	N	N	Y	Y
(3) Understanding of Sustainability consequences	N	N	N	N
(4) Stereotypical thinking	Y	Y	Y	Y

YY: "Major fulfilment of the criterion by the player"

Y: "Moderate fulfilment of the criterion by the player"

N: "Fulfilment of the criterion not achieved by the player"

As a first step in examining the challenges of curbing vehicle emissions in sub-Sahara Africa, contemporary national policy measures have been analysed (table 4.4). Particularly, we look into the current positions of the four major players, if and how their strategies have changed following lead gasoline phase out in the region, and how their roles in curbing vehicle emissions have developed. In case after case, we observe that regulations proposed by the four key players are not

optimal from a policy perspective and tend to focus only on a small set of criteria, ignoring the impacts of other major criteria. Several criteria seem not to be important for all the major players considered here, accounting for major differences in country proposals and unintended consequences with respect to the five major criteria.

First, it is observed that regulations proposed by the key players have the potential to provide the right incentives for reducing vehicle emissions but are subject to a cost disadvantage as with the case of Nigeria outlawing the import of vehicles above eight years old. As Ndoke and Jimoh (2005) explain, this policy brief has done little to reduce the twin effect of congestion and pollution because of the existing old vehicles plying the streets and highways of Nigeria. Additionally, the Nigerian proposed regulation has fundamentally discouraged stakeholders' collective involvement given that it is perceived by dealers and consumers as an economic constrain. This approach thus far has focused primarily on curbing vehicle emissions without minimising the negative economic effects to the society at large. As a result, operations have been shifted to other countries with many importers shipping their older fleets first, to the ports of the neighbouring countries of Benin and Togo, and then smuggling them into Nigeria (Nagoné and Berger, 2005).

Second, the comprehensiveness of the proposed regulations by Ghana, Benin and Cameroon is fundamentally lacking, and has to a large extent led to leakage effects and unintentional "hot air". Further, regulations proposed by Ghana and Benin take account of major economic criteria such as generating positive economic side effects, and encouraging competitiveness. Nevertheless, these policies fall short of the underlying environmental criteria and are thus destined to unsustainable trade practices. On the other hand, the Nigerian proposal is predominantly geared towards stimulating technological change without providing any incentives for such a technology spill over. Such a policy, though quite costly for importers and consumers, may result to some co-benefits in terms of reduced emissions of aerosols, nitrogen oxides, sulphur dioxide and other air pollutants and subsequently to reduced health problems, crop damage, and acid rain.

Further, the destination inspection schemes of Ghana, Nigeria as well as the pre-shipment inspection schemes of Benin and Cameroon address, in principle, technical inspection at ports with the exemption of used vehicles. Indeed, adequate monitoring and compliance are fundamentally lacking.

Given the stereotypical thinking of the key players, the likely hood of periodically revising the proposed regulations in light of new scientific and economic information has not been forthcoming as policy makers are not aware of or are ignoring the major implications of vehicle emissions for their citizens and economies. It is therefore imperative to launch regional negotiations on future collective actions in mitigating vehicle emissions that integrates adaptation and mitigation measures into development priorities such as economic growth and poverty reduction.

4.4 Recommendations for Further Actions

Having assessed the leading policy options based on the fundamental criteria that a future used vehicle regime must meet to be viewed as sustainable, this section of the chapter considers how easily and effectively each policy dilemma can be addressed and mainstreamed within sub-Sahara Africa. It does this by proposing some policy and programme options available to address each of the five major criteria according to the fundamental policy dilemmas of the major players. The chapter ends by offering some overarching conclusions about the need to address sustainable used vehicle trade in order to prevent large-scale regional climate disruption.

- **Policy Options and Methods for a Comprehensive System**

This section discusses several relevant issues in sustainable used vehicle trade to the extent that they address the identified shortcomings. Harmonising the different policy options adopted independently by the key players entails a regional framework that builds on the clean development mechanism (CDM), and enables all countries to be part of concerted action on the regional clean air initiative in the post-2006 lead gasoline phase out period, on the basis of equity and common but differentiated responsibilities - GDP, tax revenues from imported vehicles and per

capita emissions. Keeping track of such a broader picture entails a framework that provides space for a neutral multi-stakeholder discussion forum to facilitate bringing existing institutions and organisations together to promote research, cooperation and information sharing on an effective regional biodiesel CDM scheme. For this to occur, a more fundamental revision of the African Union's institutions and decision making would be needed, involving discussions to be dealt with first by regional climate expert groups before proceeding to negotiations and decisions at the political level (i.e. ministers). Finally, a small secretariat providing centralised coordination of policy development, implementation and monitoring with other international bodies is crucial. In the following sections, the chapter provides an overview of some of the policy options and programmes that might be considered to address the policy shortcomings with regard to the five major criteria addressed.

- **Policy Options to Environmental Dilemmas**

Addressing environmental effectiveness, controlling leakage of green house gases, integrating technological change and sustainable development priorities and ensuring stringency are the most notable policy shortcomings identified under the environmental criteria. A carbon tax on imported used vehicles, restructuring energy systems or other policy mechanisms for internalising externalities in energy prices could help address the environmental criteria related to road transport emissions. For instance, sub-Saharan African governments could institute a regional biofuel initiative, an effort to be undertaken by the regional secretariat in the quest to curb road transport emissions. Such a regional biofuel initiative could inevitably lead to some co-benefits such as reduced emissions of aerosols, nitrogen oxides, sulphur dioxide and other air pollutants and subsequently to reduced health problems, crop damage, and acid rain. As Brown et al. (2007) explain, such an approach would increase the competitiveness of low-carbon fuels and would place greater value on carbon capture and sequestration projects. They further point to high costs as a function of technical risks, which suggest policy interventions such as increased support for public-private R&D collaborations and demonstrations as well as greater documentation of technology performance.

- **Policy Options to Economic and Participation Dilemmas**

Mindful of the large tracts of underutilised land in sub-Sahara Africa coupled with the fact that most farmers in the region have no other available cash crops, a coordinated regional CDM biofuel/carbon capture and storage (CCS) projects would not only provide for a renewable energy source for road transport but would, to a large extent, be instrumental in local income generation, livelihood security for households, and small scale social infrastructural development. For this to occur, a standardised regional financial Institution, under the auspices of the World Bank and the African development bank, which provides concessionary funding with special lending provisions such as lower interest rates on loans and extended payback periods to potential CDM biofuel/CCS projects is vital.

- **Policy Options to Technical and Institutional Dilemmas**

Reforming energy systems within the sub-Saharan African Automotive sector could significantly accelerate the deployment of carbon mitigating technologies. This could be achieved by strategically coordinating top energy research institutes in sub-Sahara Africa to form a regional centre for scientific excellence to develop uniform guidelines for regulating carbon capture and storage (CCS) projects as well as a harmonised standard for biofuel production adopted independently in various parts of the region. Keeping track of such a broader picture entails a neutral multi-stakeholder discussion forum to facilitate bringing existing institutions and organisations together to promote cooperation and information sharing on effective regional CDM biofuel/CCS projects.

- **Policy Options to Political Dilemmas**

To overcome the political dilemmas highlighted in this study, policy makers should become aware of the implications of climate change for their citizens and economies and apply vulnerability or impact assessments to all new policies, to exclude anything that puts sub-Saharan African nations at greater risk, and integrate adaptation policies and measures into development strategies. Further, assistance should be provided to build the capacity of sub-Saharan African policy-makers so they can take part in regional climate negotiations, undertake policy

implementation domestically, and make appropriate judgments to avoid inappropriate, maladaptive policies (International Climate change Taskforce, 2005).

4.5 Chapter Summary

This chapter proffers five major criteria: environmental, economic, participation, political, technical and institutional criteria for assessing leading contemporary domestic trade policy proposals (emission reduction actions) after lead gasoline phase out in sub-Sahara Africa. The chapter employs these criteria to establish benchmarks for measuring policy performance in curbing vehicle emissions simultaneously with core sustainable development priorities as well as discussing the implications of the leading alternatives. As presented in this chapter, the strategic perspectives of the leading domestic trade policy proposals have been constrained by a pronounced dilemma of synergies between vehicle emissions reduction and core development concerns as the major players target emissions too narrowly. On that occasion, the implementation of the recently prescribed policy and programme options are crucial to effectively curb road transport emissions while sustaining economic growth. To this end, a neutral multi-stakeholder discussion forum to facilitate bringing existing institutions and organisations together to promote research, cooperation and information sharing is a necessary precondition for an effective design and continuous improvement of a sustainable road transport regime in sub-Sahara Africa. Thus, in the subsequent chapter, we will examine the role of stakeholders in designing an effective framework for a “Post Carbon” sub-Saharan African Automotive Sector.

CHAPTER FIVE

A Conceptual Stakeholder-Assisted Model and Policy Design Framework for Sustainable Road Transport in sub-Sahara Africa

This chapter assesses the role of stakeholders as they act on the ground for sustainable road transport in sub-Sahara Africa. The chapter begins by employing an indirect stakeholder-assisted representation approach by extracting individual stakeholders' underlying concerns, interests, values, and local knowledge through literature sources along with semi-structured interviews in order to gain additional data on and details of the overall vehicle emissions reduction initiatives in the region. Based on the data obtained, a conceptual system representation and a policy design framework is proposed eliciting stakeholders' fundamental prerequisites to successful stabilisation of atmospheric vehicle emissions in sub-Sahara Africa.

5.1 Introduction

The transportation sector is increasingly being recognised as the highest polluter in key African cities (UNEP, 2005). This worsening air pollution is attributed to low-income solutions to daily commuting combined with the fast pace of urbanisation and motorisation (Ndoke and Jimoh, 2005), predominantly from older fleets with lower design standards (Harrington and McConnell, 2003). To this end, resultant high emission rate of this sector has to a large extent diminished Africa's carrying capacity (Janischweski et al. 2003), posing a significant threat to human health, ecosystems on which livelihoods depend, materials and infrastructure, climate change and biodiversity (Table 5.1) (UNEP, 2005)

Table 5.1 Traffic-related lead concentration levels in selected African Countries (Source: UNEP, 2006).

Country	Air ($\mu g/m^3$)	Soil (µg/g)	Food (µg/g)	Water (µg/l)	Blood (µg/dl)
South Africa	0.36-2.1 (0.76)	76.7-80			3.8-12 (9.7)
Nigeria	0.5-45		0.01-1.6 (0.1)	0.9-9.8 (4.05)	8.7-60 (30.1)
Kenya	0.4-1.3	26.73-4000 (105)	0.45-85.5 (10.15)	0.11-19.1 (5.65)	
Egypt	0.6-4.9 (1.9)				11-36 (19)
Uganda		2.5-703 (25.5)			
Senegal					6.1-10.67 (8.4)
Zambia	0.15	16-10000[50] (1830)	0.4-66		

[a] Figures in the parentheses are median concentrations.

[b] The reported values are from available literature published in the period 1982-2005

Despite the deteriorating impacts of vehicular emissions in major sub-Saharan African cities, development politics within the complex decision-making context of climate negotiation has resulted in a clear demarcation in the strategies of both the developed and developing countries with a completely different set of positions (figure 5.1) (Höhne et al. 2005).

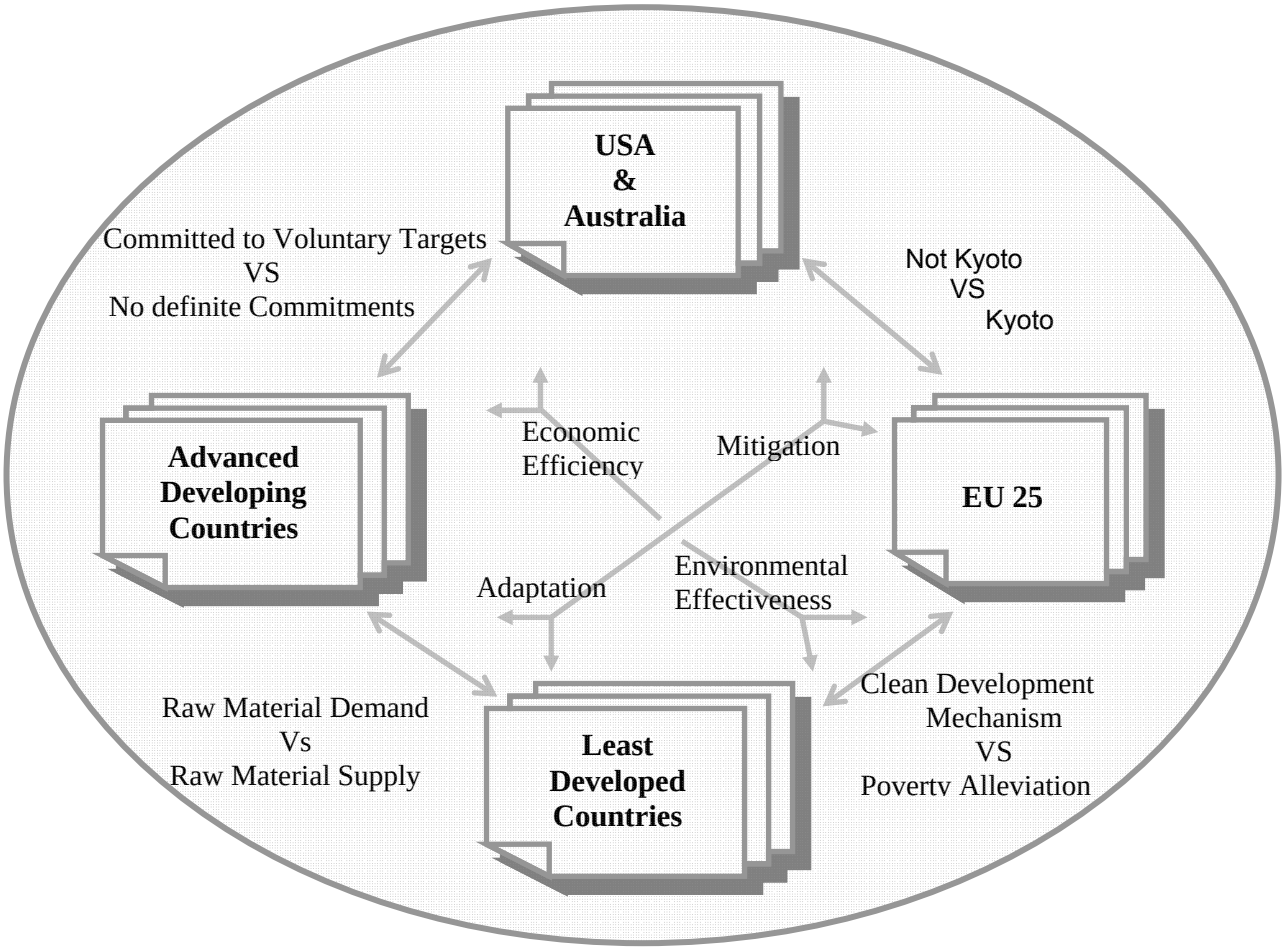
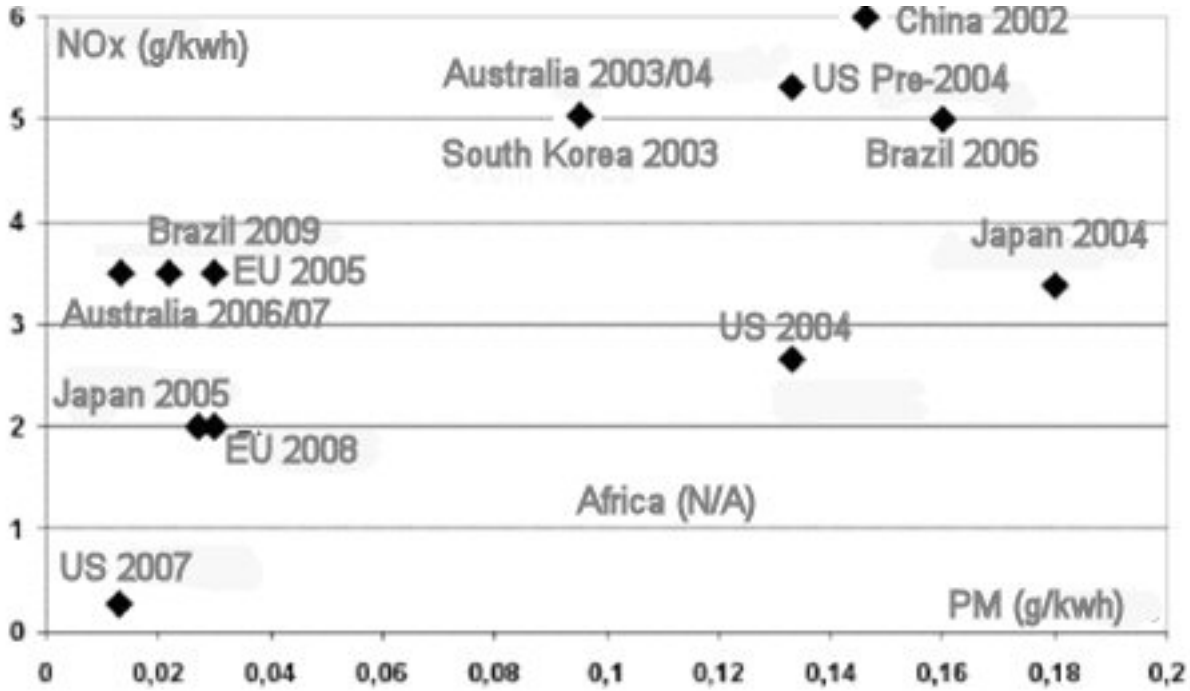


Figure 5.1 Interest and conflict areas between selected countries/groups (Source: modified from Höhne et al. 2005)

While the EU and other industrialised countries have implemented stringent vehicle emissions reduction targets as well as a robust compliance system under the Kyoto protocol, sub-Saharan African countries see climate change mitigation (vehicle emissions reduction technologies) to be in competition with economic growth and poverty alleviation: money invested in climate change mitigation is money diverted from economic growth and poverty alleviation (figure 5.2) (Heller and Shukla, 2003). Consequently, sub-Saharan African governments have continued to focus overwhelmingly on a few priority concerns such as food security and poverty alleviation, which are threatened by many factors including, at the margin, climate change and increased capacity and efficiency in the energy and transport services that underpin economic growth (Heller and Shukla, 2003).



(N/A: leaded gasoline Phase-out)

Figure 5.2 Global Vehicle Emissions standards

(Source: Modified from Umweltbundesamt, 2003).

From this premise, it is essential to bring sub-Saharan African countries on board for meaningful reductions in used vehicle emissions particularly in light with the fast pace of motorisation and the projected emissions of this sector due to less efficient fuel-burning technologies (Figueroa et al. 2004; IPCC, 1995).

To intervene against these impacts in sub-Sahara Africa, various interested stakeholders have pursued many initiatives aimed at reducing or eliminating atmospheric emission in order to avert the gravest potential consequences of climate change and to prepare for adverse effects that cannot be avoided (UNEP, 2005; Byers and Snowe, 2005; Climate Action Network, 2003). For instance, in 1998 the World Bank, in collaboration with various interested stakeholders, launched a clean air initiative aimed at reducing or eliminating vehicle emissions, presenting a profound long-term challenge for governments, businesses, and the society at large. By January 2006, leaded gasoline was completely phased out in

sub-Sahara Africa marking the end of the first phase of the regional clean air initiative (Sexsmith, 2005).

To date, there have been numerous discussions on the structure and content of a post-2006 sub-Saharan African clear air initiative though there is much uncertainty as to how the process will unfold and what a final agreement could entail (Sexsmith, 2004). From examining the relevant literature, however, no proper assessment has been carried out yet to engage sub-Saharan African nations and their peoples in a long-term effort that fairly and effectively mobilises technology and resources to curb vehicle emissions while sustaining economic growth after lead gasoline phase out in the region. Motivated by this fact and the rapidly changing economic and demographic structures in the region, it is of interest to have a holistic regional systems analysis framework, which allows stakeholders to better understand the interactions among different parts of the system and between the different technical, social and economic layers of the system taking into account stakeholders' concerns/values, knowledge and interests and cognizant of the uncertainties inherent in the consensus building analysis. On that occasion, the major questions that have loomed from the start of the second commitment period after lead gasoline phase out process arise: (i) What type and level of participation should a future sub-Saharan African clean air initiative seeks and what technological solutions should be allowed or promoted? (ii) Can emission reduction possibilities be integrated following another approach while maintaining economic growth? (iii) What alternative tools/approaches are needed to achieve sustainable development? (iv) How best to orient action to the ultimate objective of stabilising vehicle emissions in sub-Sahara Africa and how best can agreements be arrived at that are fair?

This chapter seeks to clarify these core issues and, in a preliminary way, explore a range of approaches that might help address them. Starting from this premise, adaptation strategies resulting from conceptual stakeholder representation will be provided within this study. From this premise, the objectives of this chapter are two folds: (i) to propose target strategies aimed at improving acceptance of adaptation strategies thus expanding efforts and participation, and (ii) an

integrated policy synthesis of target strategies providing regional decision-makers with a comprehensive and coherent suite of policy recommendations for reducing the region's vehicle emissions. The findings of the study intend to stimulate and facilitate constructive thinking and dialogue on the future of the sub-Saharan African clean air initiative and, should its ideas prove valuable, to contribute to meaningful action. They aim, above all, to be pragmatic.

The chapter is structured as follows: It begins with the overall method used for analysis. The next section of the chapter presents and discusses the results of the research. This section provides an overview of existing practice and discusses the factors that warrant changes in practice and outlines the issues to be addressed. The next section of the chapter proffers a robust Stakeholder-Assisted Representation and a Policy Design framework for road transport in sub-Sahara Africa and the associated implementation strategies that serve the needs of ongoing regional discussions. The final section of the chapter draws up several conclusions related to the design of the future framework.

5.2 Research Methodology

In designing an effective Stakeholder-Assisted Representation and a Policy Framework (SAM-PF) as applied to sustainable road transport in sub-Sahara Africa, this study employs an indirect stakeholder-assisted representation approach outlined by Mostashari (2005) involving: (i) a literature Meta analysis of different scientific studies within the scope of adaptation strategies and evaluating these results from different view points (e.g., suggested adaptation measures and accepted scenarios), (ii) extracting inputs from individual stakeholders through publicly available documentation and interviews and then constructing a systems representation based on the inputs, and (iii) an outside "peer review" process by independent experts who can vouch for the relative validity of the systems representation.

Contrary to a direct stakeholder involvement approach whereby stakeholders jointly create the systems representation starting from scratch, we elected to employ the indirect involvement approach, as a good supplementary source of

information, given that it was not possible to access some key stakeholders for direct input elicitation. Firstly, the major stakeholders of the systems representation were identified and categorised based on their influence/power, stake, and knowledge. Those identified were consulted to varying degrees, depending on their impact potential on the system as well as their potential to contribute to the policy process through knowledge, resources or compliance with implementation. Next stakeholders' interests, values and beliefs regarding the system were established and assessed, eliciting how they view the system and the issues they would like to have considered in any policy process. This stage generated a set of information on the basis of which a tentative systems representation was built. We then looked at ways to involve stakeholders in the representation system and identify challenges associated with such involvements and discussed their relative merits.

Data collected during the research was based on two sources. Firstly, in cases where it was difficult to reach some key stakeholders for commenting, their views were indirectly extracted from statements that express their underlying values and concerns presented in media articles, press releases, television programmes, and stakeholder websites. Secondly stakeholders' inputs were provided via unstructured interviews that take the form of a personal conversation on a certain issue (Halvorsen, 1992).

5.3 Results and Discussion

5.3.1 System Representations, Evaluation, and Policy Design Phase

In this section of the chapter, a holistic system model has been designed consisting of 4 sectors: Vehicle Technology, Maintenance and Energy, Traffic Demand and Management as well as Emissions (figure 5.3). For this study, traffic demand and management has not been considered given that the study is focused primarily on the interplay between the technical and environmental interfaces.

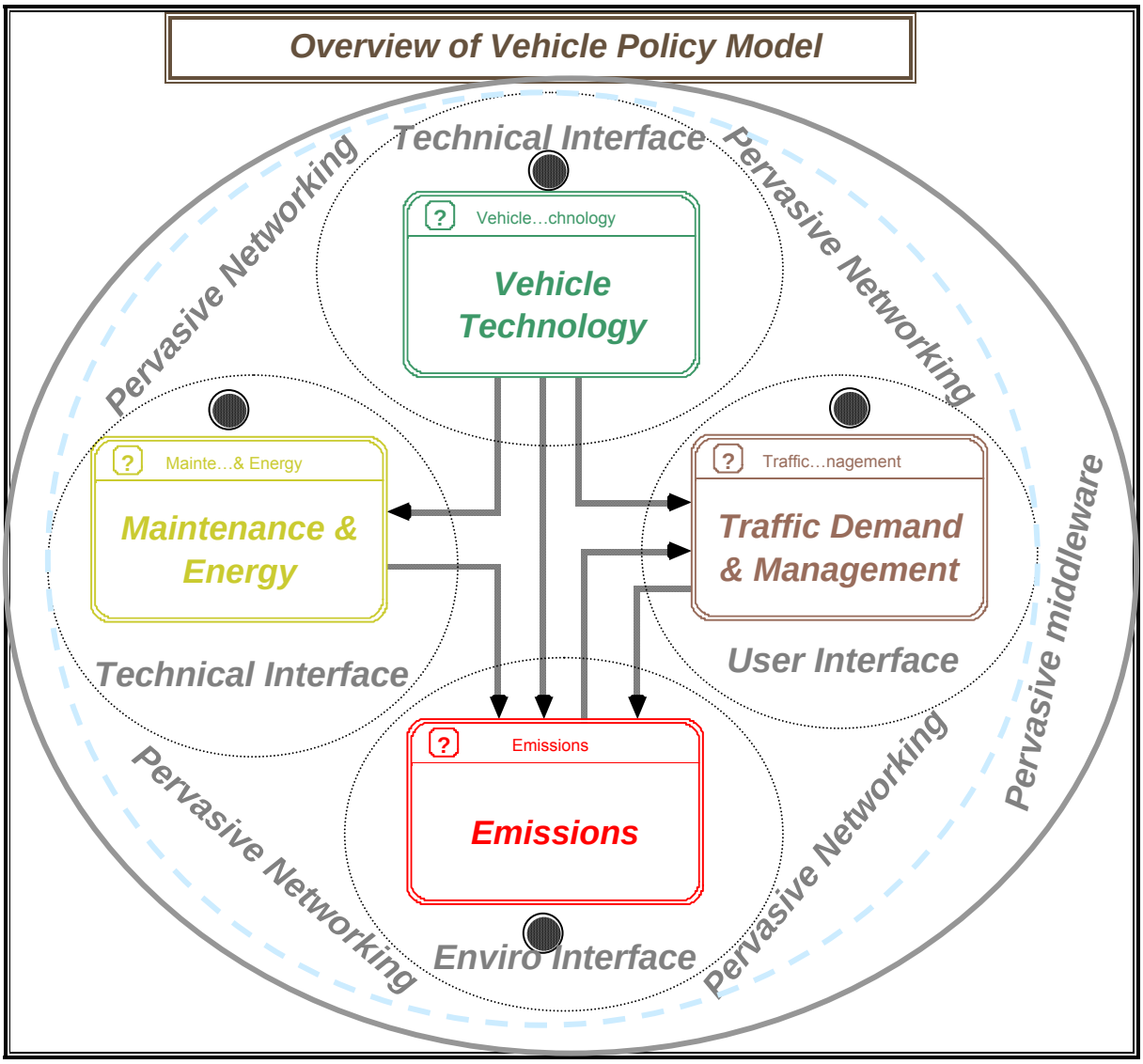


Figure 5.3 Overview of vehicle policy model

Starting from the top of the policy model (Figure 5.3), resources are used to produce vehicles that are utilised by the population. The level of transportation demand (User Interface) determines the amount of vehicle fleet (Technical Interface), which then determines the degree of congestion (User Interface). Considering the bottom of the model, the amount of emissions generated and its subsequent health and environmental effects (Enviro Interface) depends on the level of congestion (User Interface) and type of vehicle fleet (Technical Interface). From the left, the extent to which vehicle maintenance and energy types (Technical Interface) affect emissions determines the threat to health,

environment and safety (Enviro Interface). Thus a well designed management system - comprising of pervasive middleware and networking, technical, enviro and user interfaces - is imperative for a sustainable road transport regime.

Pervasive Middleware, on the one hand, comprises of tools such as command and control regulations that depict interactions with the networking kernel by means of matching vehicle operational components with environmental goals. On the other hand, Pervasive Networking provides for robust harmonisation between technical, user and environmental platforms. Further, the Technical Interface comprises of hard tools involving modification of diesel engines for plant oil and/or modification of plant oil for unmodified diesel engines. The user interface keeps users immersed in the pervasive vehicle space by means of effective interfaces between traffic management and consumers' awareness campaign on purchasing eco-efficient vehicles and green fuels. Finally the enviro interface accounts for biofuels Carbon dioxide release taken up by other plants. As a result, Carbon dioxide is recycled, and atmospheric Carbon dioxide levels remain constant, thereby mitigating greenhouse gases and global warming.

5.3.2 Stakeholder Value Assessment and Policy Design

In this section of the chapter, a Stakeholder-Assisted Model and Policy Design Framework is proposed, as applied to road transport in sub-Sahara Africa (figure 5.4).

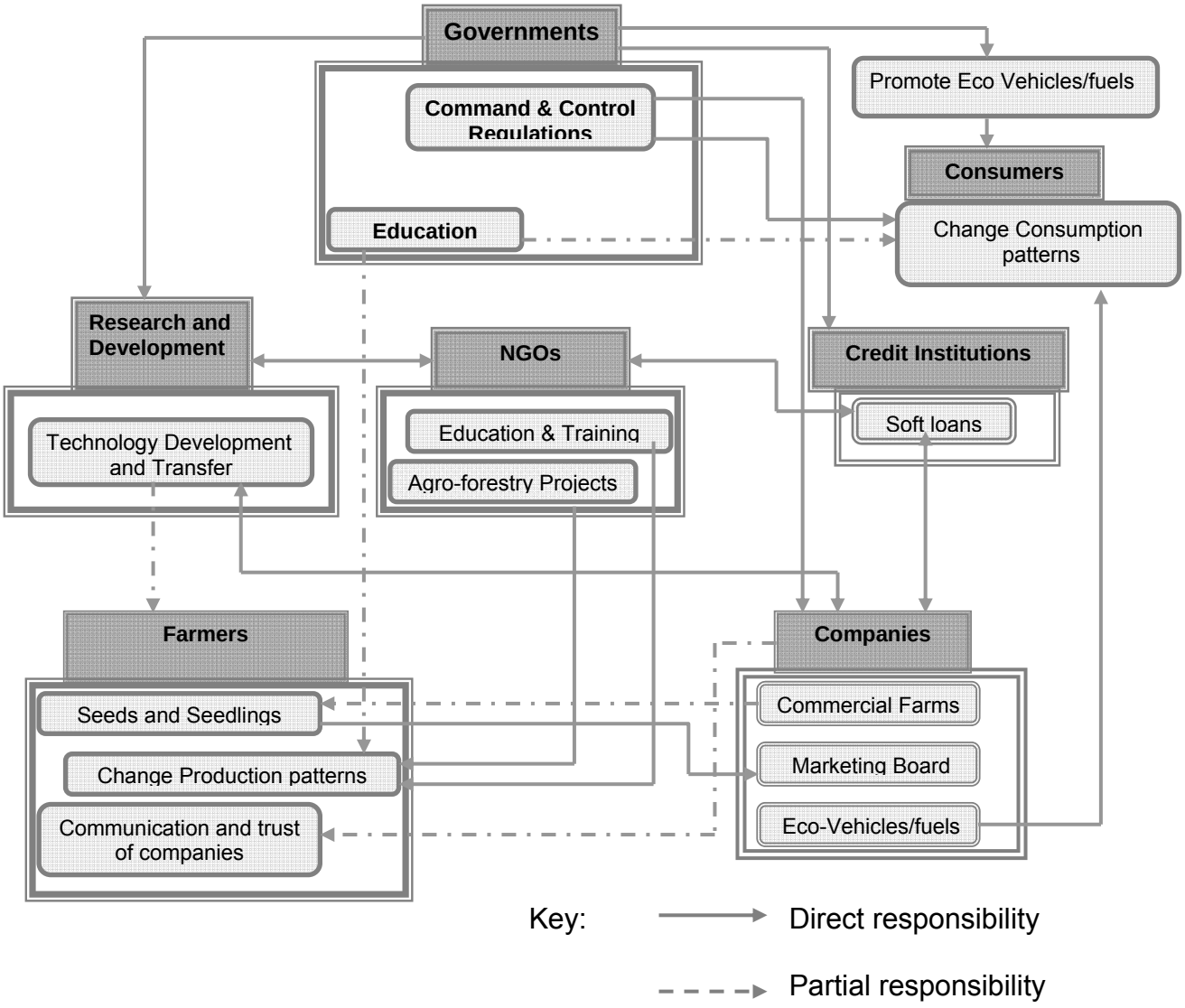


Figure 5.4 A stakeholder-assisted model and policy framework (SAM-PF) for sustainable road transport in sub-Sahara Africa

The major stakeholders, in terms of their roles, interests/values, responsibilities and authorities, as depicted in figure 5.4 are presented in the following sub-sections.

5.3.3.1 Governments

At the top of this framework, a harmonised regional initiative, which enables all countries to be part of concerted actions to support all efforts that promote trade in environmentally sound used vehicles and biofuels in sub-Sahara Africa is crucial in order to minimise the deleterious impacts of fossil fuels on the economies of African countries. Thus concerted actions by sub-Saharan African governments and their European counterparts encompassing consumers' awareness campaigns and television commercials, regulatory, pricing, and taxation mechanisms, reinforced by effective enforcement to encourage the use of clean vehicles and biofuels, and restricting or outlawing the use of polluting vehicles and fuels, and to modify travel behaviour and transport demand is critical for the post-2006 lead gasoline phase out process in the region (Faiz et al. 1990).

However, a number of high barriers exist that make it difficult for sub-Saharan African countries to initiate such an energy transition. This is why the European Union should play a key role in overcoming the institutional, technical and economic barriers as was the case with lead gasoline phase-out in sub-Sahara Africa. There is therefore an urgent need for a joint initiative on renewable energy, in which the EU couples its own development, economic and energy policies to those of sub-Sahara Africa, with bioenergy forming the core.[1] Indeed, the EU is in the process of enhancing Africa's infrastructure and institutional enforcement capacity to bolster CDM bioenergy projects in the region.[2] From this premise, consistent and coordinated programmes and policies among sub-Saharan African nations and their industrialised counterparts are necessary to change the technology trajectory of renewable energy financing in the region. This translates to greater adaptation, research and mitigation assistance with defined schedule of flows in order to combat the global threat of climate change, particularly vulnerable countries in sub-Saharan Africa.

Creating a leadership coalition committed to action on the regional clean air initiative is critical. Thus, focusing on synergies between climate and development policies and fully integrating low- and no-carbon strategies with national programmes for sustainable development are the underlying activities of such a

Government coalition in the region (Byers and Snowe, 2005). This should include the introduction of legislated requirements for the production and use of biofuels with a minimum blend of biodiesel within the sub-Saharan African Automotive sector. Indeed, Agricultural Companies are poised to act on a big opportunity, as the South African government says it wants a 2% blend for biodiesel in her transport sector for the rest of the countries in the region to follow suite.[3]

Mindful of jatropha's ability to grow well on marginal and abandoned lands and mindful of the massive demand of this plant as a non-edible feedstock, we are currently developing a legal and regulatory framework mechanism to ensure that Jatropha plantations do not lead to invasion of agricultural lands, which may eventually put food security at risk.[4] Indeed, Britain has initiated a special investigation to assess the potential effects of bioenergy production on global food security and would reconsider her position on the EU biofuel directive if biofuel production from energy crops does not ensure self-sufficiency with regard to the prevailing food crisis.[5]

5.3.3.2 Credit Institutions

Investments in biodiesel production for road transport in sub-Sahara Africa should stem primarily from companies interested in pursuing business in renewable energy. A comment from a chief executive officer of a large bio-diesel company that offers evidence to this fact is, BP's decision to join D1 in this new venture is a significant endorsement of our strategy to develop jatropha for the production of sustainable biodiesel. Indeed, BP's proven logistical, managerial and financial support will enable a significant enhancement and acceleration of the scope and pace of jatropha planting.[6] A similar judgment was made, during a personal conversation, by an Environmental manager of a large bio-diesel company regarding bio-diesel financing in sub-Sahara Africa affirming that the company is actively seeking jatropha curcas as an alternative feedstock for their biodiesel plants.

Apart from private sector financing as a tool to mainstreaming biodiesel within road transport in sub-Sahara Africa, it is imperative for governments to create financial institutions that lend money to emerging and credible Small and Medium Sized Enterprises (SMEs) as well as Non Governmental Organisations (NGOs) in the form of soft loans with low interest rates over a long period of time. In this regard, the African Rural Energy Enterprise Development (AREED) has gone a long way to offer rural energy entrepreneurs in Mali, Ghana, Tanzania, Senegal and Zambia a combination of enterprise development services and start-up financing. Indeed, this integrated financial and technical support allows entrepreneurs to plan and structure their companies for growth and makes eventual investments possible by mainstreaming financial partners.[7] Accordingly, investing in bioenergy production can be a catalyst for speeding up much needed investments in basic (energy and transport) infrastructure, agriculture and industrial development.[8]

5.3.3.3 Industrial Sector

Apart from investing in biodiesel production by opening up commercial farms, interested companies could offer biofuel seeds and seedlings to well established farmers' cooperatives in the form of soft loans to be deducted when these farmers sell seeds back after harvest within a network of trading points on a regular time schedule. In addition to our commercial farms, jatropha cultivation with our structured out-grower's scheme has been a great venture to secure our future feedstock.[9] From this premise, embarking on structured loan schemes, payback agreements or joint ventures between farmers and companies is imperative to successfully mainstream this emerging renewable enterprise within the sub-Saharan African Automotive sector.

5.3.3.4 Non Governmental Organisations (NGOs)

Mobilising environmental education, training and forging strategic collaborations with farmers particularly in the promotion of Agro-forestry projects are the underlying activities of NGOs to guarantee a successful implementation of a biofuel niche within road transport in sub-Sahara Africa. Indeed such initiatives

have not only provided for a new renewable energy source to local project developers but have equally been instrumental in local income generation, livelihood security for households, small scale social infrastructure and some environmental benefits. In Madagascar, where up to 70% of people are unemployed in some regions, jatropha cultivation has opened a new future for small farmers who can finally diversify their portfolio.[10]

5.3.3.5 Technology Development and Diffusion

Presently available technologies for biofuels production all have significant shortcomings with respect to one or more global concerns that might be affected by a major increase in the use of biofuels including; climate change, energy security, food security, ecosystem conservation, economic growth, and poverty alleviation (Lee et al. 2007). Thus Companies funding scientific and industrial research for the production of biodiesel as well as fabricating new prototypes of biodiesel engines are thus the basis for a successful deployment of this unique renewable enterprise within the sub-Saharan African Automotive sector. To this end, auto giant Daimler Chrysler has been researching, planting and testing Jatropha and bio-diesel derived from its oil for the past three years. This has included projects such as growing the crop in the middle of the Egyptian desert, to prove that it thrives in the most extreme conditions.[10]

While at any interim step it may be regarded that only Universities should play a major role in research and development, as has been the case in sub-Sahara Africa, no such thing should exist by Governments providing equal opportunities to polytechnics in the design and development of biodiesel. From this premise, broadening participation in research and development by strategically coordinating top energy research institutes in sub-Sahara Africa to form a regional centre for scientific excellence is essential to mainstream this novel renewable energy niche within the sub-Saharan African Automotive sector.

5.4 Chapter Summary

As presented in this chapter, road transport in sub-Sahara Africa has been provided with old, inefficient and poorly maintained vehicles, characterised by high congestion, high fuel consumption and high emissions, posing a significant threat to health, safety and environmental quality of African towns and cities. Despite numerous discussions on the structure and content of a post-2006 sub-Saharan African clear air initiative, no proper assessment has been carried out yet to engage sub-Saharan African nations and their peoples in a long-term effort that fairly and effectively mobilises technology and resources to curb vehicle emissions while sustaining economic growth in the region. In an attempt to avert this contemporary policy dilemma, we have developed a Stakeholder-Assisted Representation and Policy Design Framework based on inputs/information gathered from stakeholders. This holistic framework essentially consists of system and goal definition, system components, linkage representation, characterisation, design, evaluation and selection of stakeholders' interests and values.

The proposed framework allows the major stakeholders (policymakers and other government agencies, credit institutions, companies, farmers, research institutes and NGOs) to better understand the rationale behind the future of road transport in sub-Sahara Africa by examining its underlying principles. Ideally this alternative framework can overcome the tenuous state of affairs with regard to sustainable road transport by providing a gateway for the various stakeholders concerned to come to terms with the equity and technology dilemmas in prevalence. In achieving this goal, the framework takes into account stakeholders' local knowledge and experience, more inclusive policy process leading to higher acceptability of design components, better adherence to implementation due to process ownership, better understanding of stakeholder concerns and institutional issues in an integrated manner. By so doing, the framework provides the key roles of stakeholders and how they interact with one another. Indeed, the proposed framework aims, above all, to be pragmatic. For an effective implementation of the proposed framework, the following chapter presents four pan-African scenarios and decision-support tools for sustainable road transport in sub-Sahara Africa.

CHAPTER SIX

Scenario Analyses and Decision-support Tools for Sustainable Road Transport in sub-Sahara Africa

Future developments on road transportation, energy system and climate in sub-Sahara Africa are highly uncertain. In order to deal with these uncertainties, an adaptive policy is proposed that takes some actions right away and creates a framework that is robust across a range of plausible futures with technology, smart policies, and unflinching attitudes of leaders playing a pivotal role. The adaptive approach is illustrated for four scenarios vis-à-vis decision-support tools for sustainable road transport in sub-Sahara Africa.

6.1 Introduction

The international trade in second-hand vehicles involves problems, which are specific to this sector; occurring either on use in the new location or are connected with trade practices, which are neither monitored nor critically examined or addressed at all (Janischweski et al. 2003). Transport in many developing countries is often provided with old, inefficient and poorly maintained vehicles, characterised by high fuel consumption and high emissions (Figueroa et at. 2004) resulting in a rapid deterioration of the quality of air, soil and water; posing a significant threat to environment, health and safety (ESDD, 2004). In spite of this, the international trade in second-hand vehicles has gradually moved in a political and administrative vacuum; one that African nations have turned to their industrialised counterparts and suggested that they exercise better control over their exports. This request has played a subordinate role in the export policies of industrialised countries; escalating the ambiguity on how to deal with the phenomenon of increasing imports, posing a huge challenge to policymakers in sub-Sahara Africa (Janischweski et al. 2003).

Mindful of the extent to which vehicle design and fuel technology can result in cheaper vehicles and their corresponding impacts, developing countries may be able to plan ahead for their distribution and use. In as much as these countries are able to take advantage of the potential opportunities as a means to minimise the percent of their GDP that is spent on transportation, and insofar as they are also less burdened by sunk costs associated with current vehicle and fuel technologies, developing countries may be able to offer manufacturers an attractive base for a leap straight to new industrial forms best suited to next-generation vehicle technologies (Green, 1999). On that occasion, agents (individuals, businesses) and societies have the capacity to shape their own future, and often have the means to implement their vision. The task then becomes one of identifying the necessary steps and the roadmap to get there (IEA, 2003).

However, existing long-term energy and emission scenarios in the literature are either heavily aggregated at the global level or are focused on industrialised countries with a dearth of empirical studies within the context of sub-Sahara Africa. Motivated by this fact and the rapidly changing economic, demographic structures and vehicle population in sub-Sahara Africa, it is of interest to have regional specific assessments of road transport energy system development and its associated environmental implications in the region over a long-term. To this end, this study seeks to explore the possible routes of road transport in sub-Sahara Africa and to propose a road map simultaneously with guidelines to help put back the realisation of a model for sustainable development for decades. In doing so, the study puts forward the different forms future commitments might take by identifying a range of illustrative scenarios regarding the fundamental uncertainties related to the long term future developments of road transport in sub-Sahara Africa.

Thinking about the role of future road transport energy system development in sub-Sahara Africa raises a number of questions regarding technology, policy instruments, energy markets and the environment. On this score, the following fundamental questions are addressed in this chapter: (i) what could future energy

production and supply look like? (ii) how will energy production and supply influence road transport and the regional environment? (iii) what technological solutions should be allowed or promoted? (iv) what will a sustainable road transport policy to limit dangerous distortions of the environment look like? (v) by way of what type and level of participation can such an outcome be avoided and what should be the time frame for such participation?

Given the fundamental uncertainties of the future, a conceptual scenario approach has been adopted to answer these fundamental questions. It is the purpose of this paper to explore possible future routes for road transport in sub-Sahara Africa and their environmental implications with the energy system, security of supply, and technological change playing a pivotal role. Further, an optimisation road map and its corresponding policy manual for a successful implantation are proposed. Thus by highlighting the implications for policy action, including technology development, energy and climate change mitigation, policy makers may better understand how current actions affect the future, and work toward a future that is more in keeping with sustainability goals (IEA, 2003).

Developments within these scenarios reflect different hypotheses about how current trends will unfold, how critical uncertainties will play out, and what new factors will come into play based on soft and hard data about past and present trends of the major factors affecting road transport in sub-Sahara Africa. The scenarios differ with respect to two key uncertainties: technological change particularly in the energy to environmental attitudes and preferences. Consequently, four different images of road transport in sub-Sahara Africa are provided and consistent with those images, implications are suggested for the energy technologies that are likely to emerge in each of the scenarios.

The chapter is structured as follows: It begins by outlining the methodological approach with a brief description of data and data sources. Analyses of results and key findings are presented in the next section of the chapter. This section of the chapter presents four long term hypothetical exploratory and normative case scenarios based on a set of desirable and undesirable characteristics (or "norms") that the future of road transport in sub-Sahara African should and should not

possess respectively. Further, the processes to express these characteristics are illustrated. To help appreciate the scale of the challenges involved in bringing about such a scenario, a quantitative framework is provided. However, rather than simulating this scenario with the use of a model, existing data has been used and modified to fit the desired image. Next, an optimisation model (road map) and its corresponding policy manual for a successful implantation are proposed. The final section draws up several conclusions on environmentally sound distribution and use of vehicles and fuels in the region.

6.2 Research Methodology

In this study, the principal elements of a typical scenario used in environmental studies are employed comprising of: description of step-wise changes in the future, base year, time horizon and time steps, and construction of scenarios (figure 6.1) (Alcamo, 2001). Essentially, figure 6.1 follows a similar process employed by IEA (2003) in energy to 2050 scenario development. However, it is important to note that the key to scenario development is not whether the scenarios are "correct" or "most desirable" but rather, what they indicate about future policy choices (IEA, 2003).

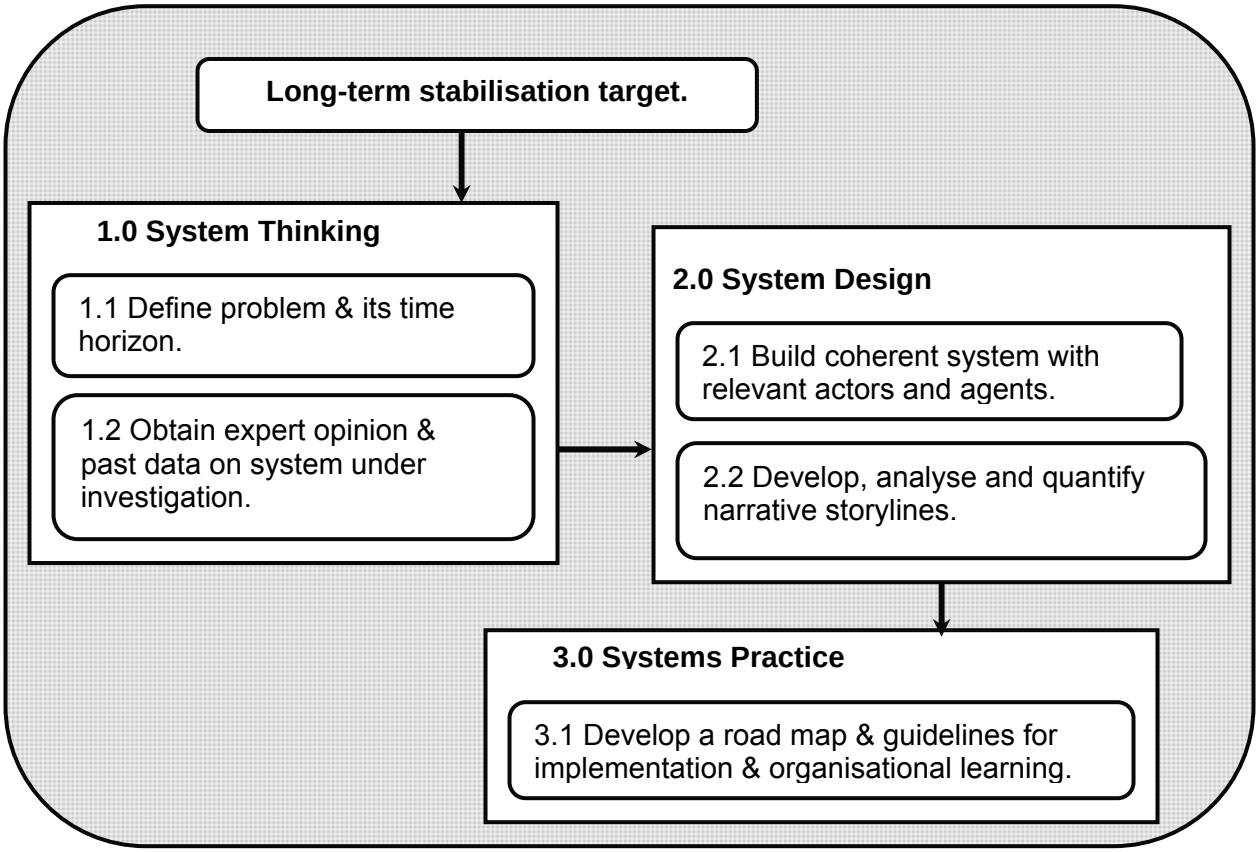


Figure 6.1 Steps for building narrative storylines for scenario development (Source: Developed from Alcamo, 2001; Maani and Cavana, 2000)

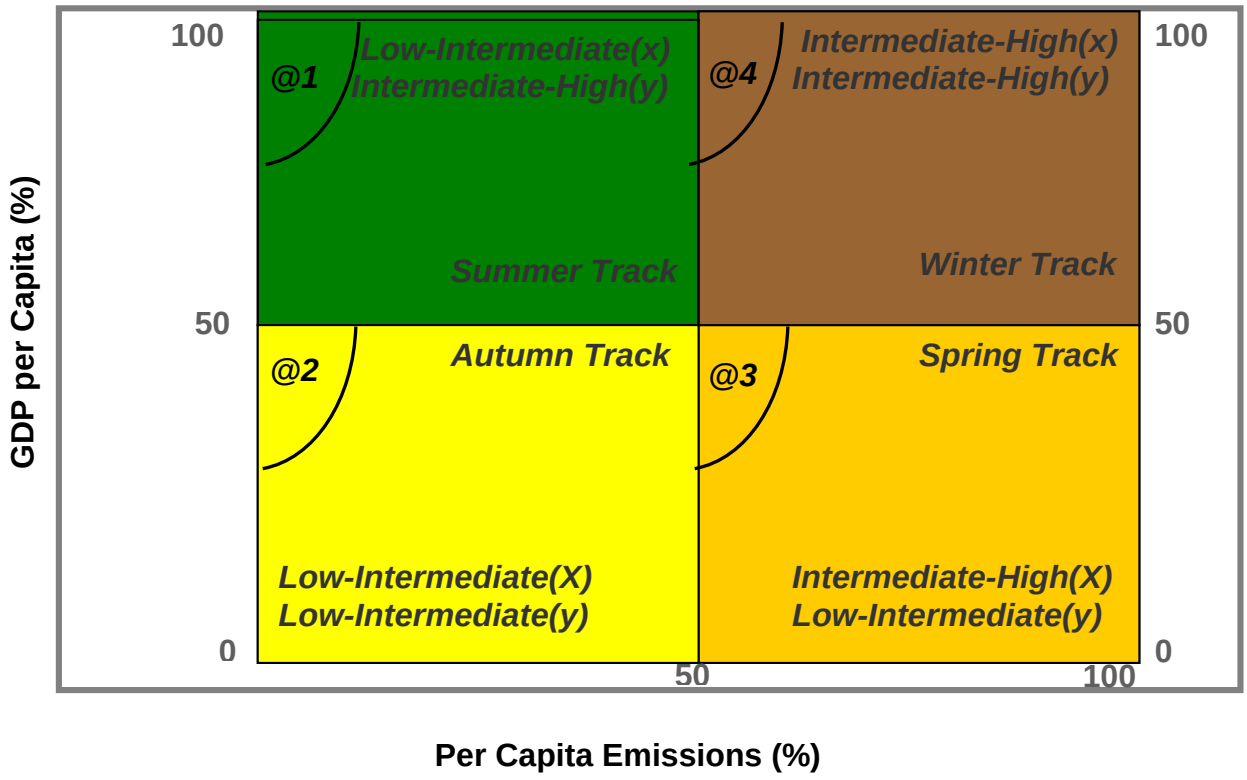
As a first step, the system under investigation and its boundaries were identified. This consists of technological variations, the actors involved and the energy system context, which comprises the economic and social environment, as well as some interfaces with the natural environment.

Past data on primary energy, the environment, vehicle and demographic population were gathered from various sources including publicly available documentation like relevant literature, indigenous consultancy reports and government documents. Key factors that would affect the system were then identified, clarifying the links and feedback between them and various parts of the system. This analysis was carried out in a qualitative fashion based on existing data, but whenever possible, causal links were identified much in the same way as is done in a deterministic model.

6.3 Results and Discussion

6.3.1 Four pan-African Scenarios

In this section of the chapter, a sustainability map has been designed (figure 6.2), which lays down the foundations of the scenario framework with both positive and negative correlations between emissions per capita (responsibility/polluter pay principle) and GDP per capita/per capita income (capacity/ability to pay); with carbon intensity (emissions per GDP) decreasing or increasing along trajectories



Key: @ = Smart growth = Optimum sustainable region for each Track

Figure 6.2 The sustainability map – Four pan-African exploratory scenarios

The map (figure 6.2) is constructed by plotting per capita emissions (X-axis coordinates) against per capita income (Y-axis coordinates). The percentages between the coordinates (X and Y axes) range from 0-50% and 50-100%. These percentage values represent a score from low to intermediate and intermediate to high along the X and Y axes. For instance, the X-axis in the summer track ranges from 0-50%, which is indicative of low to intermediate per capita emissions while

the Y-axis varies from 50-100%, signifying an intermediate to high GDP per capita.

The map is evaluated by coding each track to a colour based on a modified seasonal variation of deciduous leaves with the use of four colours:

- **Autumn Track:** Yellow deciduous foliage to denote some modest sustainability advantages
- **Spring Track:** Amber deciduous foliage to indicate high sustainability problems
- **Winter Track:** Brownish deciduous foliage to point to critical sustainability problems
- **Summer Track:** Greenish deciduous foliage to designate major sustainability advantages

The map is designed as a system-level tool to track and benchmark sustainability improvements/strategies of road transport in sub-Sahara Africa with per capita emissions and per capita income as likable tools of the effects of alternate command and control measures of possible future developments and their environmental implications. It revolves around four exploratory scenarios looking out within 2050 and develops them qualitatively. The main characteristics embedded within the scenario framework are fleshed out in the following section of this chapter.

6.3.2 Main Characteristics of the four pan-African Scenarios

6.3.2.1 Winter trajectory – Inaction where there is no commitments to Sustainable development

With an intermediate to high per capita emissions and an intermediate to high GDP per capita, the winter trajectory envisages sub-Sahara Africa full of huge disparities, where inequality and conflict, brought about by socio-economic and environmental stresses prevail. A trajectory in which "business-as-usual" developments progress with the current prevailing values and markets of conventional dirty vehicle technologies from industrialised countries. Road

transport developments towards this trend lead to undesirable/unsustainable outcomes with some clear dangers down the road should policy makers fail to steer clear of those dangers by making considerable changes to modify the trajectory. To this end, strong actions in an attempt to achieve specific social and environmental goals are crucial. Intermediate to high population growth rate, increasing affluence of personal mobility, a growing pressure on fossil fuel and a deteriorating public transport system result in medium to high emissions and critical urban air pollution posing a significant threat to health, environment and safety. Society is unconcerned about regional environmental issues with road transport based on private initiatives and market-based solutions of conventional dirty vehicle technologies.

6.3.2.2 Spring trajectory – Inaction

In this trajectory, with intermediate to high per capita emissions and low to intermediate GDP per capita, sub-Saharan African nations face deep divisions between agriculture, poverty alleviation and the high costs of curbing vehicle emissions. A gradual increase in the affluence of personal mobility, a growing pressure on fossil fuel and a deteriorating public transport system result in medium to high emissions and rising urban air pollution. As with the winter trajectory, society is unconcerned about global environmental issues with road transport based on private initiatives and market-based solutions of conventional dirty technologies from industrialised nations. African governments concentrate on core issues, such as poverty alleviation, loans and dept relief. They engage less in social infrastructure and climate change mitigation so that leakage effects of green house gases and unintentional hot air continue to grow. Regional cooperation, economic integration and international trade collapse resulting in high inflation rates as governments assign a high value to power and national sovereignty with the problem of climate change aggravating in many parts of the region.

6.3.2.3 The Summer trajectory – pro-action involving detailed plans for the future and set trends

In the summer trajectory, with low to intermediate per capita emissions and an intermediate to high GDP per capita, strong actions are undertaken by sub-Saharan African governments in an attempt to achieve specific social and environmental goals. It pictures a "fundamental re-think" in which a new development paradigm - a variety of strategic issues and policy actions - emerges in response to the challenge of sustainable road transport supported by new, more equitable values and institutions required for an effective sustainable vehicle fleet in sub-Sahara Africa. All of these are reinforced by fiscal levers or incentives such as carbon taxes and tax breaks.

Embedded in this trajectory are mandatory and voluntary targets for increasing the share of biofuels in the domestic transport energy mix of developed countries resulting in scarcity of land in OECD countries seeking to meet these targets. This trend, combined with rapidly declining reserves of fossil fuels and global security issues as well as climate change concerns, helps to boost international trade in order to exploit the production potential of biofuels in sub-Sahara Africa where there are better climatic conditions, land and infrastructure. Taking advantage of this development, sub-Saharan African nations develop strong regional cooperation and "soft laws" through well functioning public institutions, consistent and coordinated programmes and policies, and consumers' awareness campaigns on environmentally sound vehicles and biofuels. Society accepts and braces for technology-driven growth in renewable energies instrumental in climate change mitigation, local income generation, livelihood security, and immense social infrastructure. African Union (AU) Member States learn from each others' experiences, which creates a process of convergence of institutions, economic growth, harmonisation of biofuel standards and reforming the process of AU decision making laying the foundation for a successful and powerful African Union. Such a powerful body proceeds further in achieving broad international cooperation through trade and global climate change mitigation.

6.3.2.4 The Autumn trajectory – interaction, where policy makers shape and responds to changing trends over time

In this trajectory, sub-Saharan African countries commit to a moderate target for absolute road vehicle emissions. Emission level may be increasing, but are below a business as usual scenario.

6.3.3 Preliminary Quantification of Common Features and Specific Elements that differentiate the Four Scenarios

As mentioned earlier, the four pan-African scenarios share some common features, given by those trends, already apparent in today's experience and broadly recognised, that are very likely to continue in the future. These scenarios, however, are differentiated on the basis of four variables: pace of technological change, energy production and consumption, and attitudes towards the environment. With each variable characterised by a "low", "medium" or "high" level, four different scenarios are derived as already mentioned in figure 6.2. Assuming the reference case is technology, energy and environmental awareness that proceed along current paths, the four scenarios can be analysed as follows: (i) the medium environment, intermediate population, low energy and medium technology trajectory referred to as "Autumn Track"; (ii) the low environment, intermediate to high population, low energy and low technology trajectory referred to as " Winter and Spring Tracks "; and (iii) the high environment, high population, high energy and high technology trajectory referred to as "Summer Track". These fundamental characteristics are summarised hereafter with some brief comments by areas of interest.

6.3.3.1 Demographic Population

Population growth in the four scenarios will continue in a geometric progression within the next decades (figure 6.3). Other significant trends include increasing urbanisation and affluence to personal mobility leading to an increasing number of mega-cities.

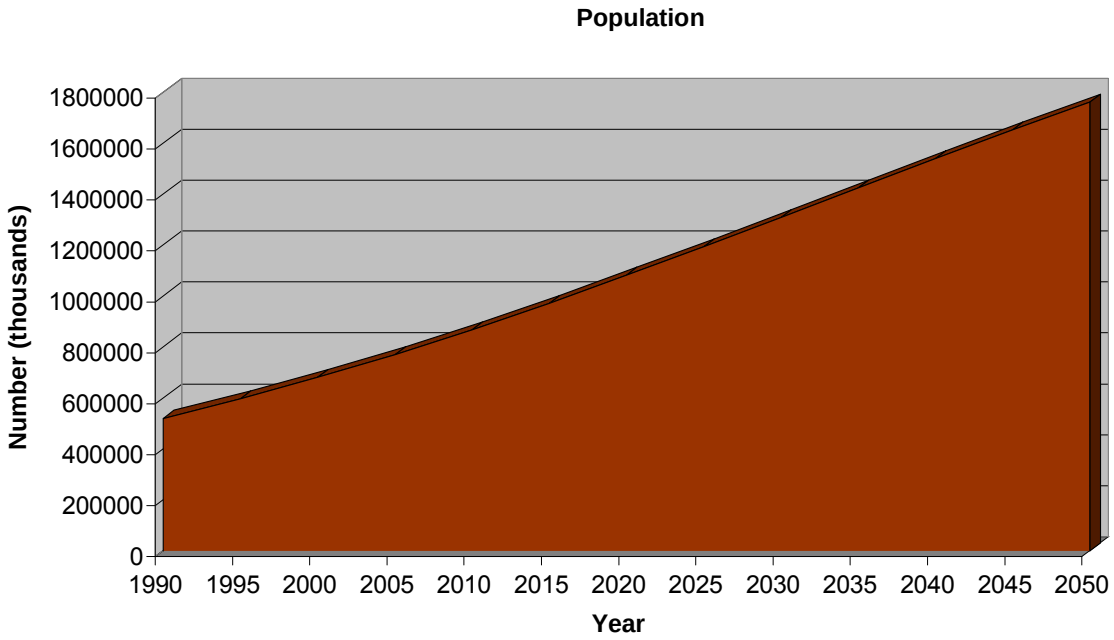


Figure 6.3 Population growth in sub-Sahara Africa

6.3.3.2 Vehicle Production and Use

Overall vehicle production and use are likely to grow in all the four scenarios with total vehicles in use outnumbering total vehicle production by a significant margin (figure 6.4).

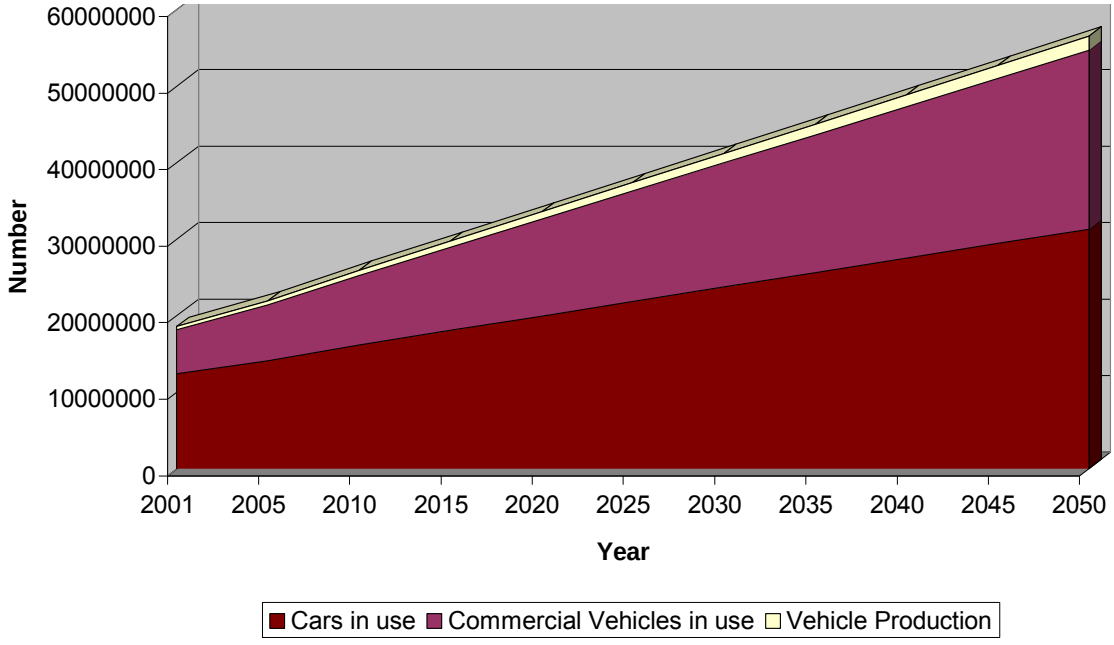
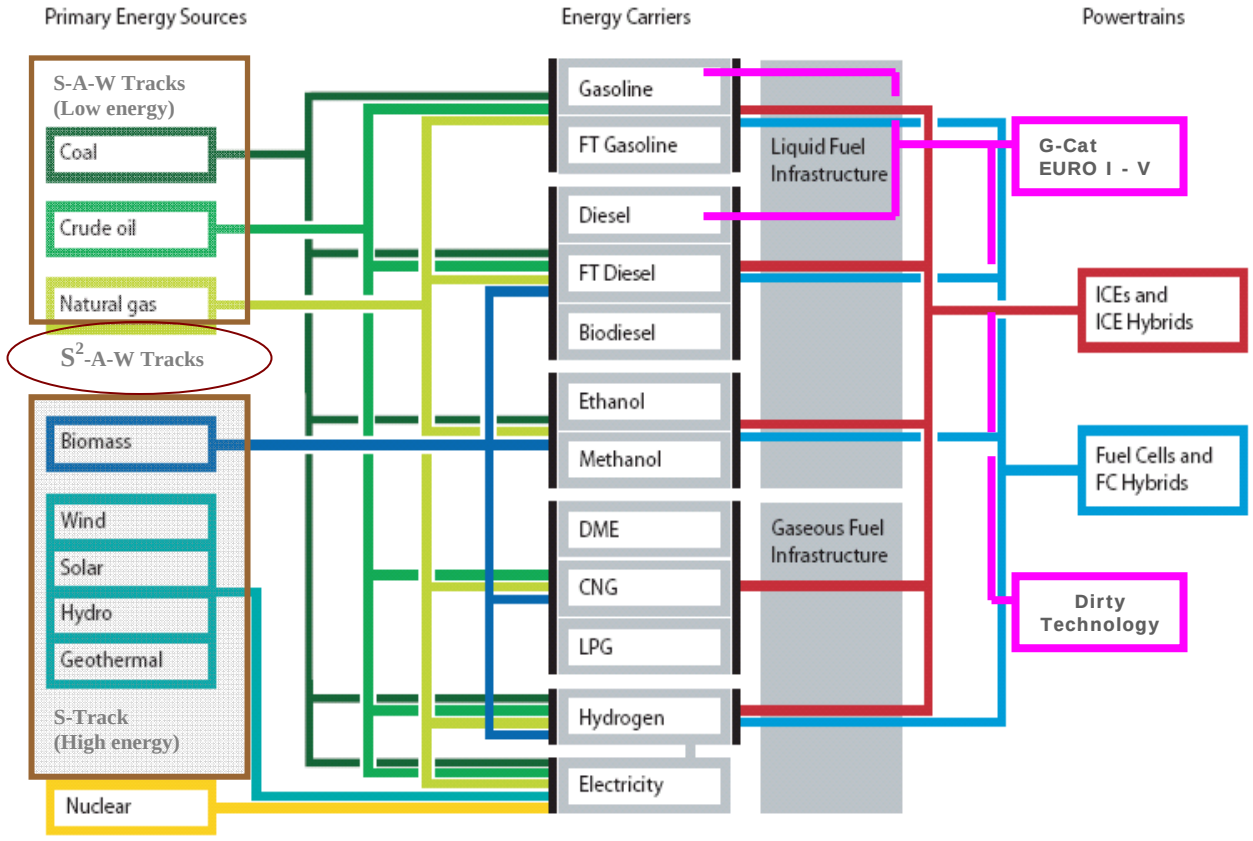


Figure 6.4 Vehicle production and use in Africa

This trend will result in a 2% increase in personal transport activity by 2050 (Sustainable Mobility Project, 2004). However the development of eco-efficient vehicles, environmental campaigns and green procurement will continue to grow predominantly in the summer track, with the distribution and use of conventional dirty technologies growing faster in the winter and spring trajectories. The scenarios developed allow for some variation (higher or lower growth) with respect to this trend, depending on the assumptions on the two main drivers - pace of technological change and the concern for the environment – explained in the subsequent section.

6.3.3.3 Pace of Technological Change.

Consistent with the direction of variable "policies and attitudes towards the environment" each scenario produces different results concerning which technologies will emerge more strongly (figure 6.5).



S-A-W Tracks – spring, Autumn and Winter Tracks
S^2-A-W Tracks – Intersection between S-A-W and S Tracks (Low and High energies)

Figure 6.5 Possible fuel transport pathways
(Source: Modified from Sustainable Mobility Project, 2004)

Accordingly, the pace of technological change will vary significantly across scenarios. On one hand, technology is projected to deteriorate considerably in the Spring and Winter trajectories with conventional dirty technology penetrating the market. However, the speed by which new technologies develop and enter into widespread use varies between the Autumn and Summer trajectories from slow (Catalytic converters, EURO I - V) to fast (Fuel cells and FC hybrids) respectively.

6.3.3.4 Total Energy Production

Total primary energy production is likely to increase in aggregate terms in all scenarios (figure 6.6).

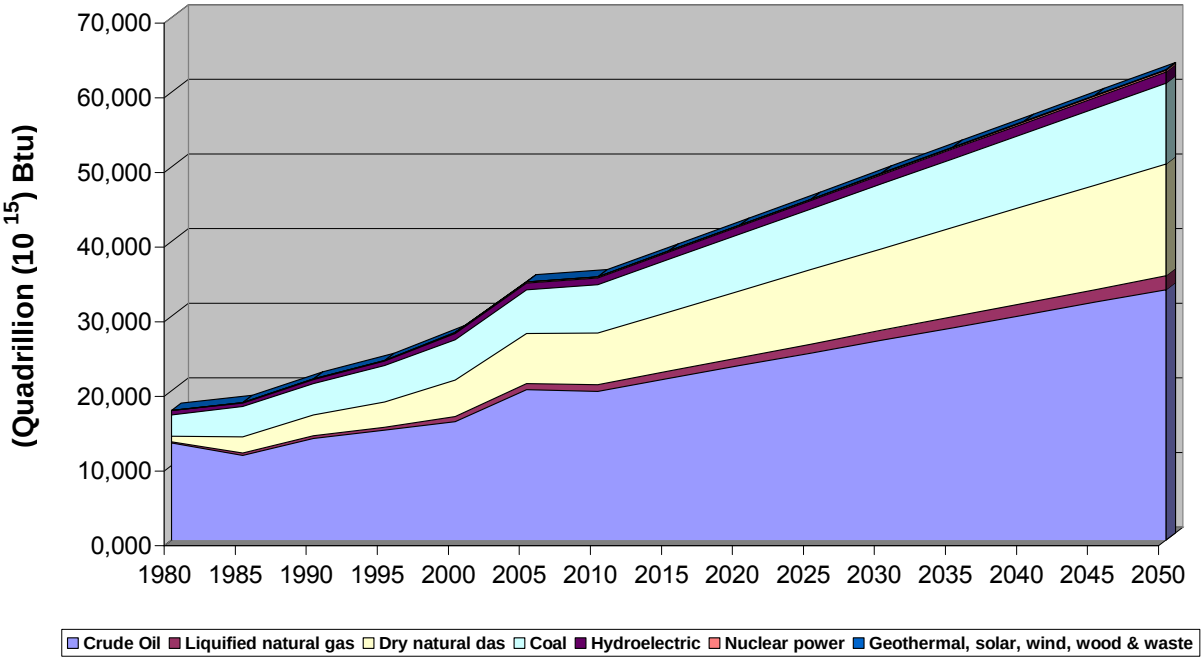


Figure 6.6 Evolution of total primary energy production in Africa

Growth in renewables and fossil fuel production will continue but will vary depending on the scenario. In a smart growth scenario with a stringent climate policy such as the Summer Track, primary energy production in terms of combine renewables and waste, solar and wind are projected to grow considerably leading to drastic cuts in emissions. Contrary to the summer trajectory, the Spring and Winter trajectories with no climate policies are likely to be embedded with high

production of coal, oil and gas with subsequent high emissions posing a significant threat to environment, health and safety.

6.3.3.5 Total Energy Consumption.

As with primary energy production, total primary energy consumption is projected to grow in all scenarios (figure 6.7).

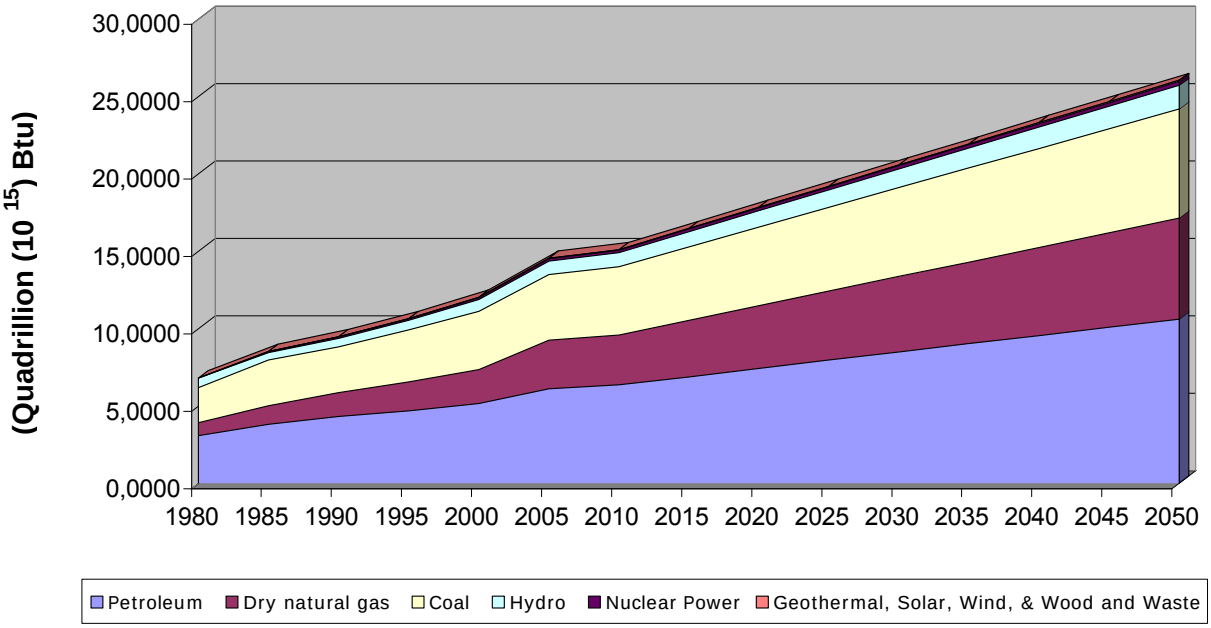
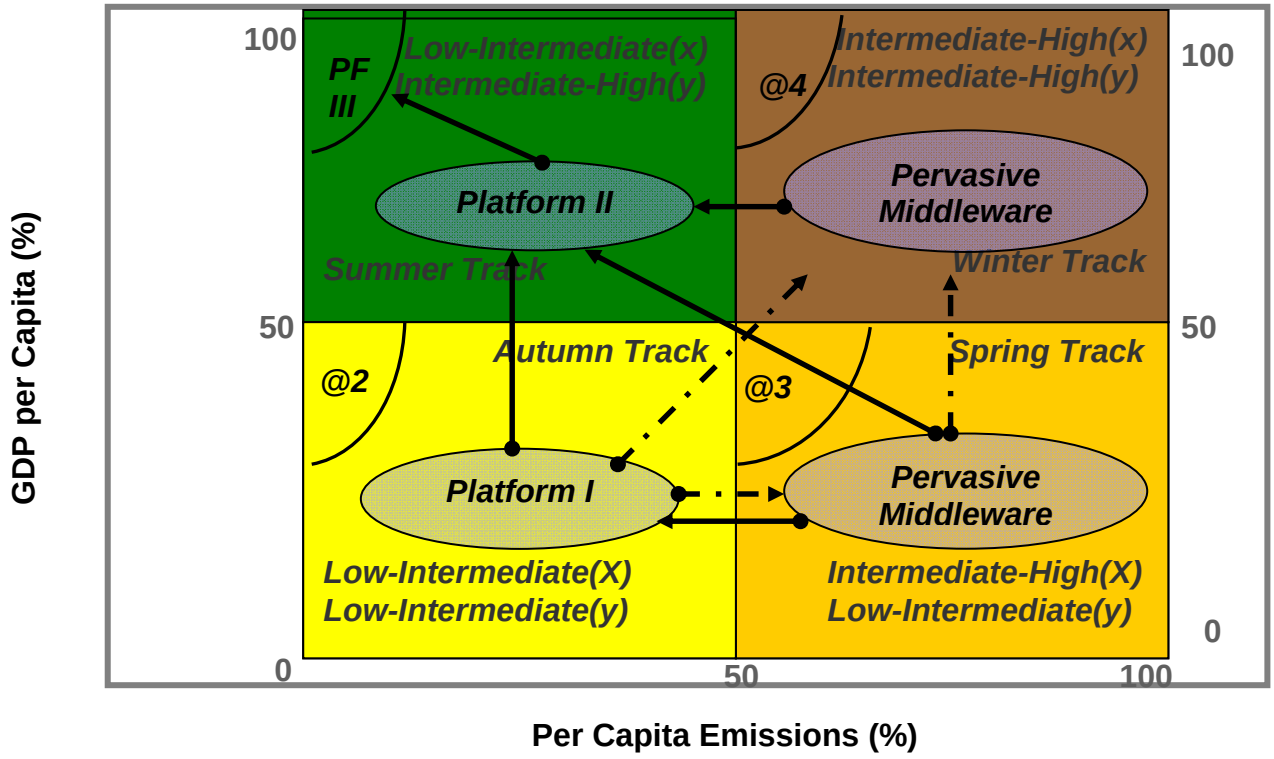


Figure 6.7 Evolution of total primary energy consumption in Africa

However, differences in regulation of production, storage and supply in all scenarios project energy production (figure 6.6) to grow stronger than energy consumption (figure 6.7) with excess energy produced exported to industrialised countries. Further, fossil fuels use per unit of output (energy intensity) in the winter and spring trajectories are projected to grow at a relative high rate while the summer track with a low energy intensity society (reduced demand) and improved efficiency in energy conversion is likely to experience a dramatic shift in energy systems to substitution of fossil energy non-carbon fuels, like biomass, solar, hydro, wind or nuclear power.

6.3.4 Road map, Policy Directions and Way Forward

In this section of the chapter, a road map has been designed (figure 6.8) based on a menu approach where countries subscribe to a number of options, but are not bound to all. As the group of sub-Saharan African countries is very diverse, not all countries would necessarily take on the same type of target at the same time. It thus enables policy makers to choose pathways that best align the regional interest in sustainable vehicle distribution and use with their own evolving national interests.



Key:

Preferred shift (Sustainability advantages)

Unwanted shift (business as usual)

PF: Platform; @ = Optimum sustainable region for each track

Figure 6.8 Regime's architecture road map

As time progresses, more and more countries enter the summer track initially via platform II before proceeding to platform III. Countries graduate and move through the stages on the road map based on proposed defined policy actions depicted in table 6.1.

Table 6.1 Policy actions for a sustainable regime

Characteristics	Regime Architecture	Policy Actions
1) **Summer Track** Major Sustainability advantages.	Optimal design.	Move all activities towards this region.
"Zero" impact. Low remediation cost	Platform II Medium Term (2030-2050)	Deployment of biofuel - Jatropha curcas; Market based
	Platform III Long Term (Beyond 2050)	Deployment of hybrids, hydrogen and steam powered cars, solar panels, synthesised chlorophyll for energy capture
2) **Autumn Track** Modest sustainability advantages.	Sub-optimal design.	Move events towards Summer track. Move away from Winter track.
Moderate impact. Modest remediation cost.	Platform I Short Term (Until 2020)	Progressively adopting EU emission technology standards
3) **Spring Track** High sustainability problems.	Sub-optimal design.	Move events towards Autumn track and if possible towards Summer track. Move away from winter track.
High impact; High remediation cost.	Pervasive middleware. Command & control regulations (to 2020)	Carbon tax to be invested in biofuel carbon capture and sequestration (CDM) projects
4) **Winter Track** Critical sustainability problems.	Quasi sub-optimal design.	Move all events out of and away from this track towards summer track.
High impact; High remediation cost.	Pervasive middleware. Command & control regulations (to 2020)	Carbon tax to be invested in biofuel carbon capture and sequestration (CDM) projects

In analysing the proposed road map, it requires an understanding of how the four different scenarios relate to the underlying sustainability space. By exploring and identifying the uncertainties "least regret" strategies have been designed to produce the fewest drawbacks, if not the greatest benefits for strategic planning purposes. On that occasion, policy options such as emission standards and/or restructuring current energy systems towards renewable energy move events between regions along sustainable paths or trajectories as depicted in figure 6.8 and table 6.1.

6.3.5 Decision-support Tools for Road Map Implementation

Designed for an effective implementation of the proposed road map for sustainable road transport in sub-Sahara Africa, figure 6.9 proffers the necessary steps and the means for governments, agents (individuals, businesses) and societies to shape their future and to implement their vision. The policy manual comprises of an affirmative green policy, effective planning, implementation, checking and stakeholders' review.

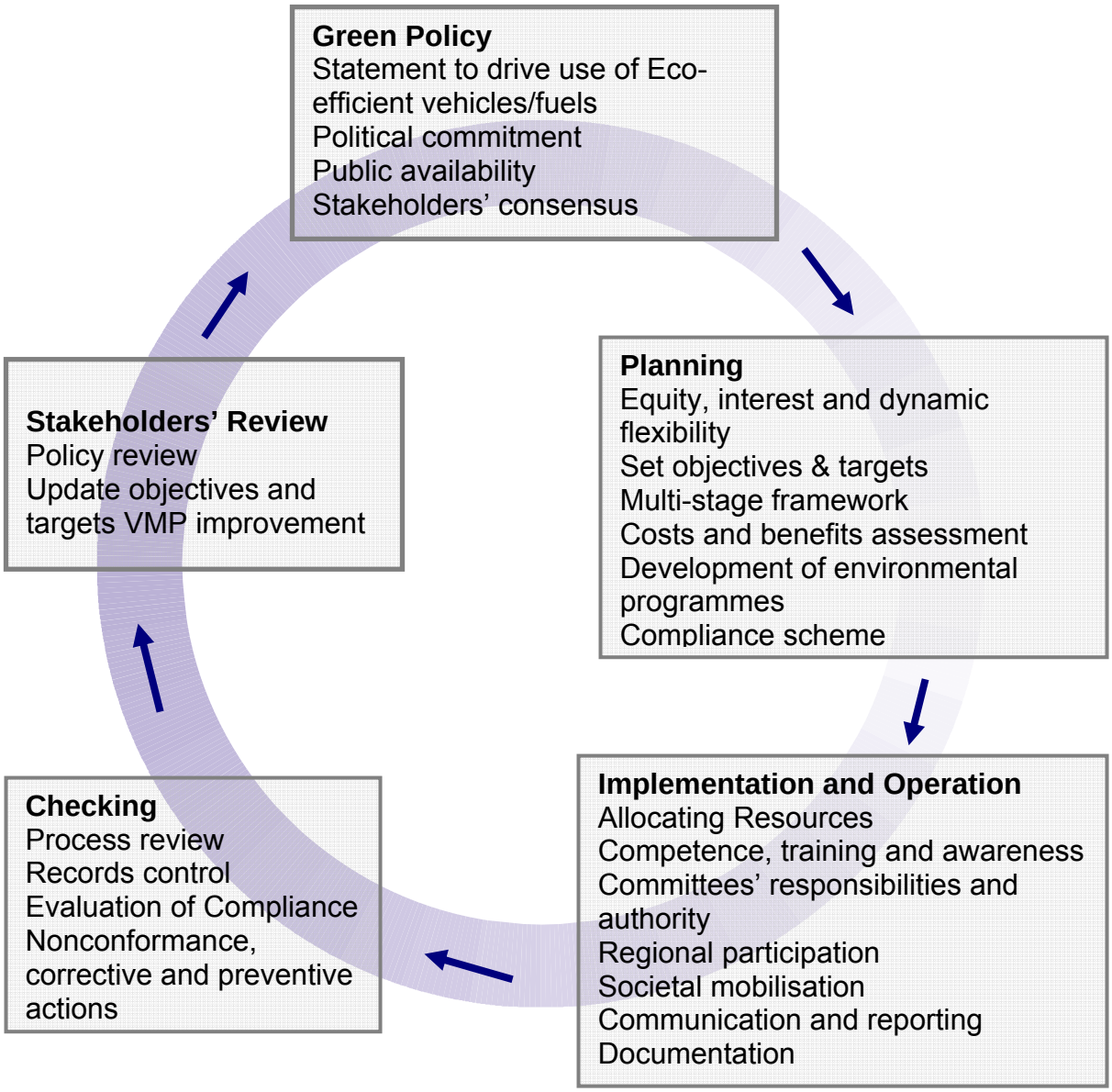


Figure 6.9 A policy manual for implementing road map

The main components of the policy manual are elaborated in table 6.2.

Table 6.2 Main features of policy manual

REQUIREMENTS	COMMENTS
GREEN POLICY	
Political commitment	An affirmative statement by sub-Saharan African governments/policy makers of their intentions and principles in relation to overall environmental performance of road transport in the region.
Eco-efficient vehicles/fuels	A framework for action and for setting of harmonised regional standards, adopted differently in various parts of the region, for environmentally friendly distribution and use of vehicles and fuels.
Public availability and Stakeholders' consensus	A publicised regional framework for consensus- building by valid interest groups/stakeholders represented by technical and sub committees.
PLANNING	
Interest	Framework should be crafted in a manner that advances regional sustainable development goals, such as sustainable land use and economic development.
Objectives and targets road	See Table 6.2 above. (I.e. Main Features of the map)
Dynamic flexibility	Framework should confer provisions for modifications to allow easier reassessment and revision in light of new scientific and economic information.
Equity	Adoption of harmonised regional standards should be perceived by all parties to be sufficiently equitable – or, at the least, not demonstrably unfair – with a sense of identity, ownership and responsibility. This should take a multi-stage framework.
Multi-stage framework	Governments should choose pathways on the proposed road map (figure 8, table 2) that

	best align the regional interest in sustainable vehicle distribution and use with their own evolving national interests
Affordability	Cost maintenance for retrofit programmes and biofuel deployment schemes must be affordable and available to provide greater emission reductions at lowest possible cost.
Compliance scheme	A compliance scheme should be crafted to adequately monitor and enforce any violation of commitments.
IMPLEMENTATION AND OPERATION	
Allocating Resources	Governments should allocate resources including human resources, organisational, infrastructure, technology and financial needs for effective implementation of framework.
Competence, training and awareness	Governments should recruit competent personnel and provide appropriate educational training to all personnel so that the regional framework can easily be adopted.
Regional participation	Development of “Biofuel Projects so that end users can understand, operate and maintain them
Societal mobilisation	Development of Environmental programmes to change public attitudes, awareness, and learning with regard to green procurement.

Table 6.2 continues

6.4 Chapter Summary

This chapter proposes four scenarios for road transport in sub-Sahara Africa. The scenarios proposed are based on a combination of technology growth and environmental policies and concerns. Building on these four scenarios, the study explored the impact of economic growth, demographic developments, institutional changes and technological improvements on energy, climate change and related issues. We started our study by raising a number of questions with respect to energy and technological developments and climate change related environmental problems. Differences across scenarios are to a large extent related to per capita GDP, which varies from high to low; technological change, which is seen to vary from fast to slow and policies, attitudes and preferences with respect to sustainable road transport showing discrepancy from concerned to unconcerned.

By exploring and identifying the uncertainties "least regret" strategies have been formulated to produce the fewest drawbacks, if not the greatest benefits for strategic planning purposes. On that occasion, policy options such as emission standards and/or restructuring current energy systems towards renewable energy move events between regions along sustainable paths or trajectories. In moving forward, it is unlikely that one size would fit all as different mitigation commitments may prove more or less attractive to different countries in the region. In this respect, a road map has been proposed based on a menu approach where countries subscribe to a number of options, but are not bound to all. As the group of sub-Saharan African countries is very diverse, not all countries would necessarily take on the same type of target at the same time. It thus enables policy makers to choose pathways that best align the regional interest in sustainable vehicle distribution and use with their own evolving national interests.

SECTION III

CORPORATE ENVIRONMENTAL MANAGEMENT

CHAPTER SEVEN

Environmental Management Systems: Definition, Origin, Principles and Types

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This chapter aims to provide the reader with the necessary background information regarding what an Environmental Management System (EMS) is. The purpose, main elements and a historical background of an EMS will be described, and a brief description of the types of EMS will be given. The chapter ends with a section that sheds light on the differences between the two dominating EMS standards: ISO 14001 and EMAS.

7.1 Corporate Environmental Management: Definition and Concepts

The values, norms, processes and institutions through which companies attempt to ensure that they operate in a safe and environmentally sustainable manner are referred to as corporate environmental management (CEM) (Studer et al. 2005). Transposing the concept of sustainable development to the business level, Dyllick and Hockerts (2002) defined corporate sustainability as meeting the needs of a firm's direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, communities etc), without compromising its ability to meet the needs of future stakeholders as well. To this end, Studer et al. (2005) argue that CEM extends well beyond compliance with environmental legislation and calls for the incorporation of environmental systems and tools in business strategic planning to ensure that environmental issues become integrated with overall corporate objectives. Accordingly, Hillary (2004); and Welford (1994, 1996) highlight the broad range of direct benefits that CEM principles can offer to businesses including cost savings from increased resource use efficiency, marketing advantages and creation of a positive image, improved relations with stakeholders, better supply chain relationships, improved overall quality of

management, improved quality systems, encouragement of innovation, and increased employee motivation.

7.2 Defining Environmental Management Systems

Environmental Management Systems (EMSs) have been developed and evolving for several years and can be said to mean different things to different people. (Brorson and Larsson, 1999). Several authors (BSI, 1992, 1996; CSA, 1996; Khanna and Anton, 2002; Welford, 1996) have highlighted different definitions, although similar, for Environmental Management Systems (EMSs). One of the most accepted defines an EMS as "the part of the overall management system that includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy" (ISO 14001, 1996).

EMSs provide a framework for managing environmental responsibilities, including regulatory compliance. By improving overall environmental performance and placing more emphasis on pollution prevention, they can also help organisations move beyond compliance and improve their competitiveness. (The National Environmental Education & Training Foundation, 2001). According to Khanna and Anton (2002), EMS represents an organisational change within firms and a self-motivated effort at internalising environmental externalities by adopting management practices that integrate environment and production decisions, which identify opportunities for pollution reduction and enable the firm to make continuous improvements in production methods and environmental performance.

In a similar vein, Hewitt and Gary (1998) caution that a vital element in understanding environmental management systems is to understand what the environment is, defined by ISO as "the surroundings in which an organisation operates, including air, water, land, natural resources, flora fauna, humans and their interrelation" (ISO, 1996). A certified EMS can therefore help achieve improvements in a number of areas such as: cost savings; enhanced innovative capability better company image; improved organisational performance, reduced

risk for liability; better employee morale, and a source of competitive advantage (Aboulnaga, 1998; Roy and Vezina, 2001; Stapleton et al. 2001; Hillary, 1999; Evangelinos and Blaza, 1999).

7.3 Historical Overview of Environmental Management Systems

This section will describe the historical overview Environmental Management Systems.

7.3.1 Historical Overview of Environmental Management Systems

The British BS 7750 was the world's first modern EMS standard published in March 1992 (British Standard Institute, 1992), which was later modified and published in January 1994 (Starkey, 1998). As part of a broader strategy to provide businesses with tools to more effectively manage their environmental impacts and contribute to sustainable development, the British BS 7750 standard was closely followed by the European Eco-management and Audit Scheme (EMAS) that was adopted in June 1993 and entered into force in April 1995. (Starkey, 1998). The initial proposal suggested that certain types of companies should make mandatory environmental audits and publish an environmental statement based on the findings of the audits (Council regulations (EEC) No 1836/93. 1993).

At this time, the International Organisation for Standardisation (ISO) had also begun to work on a standard for EMS and introduced ISO 14001 in 1996 (ISO. 1996; Clements, 1996; Brorson and Larsson, 1999). Clements (1996) further noted that the standard applies to those environmental aspects over which the firm either has control or could be expected to have an influence on.

It was not until April 2003 that the latest method for achieving a recognised environmental management system in the UK - BS 8555 - came into force. (BSI. 2003; Sheldon, 2003). Finch (2005) pointed out that BS 8555 has been designed exclusively to challenge the traditional hurdles to SMEs achieving certified EMS through implementation stages like practical training, on site support, and modular external audits.

Today, ISO 14001 and EMAS are the two dominating EMS standards widely used all over the globe. BS 7750 was the only environmental standard in use when EMAS and ISO 14001 were constructed, and its influence on their structure was significant (Windahl and Thorell, 1999). These standards sought to provide all businesses with the means to develop systematic approaches to environmental performance. EMAS and ISO are built up in a similar way although differences exist (Gilbert, 1994). The European Commission decided in 1997 that ISO 14001 is a standard within EMAS, and therefore the two systems can be considered to have a common ground.

Though environmental management has progressed through several stages over time as depicted in figure 7.1, the evolution of corporate environmental management is regarded in terms of initiatives that are best suitable to satisfy the three criteria of sustainability in a balanced manner: environmental effectiveness, economic efficiency and social responsibility. To this end, the growing synergy of this evolution is tantamount to incorporating environmental stewardship into day-to-day operations and the commitment of all employees (Boiral and Jean-Marie, 1998; Elkington, 1994; Lawrence and Morell, 1995; Miller, 1998; Walley and Bradley, 1994).

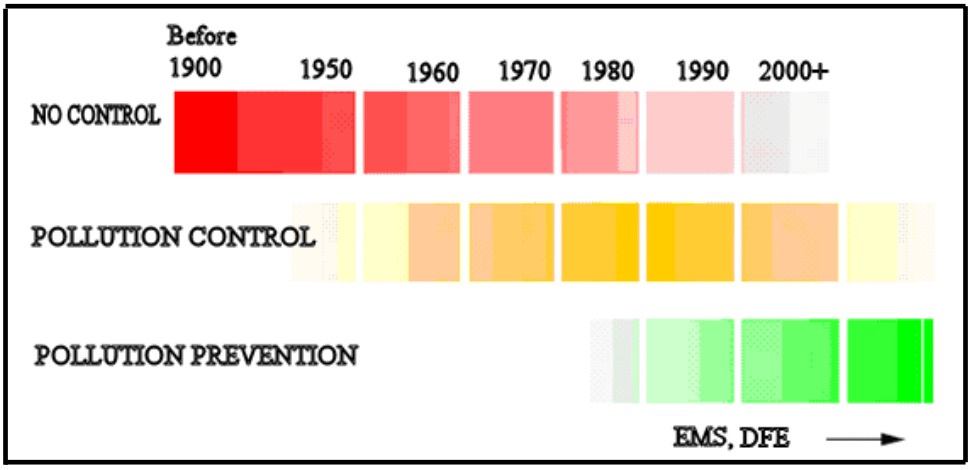

Figure 7.1 Evolution of corporate environmental management

(Source: Adapted from: Galimberti, 1998)

7.4 Environmental Management System Process: Concept and Principles

The ISO 14001 standard is the 'core' of the 14000 series, as it outlines the criteria for implementing an environmental management system (EMS) (Starkey, R. 2000; Stapleton et al. 2001). As Tim et al. (2005) put it, EMS Models today range in complexity from simple reminders of regulatory deadlines at a single facility to an elaborate, Internet-based, enterprise-wide performance management system that tracks regulatory requirements, assigns tasks, controls documentation and records, provides training, and shares information across multiple operations and facilities around the world. They further state that EMSs are most effective when they are part of normal business activities rather than treated as separate programmes or initiatives. Although businesses typically have many elements of an EMS already in place, the EMS provides a systematic way to integrate those efforts and direct them toward company-established goals. (Tim et al. 2005)

A range of authors (ISO,1996; EPA, 2002; Bansal and Bognar, 2002; Boiral and Sala, 1998; Morrow and Rondinelli, 2002; Robert, 2000; BSI, 1996; Welford, 1998) have identified the five principles underpinning ISO 14001, which are brought together and are summarised as a model below:

7.4.1 Environmental Policy.

A commitment by top management to define the organisation's environmental policy and translates their environmental commitment into a plan and series of actions the business is to take through their EMS implementation. The policy must contain a commitment to (a) continual improvement, (b) prevention of pollution and (c) compliance with relevant environmental legislation. The policy also should be documented and be available to the general public.

7.4.2 Planning.

The establishment of a procedure by which all aspects of an organisation's activities processes, products and services which have, or can be expected to have, environmental impact are identified, documented and used to frame the objectives and targets which effectively address each of the following: (1) the

overall environmental policy, (2) the organisation's environmental impacts, and (3) the organisation's legal and regulatory requirements. It also entails developing a procedure to monitor performance against the objectives and targets, and to channel this information back into the environmental management system. Additionally, the organisation must establishment a framework through which all objectives and targets are to be achieved; this work plan may consider changes in production processes, product design and services provided, employee training, communication of results, evaluation of performance indicators and documenting the above.

7.4.3 Implementation and Operation

Ensuring the availability of resources, identifying training needs, defining and assigning roles and responsibilities are imperative at this stage. Through effective communication, appropriate documentation procedures are completed, while operational control procedures such as emergency preparedness and appropriate response programmes for crisis management are outlined and communicated through relevant training. Periodic revision of documents carried out should be circulated to provide details of the individual environmental responsibilities.

7.4.4 Checking and Corrective Action.

The management system must be periodically audited to measure and track the performance of the system against its own goals and to evaluate compliance with the relevant laws and regulations. If any problems and/or deviations are identified they are rectified through corrective action and to prevent future occurrence. At this stage the compatibility of EMS goals are checked as record keeping procedures for their ability to contribute to the environmental audit programme.

7.4.5 Management Review and Continual Improvement

This is the stage where management regularly reviews the EMS to address possible need for changes to policy, objectives and other elements of the environmental management system in order to ensure its continuing effectiveness, adequacy and suitability. It also strives for a commitment to

continual improvement in environmental performance and the prevention of pollution. Accordingly, changes must be made to the system to reflect the changing context of the organisation and the commitment to continual improvement made in the environmental policy statement.

The five step implementation process of ISO 14001 highlighted above are brought together and are shown as a model in figure 7.2. The chapter then proceeds with the next section that examines the environmental management system literature, which outlines the types, differences, drivers, benefits and implementation hurdles attributed to EMSs.

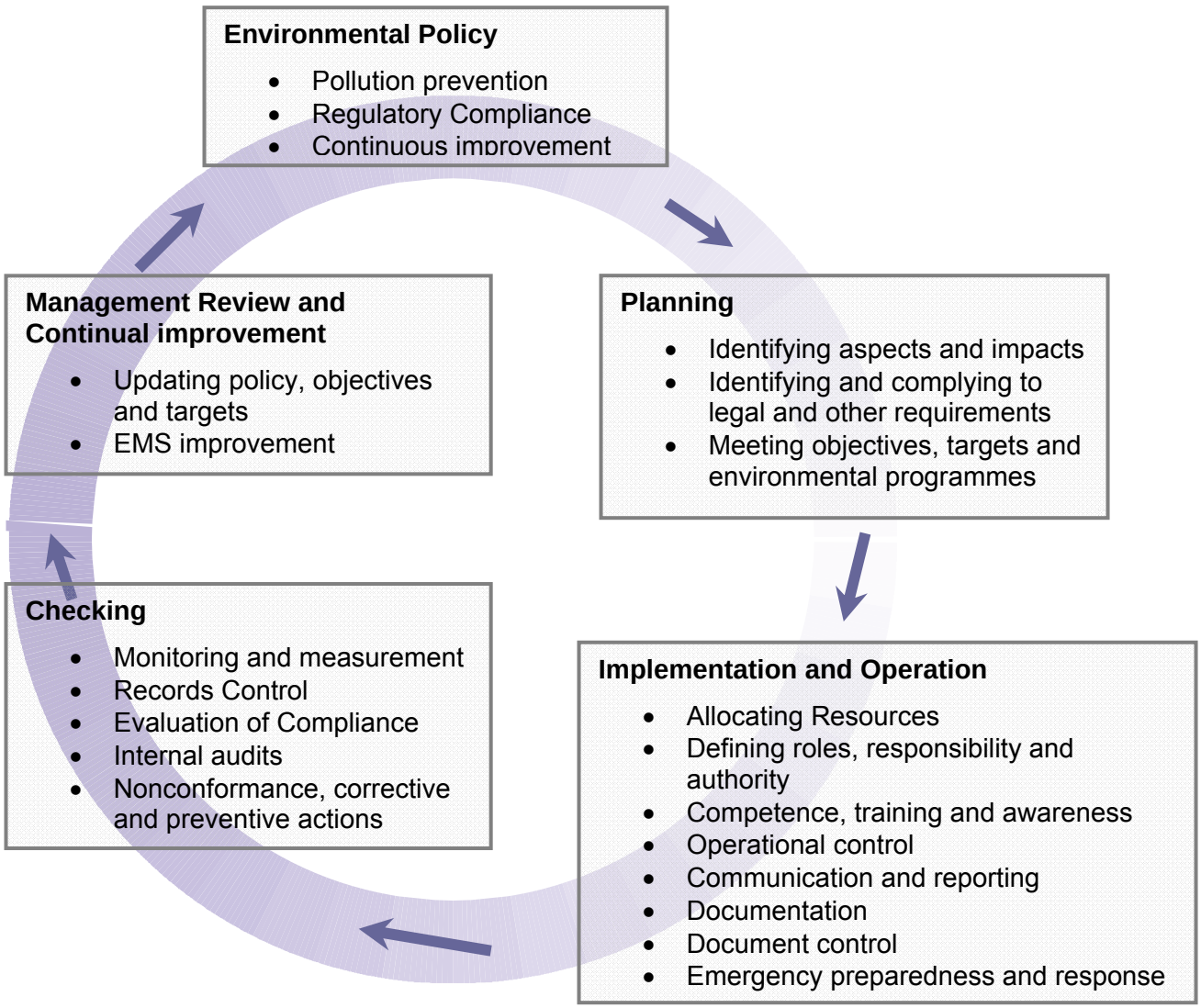

Figure 7.2 EMS model for ISO 14001:2004

7.5 Types of Environmental Management Systems

There are numerous types of EMSs. The ISO 14001 EMS, however, has emerged as the most widely accepted international standard for environmental management and has the potential to harmonise EMSs worldwide. According to Baxter (2005), the main types of EMS in use in Europe are:

7.5.1 In-house EMS

This is an aspect of companies that choose to design and implement an EMS to their own specification. An in-house EMS may be as effective as any other, but the main drawback for regulators is that it is more difficult to assess the effectiveness of such an EMS in the absence of a standard approach, including assessment criteria. Accordingly, judgments on each individual EMS may be based on the degree of conformance and whether this delivers regulatory requirements including legal compliance. Independent (third-party) checks can be made via accredited certification, inspection and verification assessments.

7.5.2 ISO 14001: 2004

ISO 14001:2004 is an international standard, entitled: 'Environmental Management Systems. The standard specifies the different elements of an EMS and how they relate to one another based on five implementing principles (see figure 2 above). The overall aim of the standard is to support environmental protection and prevention of pollution in balance with socio-economic needs. Conformity against the requirements of ISO 14001:2004 can be demonstrated through self-declaration, accredited certification or by other independent means.

7.5.3 BS 8555: 2003

BS 8555 is a British Standard, entitled: 'Environmental Management Systems – Guide to the Phased Implementation of an Environmental Management System including the Use of Environmental Performance Evaluation' (BSI, 2003). The standard:

- provides guidance to organisations on environmental management and the use of environmental performance indicators; describes a six-phase,

incremental approach to implementing an EMS using environmental performance evaluation;

- is suitable for any organisation, particularly small and medium-sized enterprises, to implement an EMS – for example to ISO 14001 standard;
- may be used to demonstrate improved environmental performance to customers and stakeholders; and
- allows organisations to proceed at their own pace up to 'full' implementation of an EMS, which may then be certified to ISO 14001 or registered under EMAS.

7.5.4 Eco-Management and Audit Scheme (EMAS)

The Eco-Management and Audit Scheme (EC, 1993) is a registration scheme, not simply a standard. It is a voluntary initiative designed to improve organisations' environmental performance. It was initially established by European Regulation 1836/93, although this was replaced by Council Regulation 761/01. This amendment incorporated ISO 14001:1996 (ISO, 1996) into the EMAS Regulation as the specification for an EMS (Annex 1A of the regulation).

7.6 Differences between ISO 14001 and EMAS

Many European countries require large manufacturing facilities to implement the Eco-Management and Audit Scheme (EMAS). The components of EMAS are similar to those of ISO 14001. However, EMAS has four significant additions: (1) a baseline environmental assessment, (2) a public environmental performance report, (3) registration only open to certain sectors, and (4) The annexes are binding as oppose to those of ISO 14001 that are merely recommendations.

7.7 Chapter Summary

In this chapter, the purpose, main elements and a historical background of an EMS were provided, and a brief description of the two dominating EMS standards, ISO 14001 and EMAS was given. In the next chapter, we will dwell on the environmental management initiatives within the South African Automotive industry.

CHAPTER EIGHT

Environmental Management, Ecological Modernisation and the Policy Process in the South African Automotive Industry.

Through a questionnaire based survey, this chapter analyses and compares the levels of corporate environmental management within South African Automotive Industry. The chapter analyses and compares the levels of voluntary environmental management initiatives between large, small and medium-sized enterprises within the automotive milieu. Finally, suggestions for motivating South African Automotive Industries vis-à-vis corporate environmental management are offered.

8.1 Introduction

South Africa is indeed struggling with increasingly serious environmental problems including growing waste disposal problems, rapid deterioration of air quality, widespread noise pollution, degradation of its marine environment, loss of biodiversity and valuable land (Department of Environmental Affairs and Tourism, 2002; Brent and Labuschagne, 2003; Energy Information Administration, 2004; Labuschagne et al. 2005). These environmental Problems and concerns, endemic to industrialising countries, dominate the South African public and corporate agenda (Engineering News, 2009). On this score, the South African Government has committed itself to a range of international treaties and domestic measures in an attempt to combat the impact of the manufacturing industry on the natural environment, health and safety (Department of Environmental Affairs and Tourism, 2002). Accordingly, the South African central environmental policy-making body, The Department of Environmental Affairs and Tourism (DEAT), in its 1997 White Paper on Environmental Management, in addition to legislative measures, outlined the need to implement strategic environmental management

systems in South Africa. The White Paper is embodied in the 1988 National Environmental Act, which addresses such issues as air, water and marine pollution, waste management, deforestation, energy efficiency and the conservation of biodiversity. Under the Act, South Africa's once-fragmented environmental legislation was consolidated and national standards were established. In addition, the Act is consistent with Section 24 of the South African constitution, which ensures the right of citizens to live in a clean and healthy environment (Energy Information Administration, 2004).

In responding to this agenda, along with other external drivers, some South African automotive companies have implemented the International Organisation for Standardisation ISO 14001 environmental management system (Kehbila et al. 2009). On this score, this chapter examines the implementation of environmental management tools in the first batch of South African automotive multinational companies. In contrast with some other industrial sectors in Europe, information on the South African automotive industry's experience with, and perception of, corporate environmental risk management is somewhat limited. Indeed, there is a dearth of EMS literature in the context of many developing African countries such as South Africa. To ameliorate this backdrop, this chapter seeks to address this gap in knowledge and provides a starting point for future research in the area of corporate environmental management within the South African Automotive Industry.

Though many sectors are notably absent (e.g., chemical, electronics, Agriculture, pulp and paper as well as the service industries), the automotive sector examined in this study represents a significant portion of South Africa's industrial capacity - 28% of domestic manufacturing output and over 87% of Africa's vehicle output in 2005 (NAAMSA, 2006). Operations within this sector combine to span the full spectrum of a vehicle life cycle as well as a wide range of market niches such as raw material extraction, manufacturing, the supply of component parts and finished consumer vehicles. Some findings of this study may, therefore, be relevant to other industry sectors or even more broadly on a national level.

It is the purpose of this chapter to identify and classify the main existing trends and models that are used to facilitate the implementation and certification of ISO 14001 within the South African Automotive Industry and see how different actors use the models. To this end, the chapter's objectives are threefold: (i) to examine the use of environmental management tools (EMTs) within the South African Automotive Industry (ii) to provide a South African perspective on successful practices and some of the issues faced by this sector in developing and implementing a certified EMS, (iii) to map out the attitudes and habits towards environmental decision-making within the South African Automotive Industry, and suggests strategic guides and methods to improve actions towards a more environmentally friendly direction.

The research framework that has been used to support this chapter's deliberations is structured as follows. The section that follows outlines the methodology of the research. In the next section of the chapter, the results of the study are presented and discussed. This section provides a South African perspective on corporate environmental management within the automotive milieu. The chapter concludes by examining the challenges faced as well as prescribing a series of recommendations that in the future could serve to improve environmental performance within the South African Automotive Industry. The research methodology that has been used to support this chapter's deliberations is now presented.

8.2 Methodology

This study was based on a questionnaire survey among South African automotive industries of various sizes. The different methods of data collection such as personal interviews, telephone interviews and self-administered questionnaires were considered and personal interviews were ruled out due to manpower and cost constraints and telephone interviews due to the nature of the questionnaire and the group surveyed - managers whose busy schedules may not allow for a telephone interview lasting approximately half-hour. Therefore the survey approach using self-administered questionnaires was selected for the study to gain the highest possible number of participants.

The companies chosen for investigation were drawn from international automobile manufacturing firms operating in South Africa. They were identified from the membership list of the National Association of Automobile Manufacturers of South Africa (NAAMSA) and the National Association of Automotive Component & Allied Manufacturers (NAACAM), the leading bodies representing the commercial interests of Automobile manufacturing industries in South Africa.

Telephone interviews were first conducted to inform and ascertain the interest of the companies identified. The questionnaire was designed for distribution via e-mail as well as the traditional postal service. Those responding to the questionnaire were assumed to be those most interested and engaged in environmental issues. This further reinforces the fact that this study mostly focused on companies with a commitment to environmental matters. The study explicitly hoped to reach respondents who have not had a certified EMS and to ascertain the elements of ISO 14001 currently being implemented.

The development of the questionnaire followed the criteria given by Fowler (1993) and the preliminary set of questions went through a sample of five respondents for pre-testing before it was put into a form for self-administration. Based on feedbacks received, the questionnaire was further modified. The survey instrument was designed to assess the implementation of nine types of voluntary environmental initiatives in the selected companies including employment of designated environmental staff, adoption of an environmental management system, publication of a policy statement on environmental matters, the setting of objectives and targets to improve environmental performance, environmental audits/reviews, environmental performance reporting, use of supply chain pressure strategies, the implementation progress on individual ISO 14001 Elements and voluntary measures to improve ecological systems, which go beyond the improvement of industrial production.

The questionnaire was accompanied by a cover letter which described the objectives of the survey, assured the respondents of confidentiality of the information provided and requested for returns to be forwarded by a deadline.

Follow-up included two reminder letters to non-respondents. The survey, including follow-ups, was conducted during the period July 2006 to March 2007.

8.3 Results

In this study, one hundred and fifty (150) questionnaires were administered and eighty nine (89) industries returned their questionnaires, often only after repeated follow-up calls. Eight (8) questionnaires with missing or inconsistent answers were eliminated and 81 responses were employed for data analysis showing a relatively high response rate of 54%. In most cases, the majority but not all questions were fully answered. Consequently, all percentage values were calculated on the actual number of respondents to each question.

Initial interviews were conducted with managers who were involved with the implementation of EMS in their establishments. Some of the respondents were particularly helpful when conversations were carried out over the telephone during the initial contact phase and their informal comments have been taken into consideration. A number of open questions were included in the questionnaire inviting comments from the respondents. The comments received as answers to these sections provided valuable evidence to substantiate many of the findings of the research, and proved a benefit to the research as a whole.

8.3.1 Characteristics of Survey Respondents

In order to provide a general picture of the South African automotive Industry, a brief profile of responding organisations is summarised in figure 8.1.

Figure 8.1 Employees profile of participating organisations

Survey results vary significantly with regard to size distribution based on the South African National Small Business Amendment Act. 2003 (D.T.I, 2003). This act defines Small and medium-sized Enterprises (SME) as organisations employing a maximum of 200 employees while large-sized companies refer to corporations employing more than 200 employees. Of the 81 respondents who completed the survey, 38 (about 47%) of the participating organisations were identified as SMEs and 43 (about 53%) were within the category of large-sized companies employing more than 200 employees.

8.3.2 Evolution of Vehicle Manufacturing

With regard to the year of initial manufacturing, just 2 (about 2%) of responding companies indicated that they began vehicle manufacturing in South Africa between 1920 and 1930 (figure 8.2).

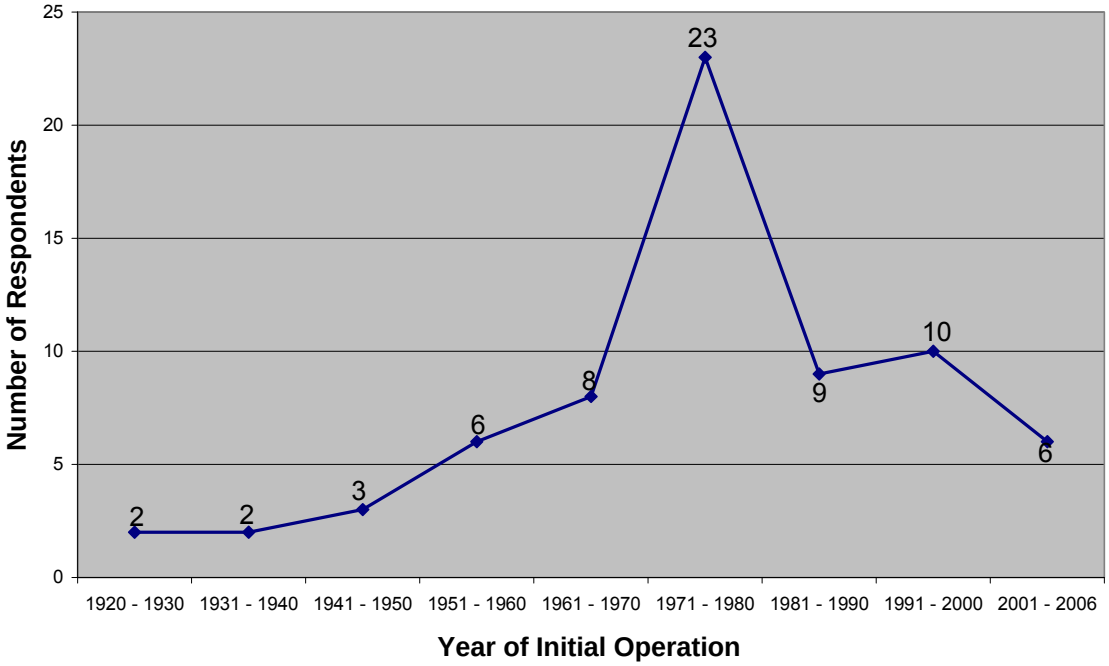

Figure 8.2 Evolution of vehicle manufacturing

There was a slight increase between 1961 and 1970 to 10%. The interval between 1991 and 2000 was the period when there was a significant increase in multinational automotive companies operating in South Africa. Initial operation reached its peak at 28% between 1971 and 1980 when the South African economy was booming with western countries and investors rushing in to get a piece of the action (figure 8.2).

8.3.3 Distribution across various Stages of Vehicle's Life Cycle

Survey results revealed a spread of companies of various life cycles and range from raw material extraction to recycling (figure 8.3). However an overwhelming majority of respondents 73 (about 90%) were engaged in vehicle manufacturing, followed by sales, design and refurbishment at 20 (about 25%), 13 (about 16%) and 5 (about 6%) respectively. Recycling and raw material extraction were least widespread at 2 (about 2%) each. This perhaps reflects the lack of regaining secondary raw materials from end of life vehicles at the end of the supply chain.

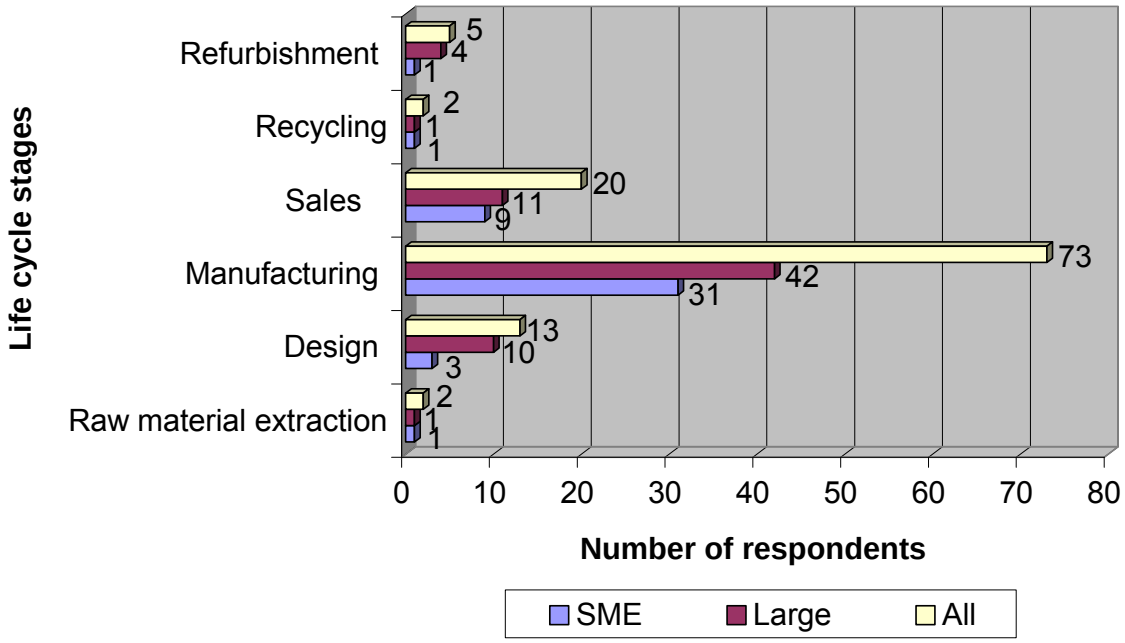

Figure 8.3 The distribution across various stages of vehicles' life cycle of responding organisations

8.3.4 Corporate Environmental Knowledge and Practice

8.3.4.1 Respondents' Job Title

The question of job title was designed into three categories as a pre-coded multiple-choice question. The questionnaires were completed by personnel from a wide variety of positions and departments (figure 8.4). This highlights the spread of standardisation and allocation of responsibilities on environmental issues within the South African Automotive manufacturing industry.

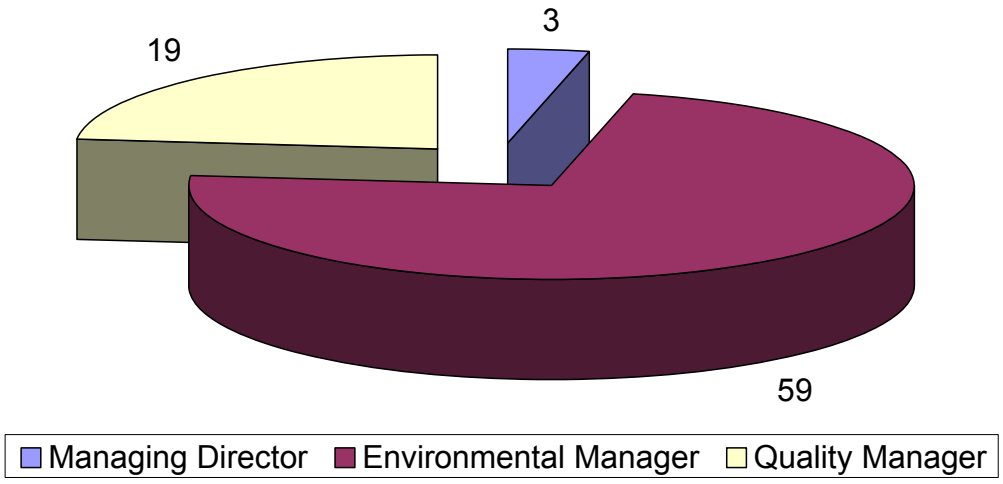

Figure 8.4 Positions held by respondents

Fifty nine (about 73%) of respondents were Environmental managers, 19 (about 23%) quality managers and only 3 (about 4%) of respondents said they were Managing directors of the participating industries. Regarding EMS responsibilities in responding organisations, the size of the company represented by the respondents included 36 (about 44%) from SMEs with up to 200 employees, and 45 (about 56%) from large companies with more than 200 employees as defined by DTI (2003). From these figures, managing directors, environmental and quality managers represent 2%, 27% and 15% of SMEs respectively. Large organisations, on the other hand, represent 1%, 46% and 9% of managing directors, environmental and quality managers respectively (figure 8.5).

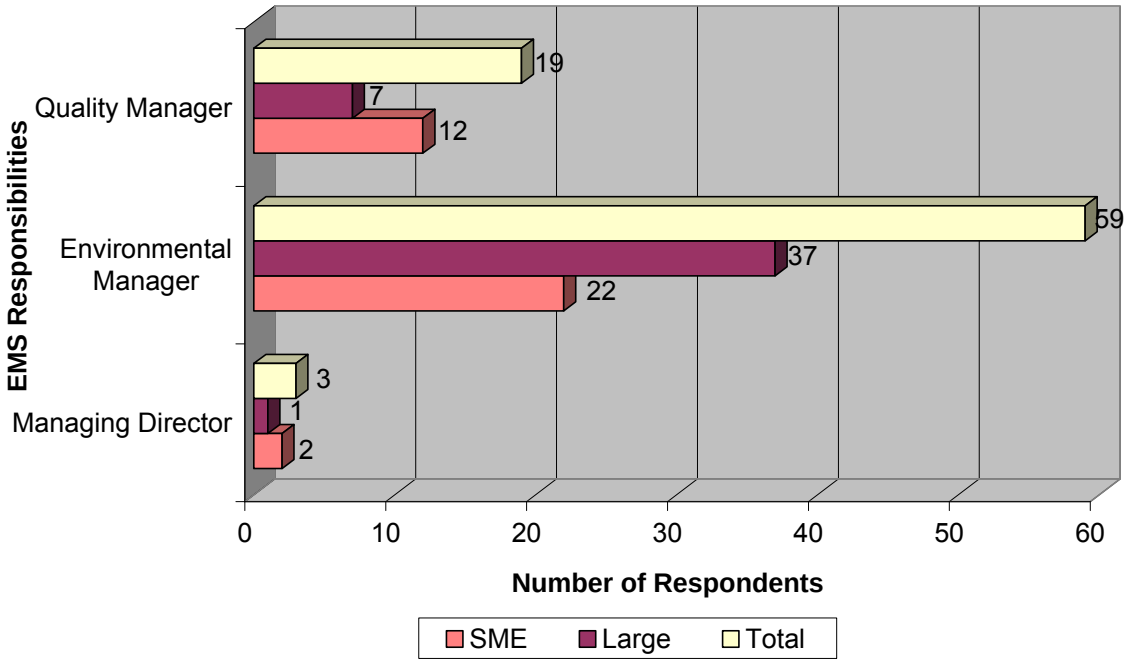

Figure 8.5 Distribution of EMS responsibilities by company size

8.3.4.2 Standardised Environmental Policies

The possibility that South African Manufacturing Automobile Industries are already concerned about environmental issues was investigated, specifically that environmental concerns may have an influence on Companies' awareness of the fundamental principle of an EMS (an environmental policy). The intention was to investigate if ISO 14001 is raising awareness of this core value of EMS in this sector.

The responding organisations provided a variety of results to this concern, and range from large corporations to SMEs. Survey results show that the organisations also varied significantly in their approach to the fundamental principle of environmental management. In particular, they varied in the extent to which procedures were formalised and documented, and in the extent to which activities that go beyond regulations had been integrated into their existing environmental management practices (figure 8.6).

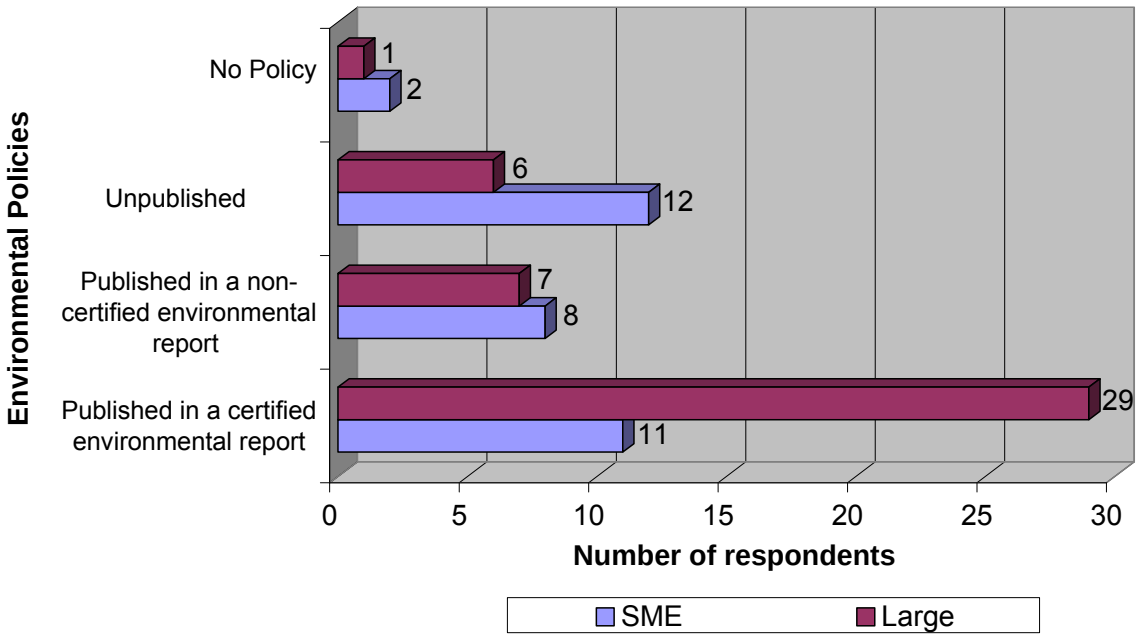

Figure 8.6 Respondents' environmental policies

Survey results revealed that 40 (about 50%) of respondents had standardised environmental policies published in certified environmental reports with just 15 (about 19%) of similar policies published in non-certified environmental reports. In contrast, 18 (about 22%) of respondents were in possession of unpublished environmental policies. Just 3 (about 3%) of respondents were not in possession of environmental policies for a variety of major reasons: (i) because no relevant effect on the environment is exerted by the manufacturing plants and products of the firms (ii) because all relevant environmental decisions are made on a case-by-case basis and (iii) because solely the Head office is responsible for environmental policy.

There was a great difference in the experience between SMEs and large enterprises with a comparatively small number of SMEs that have written published environmental policies. 29 (about 36%) and 11 (about 14%) of large companies and SMEs respectively recognised the need to enhance EMS by setting out policies published in certified environmental reports. When comparing corporate environmental knowledge and practice between the two types of companies, 11 (about 15%) of SMEs have unpublished environmental policies, whereas only 6 (about 7%) of large corporations have similar policies.

8.3.4.3 Corporate Environmental Targets

The study found that 72 (about 89%) of respondents have set targets to improve on environmental performance (figure 8.7). By company size grouping, the percent of responses from large companies compared with SMEs are 42% and 47% respectively.

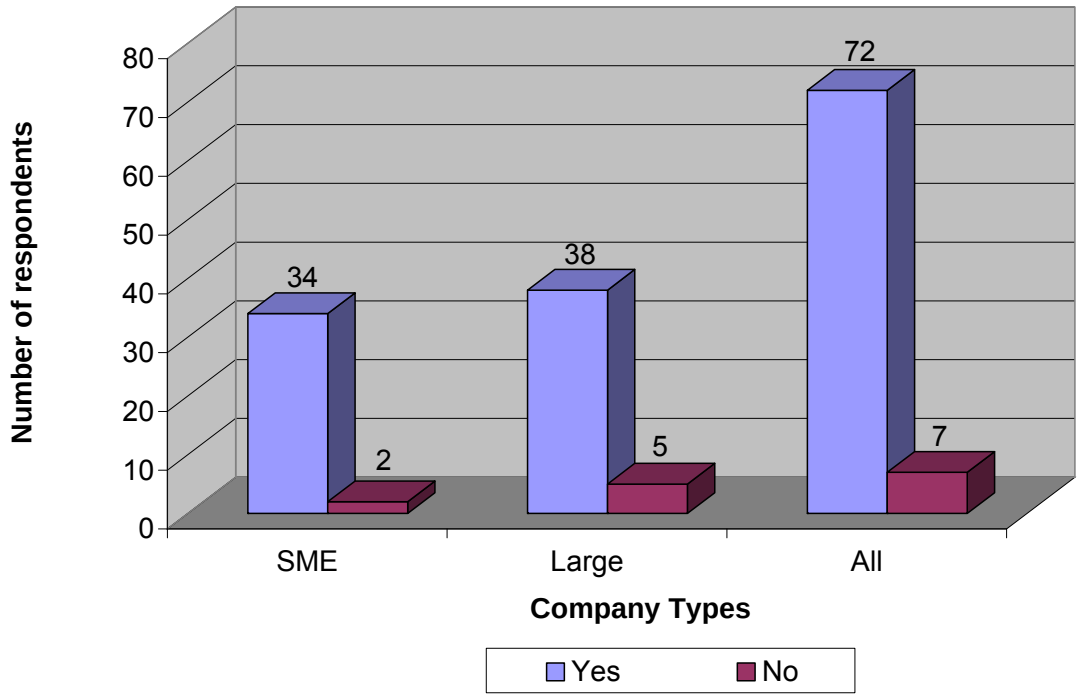

Figure 8.7 Corporate environmental targets

8.3.5 Environmental Management System Process

8.3.5.1 Evolution of Environmental Management System

As figure 8.8 illustrates, just 1% of respondents highlighted the initiation of ISO 14001 implementation in 1993. This figure rose slightly to 7% in 1999 and then more than doubled to 15% in 2000. Initiation reached its peak at 17% in 2005.

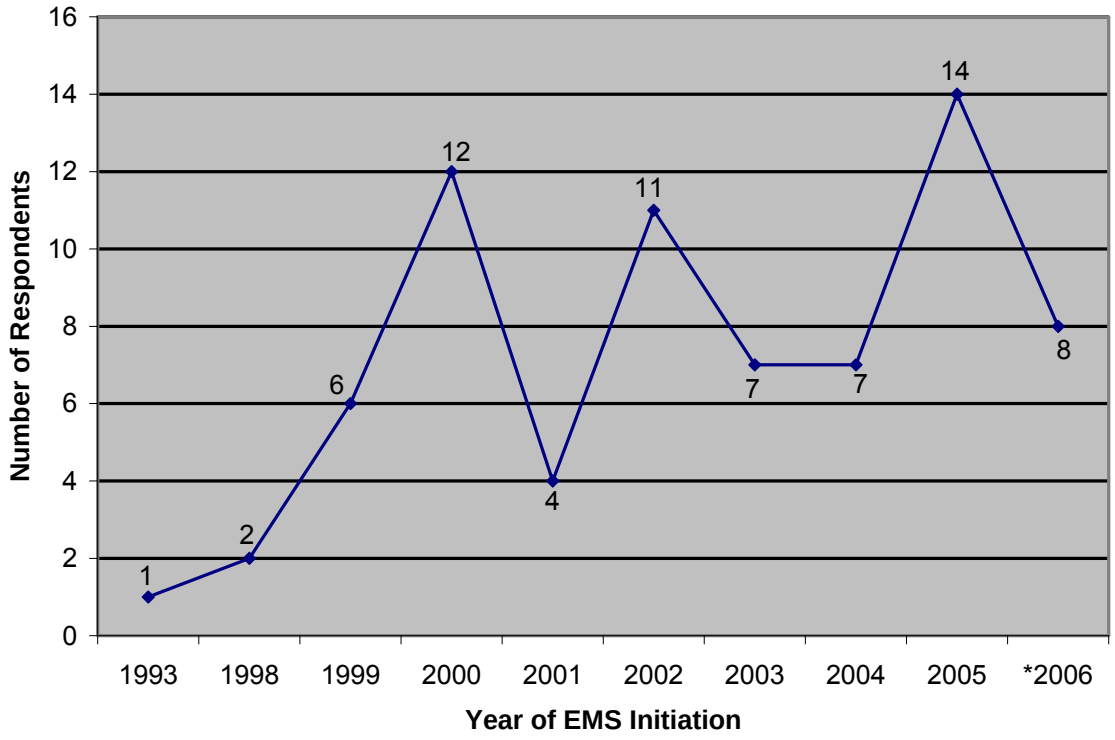

Figure 8.8 Evolution of EMS in the South African automotive industry

8.3.5.2 Characterisation of Respondents by ISO 14001 Certification and Company Size

The preliminary results show that, in contrast to early presumptions that only large corporations would adopt EMSs, such systems in fact are being implemented by companies of all sizes within the automotive milieu. Table 8.1 gives an overview of company size and ISO 14001 certification of the responding companies.

Table 8.1 Certification and Audit types

ISO 14001 Certification	SME		Large		Total	
	No.	(%)	No.	(%)	No.	(%)
Certification completed	14	(17%)	36	(44%)	50	(61%)
Certification partially completed	12	(15%)	3	(4%)	15	(19%)
Certification planned	10	(12%)	3	(4%)	13	(16%)
ISO 9001 Certification	21	(26%)	33	(41%)	54	(67%)
Audit Types						
External and Internal Audits	20	(25%)	35	(43%)	55	(68%)
Internal Audit	14	(17%)	3	(4%)	17	(21%)

Fifty (about 61%) of all respondents were certified according to the ISO 14001 standard. As expected, ISO certification was more widespread among larger firms than SMEs at 44% and 17% respectively. This unusually high proportion of ISO-certified companies is easily explained by the sampling method used.

Fifteen (about 19 %) of organisations were partially certified to ISO 14001. From this figure, 12 (about 15%) were SMEs and 3 (about 4%) large companies. It is interesting to note that, 13 (about 16%) of the industries surveyed are planning to acquire the certificate within the next few years. These respondents might be the industries with limited financial resources and environmental managers in their establishments. 3 (about 4%) did not comment on their position on ISO 14001 certification. It was equally interesting to note that 55 (about 68%) of responding organisations (25% SMEs and 43% larger organisations) engaged in external and internal audits while just 17 (about 21%) of respondents (17% SMEs and 4% larger organisations) indicated that only an internal audit is done according to corresponding directions by the organisation (See table 8.1).

8.3.5.3 Implementation Progress on Individual ISO 14001 Elements

Additional insights were gained by investigating the Implementation of Individual ISO 14001 Elements. Companies that did not have a certified EMS were asked to indicate whether they had EMS components in their establishments. Table 8.2

presents an overview of EMS components implemented by survey respondents without a certified EMS.

Table 8.2 Implementation of individual ISO 14001 elements

ISO 14001 Elements		% of Respondents
4.2	Environmental Policy	54%
4.3.2	Legal & Other Requirements	46%
4.3.4	Environmental Programme	29%
4.4.2	Training	57%
4.4.4	EMS Documentation	18%
4.4.6	Operational Control	57%
4.5.1	Monitoring & Measurement	54%
4.5.3	Preventive Action	68%
4.5.4	EMS Audit	21%
4.3.1	Environmental Aspects & Impacts Identification	57%
4.3.3	Objectives & Targets	43%
4.4.1	Structure & Responsibility	36%
4.4.3	Communication	50%
4.4.5	Document Control	32%
4.4.7	Emergency Preparedness & Response	32%
4.5.2	Non-Conformance & Corrective actions	54%
4.5.3	Records	32%
4.6	Management Review	68%

It was observed that from the 28 organisations without a certified EMS, 15 (about 54%) had an Environmental policy with an overwhelming majority of 19 (about 68%) engaging in preventive action and management review. Survey results equally revealed that 16 (about 57%) of respondents with EMS components engaged in Training, Environmental Aspects & Impacts Identification and operational control. Non-Conformance & Corrective actions, Structure &

Responsibility, as well as Legal & Other Requirements were performed by 54%, 36% and 46% of companies with EMS components respectively. Monitoring & Measurement were conducted by 62% of companies without a certified EMS. Roughly half of the respondents (about 50%) stated that they pursued initiatives relating to Communication. Less than half of the surveyed companies without a certified EMS (about 43%) participated in setting Objectives & Targets. 32% engaged in Emergency Preparedness & Response, Records and Document Control with only 21% implementing EMS Audits. Documentation was the least widespread of all the EMS components covered by the survey: Only 18% of respondents engaged in EMS Documentation.

8.3.5.4 Status of Environmental Supplier Management Policy

Apart from in-house company activities, the study seeks to establish if South African Automotive companies and their suppliers are working as part of the supply chain, which can contribute to indirect impacts on the environment (table 8.3).

Table 8.3 Environmental supplier management policy of respondents

Do you have an environmental supplier management policy?	**SME**		**Large**		**Total**	
	No.	(%)	No.	(%)	No.	(%)
Yes	20	(25%)	36	(44%)	56	(69%)
No	13	(16%)	6	(7%)	19	(23%)
What are the reasons for intensifying environmental supplier management?						
Reduction of supply risks	17	(30%)	26	(46%)	43	(76%)
Cost reduction	9	(16%)	8	(14%)	17	(30%)
Improvement of environmental situation	20	(36%)	32	(57%)	52	(93%)
Reduction of quality defects	8	(14%)	11	(20%)	19	(34%)
Improvement of logistic	4	(7%)	5	(9%)	9	(16%)

Overall, survey results revealed that 56 (about 69%) of respondents required their suppliers to comply with specified environmental standards. From this figure, 36 (about 44%) of large companies required their suppliers to comply with an environmental policy or standard with 20 (about 25%) of SMEs in this category. It is surprising that 19 (about 23%) of respondents indicated that they do not take environmental profile and performance as one of their supplier selection criteria. From this figure, 13 (about 16%) and 6 (about 7%) were SMEs and large Corporations respectively (See Table 8.3).

Of the 56 respondents who required their suppliers to comply with specified environmental standards, 52 (about 93%) designated improvement of environmental situation for intensifying environmentally oriented supplier Management from local suppliers (Table 8.3). From this figure, 57% were Large companies and 36% SMEs. Interestingly, 43 (about 76%) of respondents pointed to reduction of supply risks for intensifying environmentally oriented supplier Management from local suppliers. Cost reduction and Reduction of quality defects were least widespread at 30% and 34% respectively.

8.3.5.5 Voluntary Measures to improve Ecological Systems

Regarding the concern of improving ecological systems, all respondents were asked if they participated in voluntary measures, and, if so, the types being implemented (Table 8.4).

Table 8.4 Voluntary ecological systems measures, which go beyond the improvement of industrial production

Do you have voluntary measures to improve ecological systems?	SME		Large		Total	
	No.	(%)	No.	(%)	No.	(%)
Yes	19	(23%)	21	(26%)	40	(49%)
No	17	(21%)	21	(26%)	38	(47%)
What are the types of voluntary measures used to improve ecological systems?						
Measures to support biodiversity	9	(23%)	15	(38%)	24	(61%)
Measures to clean up of rivers	3	(8%)	14	(35%)	17	(43%)
Measures to avoid erosion	10	(25%)	5	(13%)	15	(38%)
Reforestation	6	(15%)	3	(8%)	9	(23%)

From the total population, 40 (about 49%) of respondents reported being engaged in one or more voluntary measures to improve ecological systems that go beyond the improvement of industrial production. By company breakdown, there was not a major difference between large companies and SMEs representing 26% and 23% respectively. It was surprising to note that 38 (about 47%) of respondents did not engage in voluntary measures to improve ecological systems, which go beyond the improvement of industrial production. From this figure, 26% were large companies and 21% SMEs. (See table 8.4)

Regarding the types of voluntary ecological measures, which go beyond the improvement of industrial production, respondents were told that they could choose more than one response. Of the 40 respondents who were engaged in one or more voluntary measures to improve ecological systems, measures to support biodiversity were the largest segment for both populations – 61% for total and 38% for large companies. Measures to clean up rivers and procedures to

avoid erosion were highlighted by 43% and 38% of respondents respectively. Reforestation was the least popular option placed a distant fourth at 23%.

By company size grouping, the percentages of responses from large companies compared with SMEs are evaluated. Survey results show that major differences exist between large companies and SMEs. 38% and 35% of large companies engaged in measures to support biodiversity and procedures to clean up of rivers respectively. In contrast, it is not surprising that just 23% and 8% of SMEs were identified to be implementing measures to support biodiversity as well as measures to clean up of rivers respectively. This could be explained by the fact that large companies have financial resources than SMEs and thus seek to enhance public image. It is difficult to derive any real insight from the survey about the slightly higher uptake of measures to avoid erosion by SMEs (15%) as compared to large companies (8%) as no comments to this particular issue were highlighted by the respondents.

8.3.5.6 Measures to ensure Continuous Improvement of Environmental Management System

When asked to establish if there had been any measures to ensure continuous improvement of Environmental Management, multiple answers could be selected from the questionnaire. Respondents' comments were: (i) decrease in waste to landfill using recycling/reuse techniques, (ii) adoption of Improved energy saving and manufacturing technologies that eliminate/reduce pollution and fugitive emissions, (iii) annual review of aspects and impacts and setting objectives and targets to meet or exceed legislated requirements, (iv) proper use, storage and appropriate disposal of hazardous substances, (v) customer environmental compliance (vi) purchasing packaging materials made from recycled materials (vii) reduce consumption of non renewable resources (coal and heavy fuel), (viii) a more advanced personnel environmental development (awareness training) plan and (viiii) constant engineering revision and replacement of chemical processes with more ecological friendly systems.

The first four comments can be accounted for with improving and achieving persistent compliance to the requirements of the 1997 White Paper on Environmental Management, in addition to legislative measures, which outlined the need to implement strategic environmental management systems in South Africa. This view is supported by comments from a manager who asserted that, “Our policy was defined by customer requirements, legal and local by laws”.

The remaining four comments (comments 5-9) are indicative of companies, especially large enterprises, to have been influenced by their sister companies in Europe to go beyond regulatory requirements as well as enhancing image and reputation. As one manager of a large company said about environmental management, “certification to ISO 14001 is the Company’s global requirement and a customer prerequisite for awarding of business contracts (approved supplier)”. A comment from another manager that offers additional insight to this observation is, “We are currently implementing a global environmental initiative, which is an enhanced EMS focusing on improved environmental performance, risk reduction and zero non-compliances/complaints”.

8.4 Discussion

This study revealed that an overwhelming number of South African Automotive industries, operating as multinationals, are focused solely on the manufacture, sales and design of vehicles and component parts with refurbishment and recycling playing a minor role across the entire product lifecycle. This perhaps reflects the lack of regaining secondary raw materials from end of life vehicles at the end of the supply chain. A possible explanation for this observation is a lack of clear government policy, support and encouragement to bolster the recovery of valuable secondary raw materials from end of life vehicles by the multinationals operating in the country. A further explanation for this observation is the fact that companies generally perceive recycling as a costly procedure with modest economic benefits. A comment from a purchasing manager of a large company that offers evidence to support these submissions is, “A direct use of secondary raw material without pre-treatment and processing is not possible in automobile

production. However our suppliers could partially use secondary raw materials in their products."

When asked about a standardised environmental policy as the fundamental principle of environmental management, respondents provided a variety of results to this concern, and range from large corporations to SMEs. Survey results show that the organisations vary significantly in their approach to the fundamental principle of environmental management. In particular, they varied in the extent to which procedures were formalised and documented, with a majority of organisations in possession of formal environmental policies published in certified environmental reports. This submission is not different from those of Alemagi et al. (2005) pointing to environmental policy as the most frequent EMS component in industries that see the need of an EMS along the Atlantic coast of Cameroon. Moreover, these results are buttressed by Emilsson and Hjelm (2002) who pointed to an environmental policy as the main and central document of an EMS. They further argued that an environmental policy sets an organisation's ambitions and reflects its overall principles in environmental performance. Indeed, this submission is consistent to those of Smink et al. (2006) who pointed to environmental protection as an important aspect of the environmental policy of BMW's Rosslyn plant in South Africa.

It was interesting to note that while the manufacture of automobile in South Africa was initiated between 1920 and 1930, attaining its peak between 1971 and 1980, EMS implementation was only initiated in 1993, 73 years after initial production of the first company. EMS initiation reached its peak in 2005, only after the introduction of the South African 1997 white paper on environmental management. This observation is buttressed by the submissions of Kehbila et al. (2009), who pointed to improving and achieving consistent compliance as the major motivating factor for EMS adoption within the South African Automotive industry.

Preliminary results equally confirmed that, in contrast to early presumptions that only large corporations would adopt EMSs, such systems in fact are being implemented by companies of all sizes within the South African automotive milieu.

However, ISO certification was more widespread among larger firms than SMEs. This observation is not different from those indicated by Turner et al. (2000) who argued that larger firms are likely to spread cost of certification to ISO 14001 and other standards thus able to benefit from certification. It was also interesting to note that most of these companies have been certified to ISO 9000/9002 quality management system (QMS) (NAAMSA). Accordingly, they have the expertise and setups to get the ISO 14001 certificate without putting in new management structures. Moreover, survey results show that a small fraction of industries surveyed were planning to acquire the certificate within the next few years. A possible explanation for this observation is that these industries may have limited financial and human resources dedicated to implementing a certified EMS as indicated by Smink et at (2006), Cockrean (2000), Goodchild (1998) and Hillary (1997).

It is not surprising that large companies have a comparatively greater number of action plans for achieving environmental targets than SMEs. This can be explained by the fact that large companies have the money and human resources dedicated to environmental management as indicated by Turner et al. (2000). Indeed some respondents submitted, upon request, an action plan beyond a written statement to achieve their targets.

Regarding the implementation of individual ISO 14001 Elements, it is perhaps not surprising that a majority of companies devoid of a certified EMS had an Environmental policy and engaged in preventive action, environmental aspects and impacts identification, communication, legal and other requirements, Non-Conformance & Corrective actions and management review. Some of these submissions are consistent with the results of Alemagi et al. (2005) who pointed to compliance with legal and other requirements, environmental policy, communication of environmental work and operational control of environmental work as the most frequently occurring components of EMS in industries that were devoid of EMS along the Atlantic Coast of Cameroon.

However, it is unclear why EMS audit was one of the least widespread of all activities covered by the survey. One possible reason is that organisations may

choose to wait until most other EMS elements are in place before developing an EMS audit programme. Another possible reason is that organisations may have limited financial and human resources dedicated to environmental management as reported by Hilary (2004), Ibbitson (1997), Hitchens et al. (2003), Pimenova and van der Vorst (2004).

The question on EMS responsibilities sought to ascertain if the issue of limited human resources within SMEs was a problem and if ISO 14001 has managed to challenge this. An assumption was made that it would be owners/Managing Directors or Managers with other responsibilities overseeing the EMS process in SMEs whilst large organisations can afford dedicated environmental managers as reported by Hilary (2004). Indeed, there were mixed results with the above assumption as EMS responsibilities were managed by personnel from a wide variety of positions and departments. As such companies that do not have personnel responsible to the environment would probably depend on other staffs who are not environmentalists to undertake environmental issues. This highlights a lack of standardisation of the allocation of responsibilities on environmental issues within the South African Automotive industry. Certainly, of the environmental managers who had the responsibility with dealing with EMS, 37 (about 46%) came from Large-sized companies and 22 (about 27%) from SMEs. It was equally interesting to note that of the quality managers who had the responsibility with dealing with EMS 7 (about 9%) came from Large-sized companies and 12 (about 15%) from SMEs. However there was an even spread of EMS responsibilities dedicated to managing directors between SMEs and large companies. This perhaps reflects the assumption of the traditional barriers that implementation of an EMS puts severe strain on human resources was an issue imbedded within the South African automotive milieu.

Overall, survey results revealed that 69% of companies generally have a more positive attitude towards using environmental profiles and performance indicators as supplier selection criteria, encouraging their suppliers in the implementation of a certified EMS. A comment from an environmental manager that offers evidence

to support this suggestion is, “As part of automotive industry, components must be assured to be free of all automotive approved hazardous substances”.

The difference was particularly striking when it came to participating in voluntary environmental initiatives by responding organisations with positive answers obtained from 44% of larger companies and only 25% of SMEs. This discrepancy probably reflects the fact that so far little effort has been made by SMEs to implement voluntary measures to improve ecological systems, which go beyond the improvement of industrial production. It is interesting to note that measures to support biodiversity was frequently cited by respondents and the issues surrounding this is attributed to comments provided by respondents including, monetary contributions to local environmental action groups such as New Germany Conservancy, the cleaning and maintenance of land surrounding facility with the removal of alien/invasive vegetation and trees as well as clearing of litter and cutting of long grass.

8.5 Recommendations

Based on the experience of the organisations in this study, it became apparent that certain types of guidance are very important for organisations of all sizes attempting to implement ISO 14001. These include:

- Integrating EMS into Quality Management Systems
- Incentives for recovering secondary raw materials from end of life vehicles
- National database on environmental management systems (NDEMS) and
- Information sharing and networks

• Integrating EMS into Quality Management Systems

As most of the organisations already have ISO 9001 quality management systems in place, it is recommended that steps should be taken to examine how EMS Programmes and resources can be integrated into existing quality programmes to curb the high cost of implementing both systems individually. Such a procedure, we argue, will provide an opportunity to address and understand the interaction and interplay between different quality and environmental issues and develop a

more holistic and cost effective approach toward managing environmental aspects and their corresponding impacts. On this score, supporting internal training of quality personnel to increase familiarity with EMS concepts and terminology is imperative. There should equally be the prospects of implementing joint EMS by SMEs that can not afford the single system. However, such an amalgamation should comprise of SMEs with similar characteristics: processes, chemicals and materials.

- **Incentives for recovering Secondary Raw Materials from end of life Vehicle**

In this study, it was surprising to note that recycling was least widespread within the automotive industry at 2%. As mentioned earlier, companies generally perceive the recovery of secondary raw materials from end of life vehicles as a costly procedure with modest economic benefits. From this premise, it is recommended that government incentives in the form of tax-breaks be awarded to automotive companies that are engaged in design for recycling characteristics (e.g. hazardous substances in the product, ease of disassembly) as well as subsidies to firms that are proactive in the take back and recovering of secondary raw materials from end of life vehicles.

- **Development of National Database on Environmental Management Systems (NDEMS)**

There is a need for a concerted effort between the government, industries, universities, and some non-profit organisations to develop a common set of fundamental rules and data collection protocols for state pilot projects with facilities adopting EMSs, and to pool data on the environmental and economic results into a national, publicly-accessible database, the National Database on EMSs (NDEMS). This National database should provide standardised real time detailed information on the substantive characteristics and design procedures before, during, and after EMS implementation. This will provide a level of detailed, comparative tracking of implementation and change over time, which cannot be produced by other research methods – such as individual case studies or mail surveys – which constitute much of the other emerging research literature on EMSs.

- **Information sharing and Networks**

Survey results revealed that some industries have partially completed the certification of ISO 14001, with others planning to do so in the future. These industries, we argue, might be those with limited financial resources and environmental managers in their establishments. On this score, it is recommended that the economic benefits and successes of a certified EMS be widely dispersed throughout the industry. In doing so, it is imperative for the government to sponsor pilot projects that provide EMS support, promote networking, the sharing of EMS implementation success stories as well as learning from previous missteps. Thus building a business case for EMSs through EMS implementation case studies and working with trade associations and other Industry groups to promote the economic and environmental benefits of EMSs is vital.

8.6 Chapter Summary

Major issues emerging from this study on the uptake of EMS ISO 14001 within the South African automotive industry demonstrate that a majority of industries have sought to improve their environmental performance by integrating environmental considerations into their activities. On this score, survey results revealed a wide variety of corporate environmental knowledge and practice including: allocation of responsibilities on environmental issues, written environmental policies, setting of targets to improve environmental performance, implementation of individual ISO 14001 elements, ISO 14001 certification, and environmentally oriented supplier management and voluntary measures to improve ecological systems, which go beyond the improvement of industrial production.

As Kehbila et al. (2005) submit, the uptake of the above environmental initiatives was largely attributed to improving and achieving consistent compliance with major benefits encompassing improved customer relations and competition. Though these environmental initiatives were largely embedded within the South African Automotive Industry, the extent to which EMS will actually lead to significant and measurable advances in environmental quality will explicitly depend on how the recommendations prescribed in this study are addressed.

Finally, it should be recognised that the results presented in this chapter outline the first part of a research project that attempts to identify effective and realistic environmental management initiatives and tools embedded within the South African Automobile industries, particularly as SMEs move beyond regulatory compliance with existing environmental legislation. The results of this chapter therefore act as a starting point for later stages of the research Project that will evaluate possible drivers, benefits and implementation hurdles of ISO 14001 within the South African automotive industry as presented in the subsequent chapter.

CHAPTER NINE

Strategic Corporate Environmental Management within the South African Automotive Industry: Motivations, Benefits and Hurdles.

This chapter conveys the experiences of South African automotive industries as they attempted to implement the ISO 14001 Standard. Through a questionnaire based survey, SMEs as well as larger companies were asked about the key motivations for engaging in environmental change, the benefits accrued and the barriers that prevented them from doing so. The chapter analyses this variation in adoption rates in order to establish different relationships between them and concludes by prescribing robust recommendations that would set off the pace for government officials to incorporate effective and realistic incentives into future policy to better encourage environmental compliance and improved performance while minimising costs both to businesses and to the government.

9.1 Introduction

The South African automotive industry, which operates as multinational companies, incorporates the manufacture, distribution, servicing and maintenance of motor vehicles and components with original equipment manufacturers (OEMs) being the critical role players (Smink et at. 2006). This industry is South Africa's largest manufacturing sector contributing during 2005 to 28% of manufacturing output (NAAMSA, 2006). Recently, the automotive industry has grown into one of the most successful in the post-apartheid era, contributing in 2005 an excess of R201,7 billion to the nation's income, which amounts to 7,64% of the country's R1 523 billion Gross Domestic Product. Although the industry is responsible for only 0.8% of the world's vehicle production, it produced over 87% of Africa's vehicle output in 2005 (NAAMSA, 2006). The industry is made up of all major multinational automobile manufacturers (TISA, 2003) and is ranked 21st in terms of vehicle production in 2005 - ahead of countries such as Indonesia, Taiwan, Australia, Sweden and Argentina (International Organisation of Motor Vehicle

Manufacturers, 2006). It employs more than 322 570 people, accounts for nearly 20% of the nation's total industrial investment in 2006 and provides high quality, affordable vehicles and components to domestic and international markets (NAAMSA, 2006).

Despite its dominance in the South African economy, the relative contribution of the automotive industry to the total national industrial environmental impact is unknown but considerable, given its contribution to total production, high energy consumption and its dominance in the country's economy. As the Department of Environmental Affairs and Tourism, 2002; Brent and Labuschagne, 2003; Energy Information Administration, 2004; Labuschagne et al. 2005 explain, a significant amount of South Africa's national environmental burdens is attributed to the automotive manufacturing industry, primarily through growing waste disposal problems, rapid deterioration of air quality, widespread noise pollution, degradation of its marine environment, loss of biodiversity and valuable land. To intervene against these impacts in South Africa, the local government has focused its environmental protection efforts mainly on non-binding pollution prevention guidelines with no enforcement authority. Thus, attempts at addressing more fundamental and far-reaching issues such as environmental governance and sustainable development in South Africa have been ambivalent and often lacking in clarity and determination (Energy Information Administration, 2004).

While a wealth of EMS studies abounds in the literature, the lack of sector specific material for EMS implementation has been a setback. This issue has so far attracted relatively little research interest in Africa particularly within the South African automotive industry, even though its environmental impact is not less important. Indeed, there is a dearth of empirical research with no systemic findings in the literature to clarify when, why and how South African automotive companies have used voluntary environmental initiatives as part of their corporate strategy and what the implications of these initiatives are for environmental performance, company behavior, regulatory effectiveness and social accountability. Therefore, in South Africa, there is a need for "real life" examples from the automotive industry about the challenges and benefits of implementing

EMSs and the drivers for doing so. Against this backdrop this chapter attempts to redress this gap in knowledge and awareness within the automotive milieu and provides some early data against which to benchmark future developments.

This chapter seeks to provide an insight into the behavioural patterns of South African Automotive industries in their quests to engage in environmental change and determine if these patterns are similar to other studies as given in the literature, or if they differ, in what ways. To this end, the objectives of this chapter are fourfold: (i) to identify the main motivations of EMSs implementation within the South African automotive industry, (ii) to examine the EMS implementation process along with the ongoing challenges/barriers involved with participating in this initiative, (iii) to assess the organisational benefits that automotive companies have accrued in implementing an EMS, (iv) to identify and assess any differences that might exist between small and large automotive industries in their ability to implement an EMS. The findings of this study, it is hoped, will provide a forum for organisations to learn from each other's EMS experiences.

The chapter is structured as follows. It proceeds in the following section with an overview of previous studies so that when the survey results are presented, the reader understands the correlation to the experiences of South African Automotive industries. Next a description of the method used to collect data is presented. The subsequent section presents the results of the study followed by the discussion of the findings. The chapter then proceeds by proffering options for future actions and wraps up the study with some concluding remarks.

9.2 Prior Research

Empirical studies of EMS implementation have emerged in most parts of the world. However, the implementation process, drivers, implementation hurdles and benefits accrued vary significantly across the globe. The findings of studies carried out by Del Brio (2000) and Ayuso (2006) in Spain as well as Hillary (2000) and Strachan (1999) in the United Kingdom pointed to improving corporate image as the main benefit accrued in implementing a certified EMS. On the contrary Nakamura, Takahashi and Vertinsky (2001) concluded that Japanese companies

see the benefits of ISO 14001 certification in terms of profit and utility maximisation. These benefits coincided with those of Melnyk et al. (2002) who concluded in their study that reduced costs and improved quality were the main paybacks as a result of EMS implementation for more than 1500 organisations in North America. Smink et at (2006) highlighted further benefits such as significant reductions of environmental impacts, risks and accidents as a result of implementing a certified EMS at the BMV Rosslyn Plant in South Africa.

Studies conducted in Germany by Seuring (2006), in Turkey by Küskü (2006) and in the Netherlands by Revell and Rutherfoord (2003); Rutherfoord et al. (2000) found that companies became more actively engaged in EMS implementation as a result of a robust legislative, licensing and inspection system. In a similar vein, Quazi et al. (2001) identified cost savings, employee welfare, meeting environmental regulations as the main triggers for EMS implementation for companies in Singapore. This view is supported by Kwon et al. (2002) and Ayuso (2006) who investigated the impact of ISO 14001 on Korean companies and Spanish hotels complying with environmental regulations and envisioned cost savings respectively. They noted that EMS provides a practical workable framework to control environmental risks, improve and optimise operational efficiency thus preventing accidents, violation of environmental regulations, costs minimisation and competitive advantage. These motivations coincided with those of Mohammed (2000) who argued that minimising the risk of accidents was the main cause for EMS implementation by Japanese companies.

The overwhelming initial and present EMS priority in studies by Hahn and Scheermesser (2006), Alemagi et al. (2006) pointed to ecological responsibility and environmental conservation as the main catalysts for EMS implementation among German companies and in industries along the Atlantic coast of Cameroon respectively. A similar research, with similar results, was carried out in Greece by Evangelinos and Halkos (2002) citing top management concern, recognition of opportunities arising from their activities with regard to environmental issues, and to operate in sensitive environmental conditions as the three major motives in companies that were adopting an EMS.

However, the message that an EMS brings compliance was seen as the most important one to companies, followed by the demand from parent company, good corporate image and customer procurement demands in a study by Smink et at (2006), Mbohwa and Madzinga (2000). While raising employee's awareness was noted by summers (2002) as a primary initial reason for 131 ISO certified companies across the world, a study by Strachan, Mackay and David (2003) revealed that business reputation and business requirement were the main driving forces pushing the adoption of ISO 14001 within the UK oil and gas industry. Further, studies carried out by a range of authors (Nawrocka, 2007., Beske et al. 2006., Halila, 2006., Smink et at, 2006; Hahn and Scheermesser, 2005., Teuscher et al. 2005) pointed to customer requirements as the main trigger for companies adopting a formal EMS. Other researchers like Haddock-Fraser and Fraser (2007) are of similar opinion that companies who are close to market, or are brand-name companies, are highly likely to adopt one of the several forms of environmental reporting. Indeed, the findings of Wahba (2007) demonstrate that the market compensates those firms that care for their environment.

A major source of irritation for SMEs, surfacing in studies by Goodchild (1998); Hillary (1998 and 1997) and KPMG (1997) is the cost of EMS certification. They also found that SMEs are aggrieved by the cost and quality of consultants advising them. On the contrary, human rather than financial resources were the major barriers impeding EMS implementation frequently cited in studies conducted by Poole et al. (1999); Goodchild (1998) and Charlesworth (1998). Additionally, negative corporate attitudes and an unfavorable company culture were often cited by Hillary (1998), Rowe and Hollingsworth (1996), and NALAD (1997) as the main barriers for EMSs implementation especially in SMEs. Practical difficulties, such as, uncertainty with regulatory agencies and lack of time also scupper implementation of EMS by US firms in a study by Delmas (2002). In a similar vein, studies by Smink et at (2006) and Cockrean (2000) pointed to inconsistent top management support and financial constrains as the major barriers impeding EMS implementation. Further, Smink et at (2006) and Studer et al. (2005) cited extensive and incomprehensive legislation, a lack of clear government policy, support and encouragement as the key factors impeding

businesses in implementing a certified EMS. Other significant barriers indicated by Halila (2006) that hindered EMS implementation by SMEs were time constrain, low integration of environmental work in the daily work and high demands on documentation.

9.3 Research Methodology

The original intention of this survey was to identify South African Automotive companies that have had experience of using ISO 14001 to achieve EMS certification or are currently using ISO 14001 as a means of achieving an EMS and then contact these companies with a view to completing a questionnaire. Companies that have not had experience of gaining EMS certification were not included in this study because the barriers, benefits and drivers leading to EMS adoption can only be analysed from respondents that have actually engaged in this initiative.

The major weakness of this approach is that it relies on others to pass on information. To ameliorate this drawback, a covering letter was enclosed explaining the reasons for the research, why it was important and why the recipient had been selected. There was also a guarantee of confidentiality (Bryman, 2001). However with a third party in the loop it loses that personal touch, when the questionnaire arrives at its destination. In this vein, the importance of filling out a research questionnaire is a low priority and might be neglected in a busy commercial environment. Therefore a more reliable source of information was required. To this end, Industries that have had the most experience for achieving an EMS seamed the ideal starting point. A search of the databases of the National Automobile manufacturers of South Africa (NAAMSA) and the National Association of Automotive Component and Allied Manufacturers (NAACAM) revealed relevant contact details for initial telephone contacts.

Three distinct sources of information were used to select appropriate subjects for the questionnaire: (i) the Environmental Manager of BMW South Africa in order to identify any concerns and questions the Manager may highlight as regards the challenges and opportunities of implementing an EMS as the company has had a

wealth of experience in this milieu, (ii) two experienced professional EMS consultants in South Africa in order to ascertain any relevant questions and themes for the research, (iii) A review of the literature in order to incorporate the drivers, benefits and the implementation hurdles into the questionnaire to test if South African automotive industries generated similar results and whether expectations were being met.

Once themes were identified, the questionnaire was developed comprising of open and pre-coded multiple-choice questions. The questionnaire was subdivided into two parts. The first part requested some general information of the sampled industries such as their location, the job title of the respondent in the establishment, when the company started operating in South Africa, the most productive business lines, the number of employees and manufacturing plants of the responding companies. The second part of the questionnaire focused on the experiences of EMSs implementation including when an EMS was initiated in an establishment, if a company has an environmental policy and sets objectives and targets. This section equally requested the main motivations, hurdles and benefits accrued in the implementation of a certified EMS, which form the basis of this chapter. Different options were given to the respondents, who selected the appropriate ones.

Efforts were made to keep the questionnaire below five pages and to take up as little time as possible. The questionnaire was equally designed for distribution via e-mail as well as the traditional postal service. It was then piloted using three different groups: (i) colleagues within the environmental department of the Brandenburg University of Technology, Cottbus, Germany (ii) the environmental Manager of BMW South Africa, (iii) two professionals who had agreed to look over the questionnaire. Feedback meant some minor changes and timing took between 10 and 20 minutes depending on the level of detail entered into during the open questions. Based on answers of the respondents, the following results were obtained.

9. 4 Results

The response rate of this survey was 54%, corresponding to 81 returned questionnaires out of 150 that were posted. From this number, 15 (about 19%) of the respondents were Original Equipment Manufacturers (OEM) and 66 (about 81%) were Automotive Component Suppliers to OEM. Additionally, of the 81 participating companies, 43 (about 53%) were large-sized companies and 38 (about 47%) were Small and Medium-sized Enterprises (SMEs). This classification was done in accordance with the standards of South African Department of Trade and Industry (2003) classifying SMEs as companies employing up to 200 employees and large-sized companies to corporations employing more than 200 employees.

Originally, it was assumed that the return rate would be low given the local situation where companies are not usually enthusiastic about surveys. However, such a reasonable return rate was achieved often only after repeated follow-up calls between the period of July 2006 and October 2007. Generally, it was not surprising that ISO 14001 Automobile manufacturing companies were more willing to participate in this type of survey as they have already implemented such concepts in their businesses. Thus, when analyzing the results of this chapter, it is worth bearing in mind that the study mostly focused on Automobile manufacturing companies with a certain interest in environmental matters and thus, does not present an overview of the average business community in South Africa. This approach is reasonable, as the drivers leading to EMS adoption, the barriers encountered and benefits accrued can only be analysed if a sufficient number of respondents are actually engaging in this activity.

9.4.1 The most Productive Business-lines of South African Automotive Companies.

This section of the chapter proffers companies' product groups/products according to their most productive business-lines. This question was left as an open question. This was reflected in the fact that 26 different product groups/products were received with brake parts being the most cited productive business-line (table 10.1). Indeed, the companies provided a variety of products, and range from large corporations to small and medium manufacturers.

Table 9.1 Breakdown of respondents' product groups/products into productive business lines and size classification

Productive Business Lines	SMEs	Large	Total
Air conditioners	2	3	5
Automotive tooling	0	1	1
Axles (driving/non-driving)	1	0	1
Batteries	0	1	1
Body parts/panels	0	2	2
Brake parts	7	5	12
Clutches/shaft couplings	0	2	2
Engines	0	3	3
Engine parts	2	3	5
Exhaust systems	0	1	1
Electronic modules	0	1	1
Filters	0	1	1
Fuel tanks	2	1	3
Gaskets	0	1	1
Gauges/instruments/parts	0	1	1
Gear boxes	0	1	1
Glass (Screens, mirrors)	2	0	2
Jacks	0	1	1
Lighting/signalling/wiping	0	3	3
Radiators	0	2	2
Road wheels/parts	0	2	2
Seats	1	1	2
Seat parts/leather covers	1	3	4
Seatbelts	1	0	1
Shock absorbers	2	1	3

Steerings/wheels	1	2	3
Wiring harnesses	2	0	2

Table 9.1 continues

Twelve (about 15%) of the surveyed companies pointed to brake parts as their most productive business-line. From this figure, 7 (about 58% were SMEs and 5 (about 42%) were Large companies. Just 3 (about 4%) of large companies pointed to air conditioners, engines/engine parts, lighting/signaling/wiping, seat parts/leather covers as their second most productive business lines with SMEs representing less than 2 (about 2%) of these product groups. The least cited product groups were Automotive tooling, axles, batteries, exhaust systems, electronic modules, filters and gaskets, just to name a few. 20 (about 35%) did not comment on the above business lines. From this figure, 15 (about 75%) were OEM.

9.4.2 Major Drivers for adopting Voluntary Environmental Initiatives

In this survey, respondents were asked to choose, from a given list, their most relevant drivers for engaging in environmental change. A breakdown of the major drivers for EMS implementation in small and large companies is given in figure 9.1.

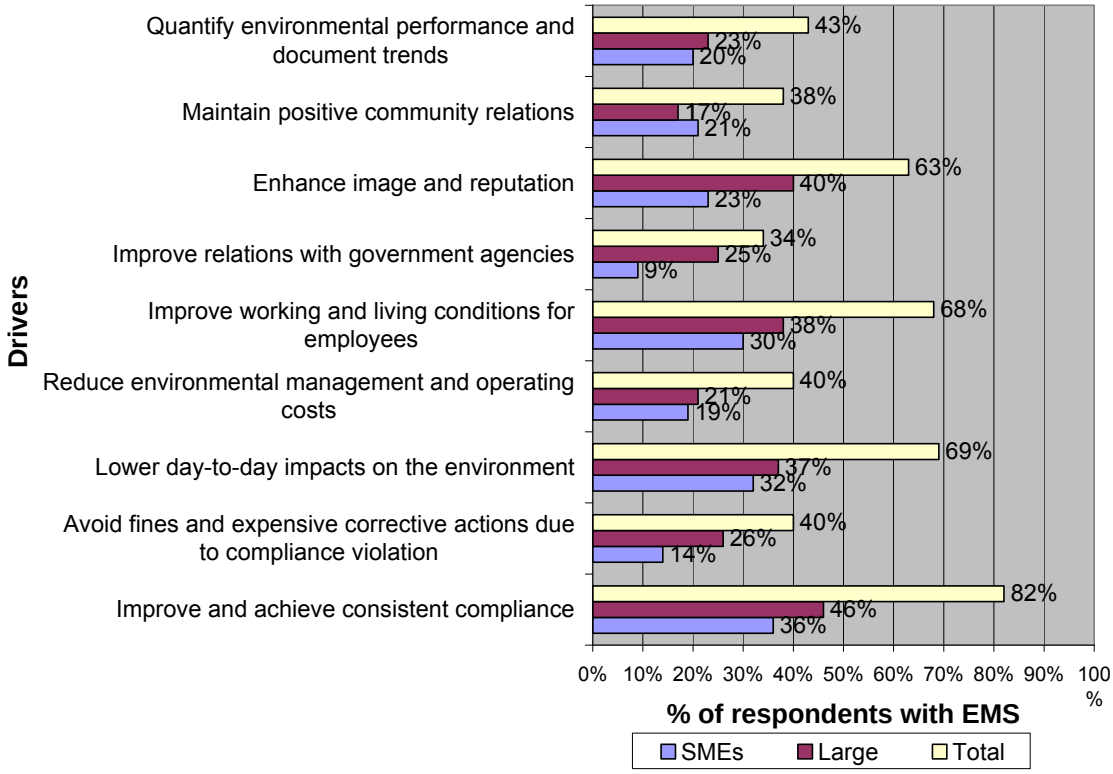

Figure 9.1 Importance of various drivers for engaging SMEs and large companies in compliance-plus environmental initiatives

The three most frequently named drivers for introducing environmental management systems within the South African Automotive industry were improving and achieving consistent compliance, lowering day-to-day impacts on the environment and improving working and living conditions of employees. They were cited by an overwhelming 66 (about 82%), 56 (about 69%) and 55 (about 68%) of respondents respectively, for a variety of additional reasons: to provide training for their employees, and to raise the awareness of their workforce as well as to fulfill the requirements of a client, just to name a few. Drivers such as enhance image and reputation were cited by 51 (about 63%) of respondents and 35 (about 43%) pointed to quantifying environmental performance and documenting trends. Reduce environmental management and operating cost, maintain positive community relations and improve relations with government agencies appeared to be minor drivers for EMS implementation within the South African Automotive Industry, with 32 (about 40%), 31 (about 38%) and 27 (about 34%) of responses respectively.

Though the rates of recurrence of most drivers were rather similar between small and large companies, significant differences occurred in some cases. Evidently, large companies responded more strongly to arguments pertaining to improving and achieving consistent compliance 37 (about 46%), whereas this driver was mentioned by 29 (about 36%) of SMEs. Moreover, more emphasis on lowering day-to-day impacts on the environment was highlighted by 30 (about 37%) of large companies compared to 26 (about 32%) of SMEs. These may be signs of an increasing awareness of the positive impact of corporate environmental management between both company types. Indeed, improving working and living conditions for employees was another prime motivating factor for 31 (about 38%) of large companies compared to 24 (about 30%) of SMEs. Evidence of reduce environmental management and operating cost was relevant for small and large companies with a minor difference of 2%, as was quantifying environmental performance and documenting trends with a difference of 3%. Interestingly, 17 (about 21%) of SMEs responded more strongly to maintaining positive community relations compared to 14 (about 17%) of large companies.

9.4.3 Barriers to Successful EMS Implementation

The second part of the survey consisted of a number of questions covering the topic of barriers to successful EMS implementation. Respondents were asked to choose, from a given list, the major barriers they had to overcome in the development of an environmental management system. Results are given in table 9.2, which provides an overview of the relative importance of various hurdles for EMS implementation in small and large South African Automotive companies.

Table 9.2 Importance of various barriers to successful implementation of EMSs by SMEs and large South African automotive industries

	SMEs		Large		Total	
Internal Barriers:	**No**	**(%)**	**No**	**(%)**	**No**	**(%)**
Lack of knowledge of certifier's system	6	(7%)	1	(1%)	7	(8%)
Lack of specialists in environmental issues	10	(12%)	13	(16%)	23	(28%)
Inconsistent top management support	7	(9%)	3	(4%)	10	(13%)
Low awareness of Employees	28	(35%)	33	(41%)	61	(76%)
Difficulty in dealing with environmental aspects	9	(11%)	7	(9%)	16	(20%)
Uncertainty in maintaining continual improvement	2	(2%)	6	(7%)	8	(9%)
Cost constraints	25	(31%)	21	(26%)	46	(57%)
Lack of time	7	(9%)	10	(12%)	17	(21%)
	SMEs		**Large**		**All**	
External Barriers:	**No**	**(%)**	**No**	**(%)**	**No**	**(%)**
Bureaucratic work	8	(10%)	4	(5%)	12	(15%)
Lack of support and guidance	4	(5%)	10	(12%)	14	(17%)
Insufficient benefits and drivers	3	(4%)	10	(12%)	13	(16%)

Low awareness of Employees and costs constraints emerged as the two key barriers to successful implementation of an environmental management system within the South African Automotive Industry. They were cited by 61 (about 76%) and 46 (about 57%) of respondents respectively. Additionally, 23 (about 28%) of respondents cited lack of specialists in environmental issues as the third major barrier to successful EMS implementation. 17 (about 21%) of respondents mentioned lack of time, and another 16 (about 20%), difficulty in dealing with

environmental aspects. Evidently, external barriers such as lack of support and guidance 14 (about 17%), insufficient benefits and drivers 13 (about 16%) and Bureaucratic work 12 (about 15%) appeared to be of lesser importance, with major differences between small and large companies. The least frequently cited barriers were inconsistent top management support 10 (about 13%), uncertainty in maintaining continual improvement 8 (about 9%) and lack of knowledge of certifier's system 7 (about 8%).

As with drivers, some similarities between the two types of organisations were observed. SMEs and large organisations cited most EMS implementation barriers (e.g. lack of specialists in environmental issues, cost constraints, difficulty in dealing with environmental aspects, and lack of time) in roughly equal proportions. Evidently, low awareness of employees topped the list for both SMEs and large companies at 35% and 41% respectively.

For other barriers, however, there were notable differences between the two company types. SMEs were more likely than large organisations to identify difficulty in dealing with environmental aspects as an obstacle for successful EMS implementation (11%, compared to 9% of larger companies). Interestingly, 25 (about 31%) of SMEs, compared to 21 (about 26%) of larger companies, pointed to cost constraints as the most important hurdle for successful EMS implementation in their various establishments. Bureaucratic work was equally a major barrier for 8 SMEs (about 10%), which was mentioned by only 4 (about 5%) of large companies. Large organisations, on the other hand, were more likely to identify low awareness of employees (41%, compared to 35% of SMEs), lack of specialists in environmental issues (16%, as opposed to 12% of SMEs), and insufficient benefits and drivers (12%, contrary to 4% of SMEs) as impediments to successful EMS implementation in their industrial setting.

9.4.4 Organisational Benefits for EMSs Implementation

This section of the chapter seeks to unravel the EMS benefits accrued by South African Automotive companies engaging in environmental change. Respondents were asked to indicate their organisational benefits for implementing an EMS.

Indeed, our results reveal that respondents have realised several benefits of implementing EMSs in their industrial settings. The benefits cited are shown in figure 9.2.

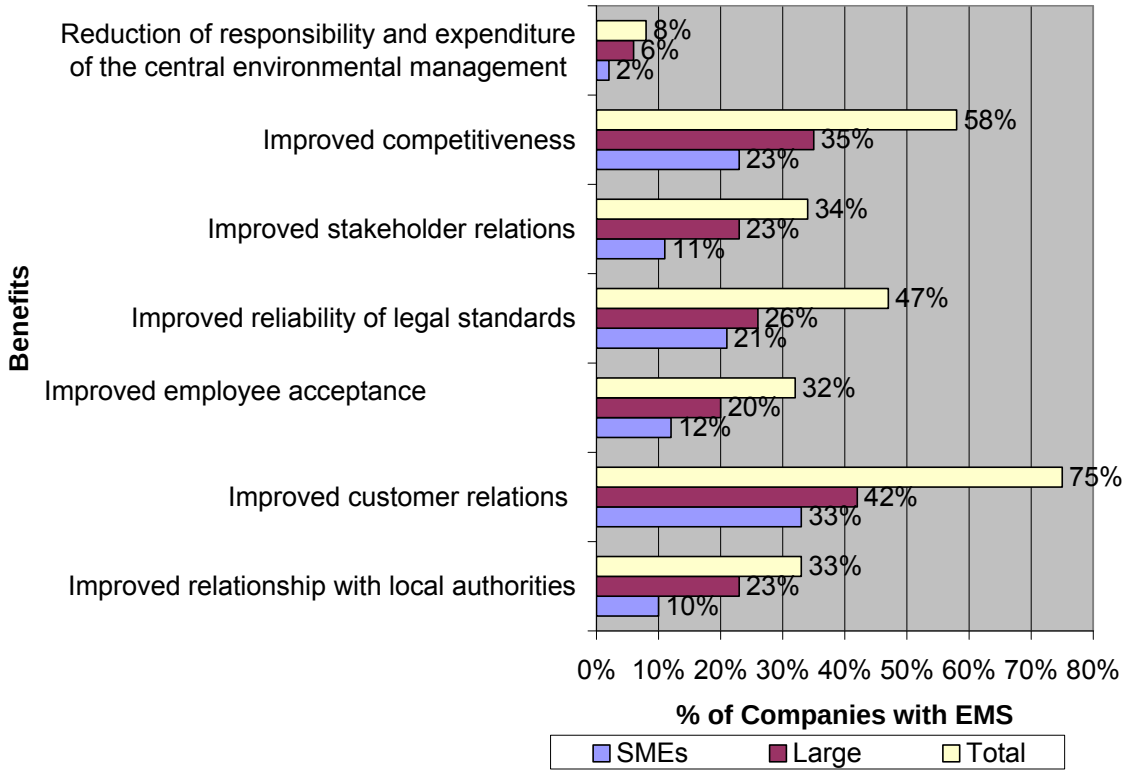

Figure 9.2 Importance of various benefits for EMS implementation by SMEs and large South African automotive companies

When asked what benefits an organisation has achieved in adopting an EMS, the results suggest that a wide range of benefits have been realised to a greater or lesser extent in organisations and that as a method for improving environmental performance, ISO 14001 can only help tip the balance in favor of south African automotive companies engaging in environmental change.

An overwhelming number of respondents cited improved customer relations 61 (about 75%) and improved competitiveness 47 (about 58%) as the most common benefits accrued in implementing a standard EMS. 38 (about 47%) of respondents pointed to improved reliability of legal standards and another 28 (about 34%) to improved stakeholder relations. Other benefits accrued include improved

relationship with local authorities 27 (about 33%) and improved employee acceptance 26 (about 32%). The least frequently cited benefit was reduction of responsibility and expenditure of the central environmental management cited by 7 (about 8%) of respondents.

Just as with drivers and barriers, some similarities and differences emerged when respondents were asked to indicate their organisational benefits for implementing EMSs from a given list. For certain benefits identified by participants (Reduction of responsibility and expenditure of the central environmental management and improved reliability of legal standards), there was no major difference between the proportion of SMEs and large companies citing them as benefits. Interestingly, both SMEs and large companies cited improved customer relations as the major benefit with a 9% difference between them (33% of SMEs, 42% of larger companies). Additionally, improved competitiveness appeared to be the second prime benefit for both SMEs and large companies at 23% and 35% respectively.

9.5 Discussion

As already mentioned, the main goal of this chapter was to provide an insight into the behavioral patterns (drivers, barriers and benefits) of SMEs and larger South African Automotive industries in their quests to engage in environmental change and determine if these patterns are similar to previous studies, as given in the literature, or if they differ, in what ways. A number of open questions were included in the questionnaire inviting comment from respondents. The comments received as answers to these sections provided valuable evidence to substantiate many of the findings of the research, and proved a benefit to the research as a whole. Generally, our findings observed some similarities and differences between survey results and those provided by the EMS literature.

Respondents most frequently cited low awareness of employees as the key barrier for EMS implementation with a minor difference between SMEs and large companies at 35% and 41% respectively. This result is not different from those indicated in previous studies, such as the study carried out by Hillary (1998) and the survey done by Rowe and Hollingsworth (1996) and NALAD (1997) who

pointed to a low degree of awareness of supply chain issues, negative corporate attitudes and an unfavorable company culture as the main barriers for EMSs implementation especially in SMEs. A comment from an environmental manager of a large company that offers evidence to support these results is, “the biggest obstacle in implementing environmental management system was buy in at shop floor levels in the company and based on the culture of the company, it was very difficult to drive home the benefits of environmental management especially to an old workforce”.

A major barrier revealed by this study is the cost associated with EMS certification, cited by 46 (about 57%) of respondents, with roughly equal proportions between SMEs and large companies. This focus on high certification costs and limited financial resources have equally been observed in various other studies particularly with SMEs, for instance studies by Goodchild (1998); Hillary (1998 and 1997) and KPMG (1997); Pimenova and van der Vorst (2004); Hitchens et al. (2003); Smink et at (2006). Indeed, Survey results by Post and Altman (1994) showed that firms spent around $10,000 to $50,000 to get certificate depending on their size. This perhaps reflects the fact that South African Automotive companies, especially SMEs, are generally unwilling and often unable to allocate their limited resources to activities that do not offer a direct benefit to their core business. This is a view contrary to that of Gerstenfeld and Roberts (2000) who suggested that SMEs do not think strategically as regards the long-term benefits of EMSs. As Turner et al. (2000) explain, larger firms are likely to spread cost of certification to ISO 14001 and other standards thus able to benefit from certification. A comment from an environmental manager of a large company that offers evidence to support this submission is, “it makes good financial and business sense to have ISO 14001”. A similar judgment was made by another manager regarding environmental management affirming that, “initially environmental management was a costly exercise but long term financial benefits far out way the initial costs”.

When asked about the benefits accrued from the implementation of an EMS, improved customer relations and improved competitiveness were frequently

mentioned by 61 (about 75%) and 47 (about 58%) of respondents respectively. This perhaps reflects the fact that South African Automotive companies have integrated environmental management into corporate priorities as a way to sustain their competitive position in the global market place. This submission is not different from those indicated in previous studies carried out by Nawrocka (2007); Beske et al. (2006); Halila (2006); Hahn and Scheermesser (2005); Teuscher et al. (2005); Smink et at. (2006) pointing to customer requirements as the main trigger for EMS implementation by supplying companies. Indeed, this trend is attributed to an increasing international influence, whereby more suppliers are required by their customers to become environmentally conscious and to improve environmental performance of the supply chain. As an environmental manager of a certified firm pointed out, “EMS implementation is a Customer (OEMs) expectation for doing business as a Tier 1 Supplier”. A similar comment from an environmental manager of a large company that offers evidence to support this suggestion is, “EMS certification was a major breakthrough to export to European markets”. Indeed, these submissions appear to buttress the fact that South African Automotive industries have recognised the importance of environmental stewardship and are therefore using EMS as a market penetration strategy. As Giménez et al. (2003) explain, eco-management through the implementation of an EMS can provide an excellent vehicle for a company’s competitive advantage. To this end, certified EMS has undoubtedly projected an excellent image of South African Automotive companies and consequently their products - suppliers’ component parts and OEM built vehicles - have easily been marketed in both the national and international markets.

However, hurdles identified by other authors, such as, inconsistent top management support (Cockrean, 2000) were not important for the South African automotive respondents. This observation could be explained by the fact that consistent government pressure as well as improved competitiveness emerged as the major arguments for the uptake of EMS by top management representatives within the South African automotive Industry. Indeed, this submission appears to buttress the fact that government pressure played a significant role to influence the uptake of EMS by South African automotive Industries. Similar studies in

Germany by Seuring (2006), in Turkey by Küskü (2006) and in the Netherlands by Revell and Rutherfoord (2003); Rutherfoord et al. (2000) found that SMEs became more actively engaged in EMS implementation as a result of a robust legislative, licensing and inspection system. However, the great difference of this study's results between SMEs and large companies probably also reflects the limited amount of attention the South African government has paid to SMEs in their quest to bolster environmental change.

Apart from Government legislation, which was the most popular motivating factor for EMS adoption, lowering day-to-day impacts on the environment was equally a major driver for the uptake of EMSs within the South African Automotive industry with some differences between SMEs and large companies. This result is supported by Kwon et al. (2002) and Mohammed (2000) who pointed to minimising the risk of accidents as the main trigger for EMS implementation by Korean and Japanese companies respectively. Similar studies, with similar results, by Hahn and Scheermesser (2006), Alemagi et al. (2006) pointed to ecological responsibility and environmental conservation as the main catalysts for EMS implementation among German companies and in industries along the Atlantic coast of Cameroon respectively. Further, improving working and living conditions for employees was also a major motivating factor frequently cited by respondents along the Atlantic coast of Cameroon. Indeed, this observation supports the results reported by Quazi et al. (2001) who equally pointed to employee welfare as one of the major motivating factors for EMS implementation for companies in Singapore. Our results equally revealed that the third motivating factor for adopting EMSs indicated by most of the organisations was to improve their corporate image, which was also mentioned as an important motivation factor in previous studies, for instance, researches carried out by Hillary (1999) and by Morrow and Rondinelli (2002).

9.6 Recommendations for Future Action

After a comprehensive analysis of the drivers, barriers and benefits to engaging South African Automotive Companies in environmental change, we identified various factors that these companies had to overcome in the adoption of EMSs in

their establishments. Against this background, we have prescribed a number of recommendations to bolster the uptake of environmental management systems more widely in the South African Automotive industry. Indeed, there is apparent need for the following recommendations outlined below.

- **Government Incentives to Industries**

As revealed in this study, financial constraints emerged as one of the key barriers to successful implementation of EMSs within the South African Automotive Industry. As Kolln and Prakash (2002) suggest, governments and interested stakeholders can play a fundamental role in encouraging firms to adopt voluntary environmental codes by finding the right mix of incentives in a specific national context, and they attribute this as the key to successful EMS implementation. From this premise, it is recommended that government incentives in the form of tax-breaks be awarded to companies with environmentally friendly production systems as well as subsidies to firms that are proactive in environmental conservation activities. Also, embarking on group training and mentoring are fundamental prerequisites to significantly reduce the high costs of external assistance. Further, working with associations to develop automotive-specific EMS template would serve an effective way to reduce the cost of implementation.

- **Education, Training and Awareness**

As low environmental awareness of employees emerged as a major barrier respondents had to overcome in implementing environmental management systems in their establishments, a government sponsored national personnel environmental development programme, to be widely distributed to environmental assistance providers who can offer the programme for free or at a nominal cost is crucial to achieving successful EMS implementation in these industries and other sectors of the economy. Such a personnel environmental development programme should aim at improving environmental awareness, specifically the education, training and other support targeted specifically at SMEs. Such a nationwide Technical Enterprise Network should equally put emphasis on demonstrating the need for and benefits of good environmental governance such as minimising accidents, enhancing reputation and competitive advantage.

- **Technical Assistance and Outreach Efforts**

As a therapy to the lack of specialists in environmental issues and consequently the difficulty in dealing with environmental aspects, which appear to be the major hurdles for EMS implementation by South African Automotive industries, automotive-specific EMS Implementation Guide and partnerships with trade associations can provide an excellent vehicle for reaching businesses, establishing credibility and sustaining momentum. Such a technical assistance should comprise of: (i) developing tools and resources to help companies in performing aspect and impact analysis such as identifying, understanding, and measuring environmental aspects and impacts, (ii) developing an on-line database of environmental laws, searchable by process, chemical and material to help companies ascertain applicable laws and compliance requirements, (iii) developing tools and resources to help companies set objectives and targets (iv) Carbon foot-printing the supply chain and developing action models for process improvement, material substitution and performance benchmarking information related to pollution prevention for generic activities, and (v) Sharing previous lessons learned from successful EMS implementation. Indeed, such technical assistance will help cut implementation time and costs significantly.

For companies without technical backgrounds in environmental issues, which seem to be the major hurdle identified by this study, external technical assistance will help clarify steps and elements for successful EMS implementation in these industries. Further, exploring additional ways to support efforts to green the supply chain, particularly as they relate to new and emerging successful programmes such as the US EPA's Performance Track programme and Mexico's Environmental Auditing Programme could be particularly beneficial to South African Automotive industries. Thus by sharing experiences and success stories of environmental supply chain management, governments and technical assistance providers can improve their delivery of services to the south African Automotive Industry by building on existing lessons learned.

- **New Concepts/Models**

In order to overcome the major impediments to successful EMS implementation identified by this study, it is suggested that the South African government adopt the following approaches that have widely been used in Europe to facilitate EMS implementation and certification in small firms including: (i) joint EMS and group certification where a number of companies with similar processes share an EMS and have common audit procedures in order to save time and money (ii) incremental approaches whereby implementation and certification are performed in a step-by-step approach including (BSI, 2003):

1. Top management commitment, initial environmental review, initiating culture change and the continual improvement process.
2. Identifying and complying with legal and other requirements
3. Management of significant environmental aspects and impacts, setting objectives and targets.
4. Implementation and operation of an effective EMS.
5. Checking, audit and review of the EMS.
6. EMS registration.

In this model, participating firms can stay at any level they want, and they will achieve a certificate at each level, which will then act as stimulus to move further to the final stage where a complete certificate will be issued.

- **Monitoring Regulatory Compliance and Building a Business Case for EMS**

As EMSs can provide the methodology a company needs to identify and implement ways of making environmental improvements, a mandatory requirement for procurement of business contracts and effective monitoring of regulatory compliance, imposing fines and penalties on those that pollute the environment, is crucial for EMS to achieve its intended purpose (protection and preservation of the environment). Without these, very little effort will be expended in environmental conservation. However, EMSs should not be completely seen as a jurisdictional issue. Thus, the Government should incorporate the right mix of punitive measures together with the aforementioned incentives in order to boost EMS uptake in South Africa.

9.7 Chapter Summary

The main objective of this chapter was to provide an insight into the behavioural patterns (drivers, barriers and benefits) of SMEs and larger South African Automotive industries in their quests to engage in environmental change and determine if these patterns are similar to previous studies, as given in the literature, or if they differ, in what ways. A number of open questions were included in the questionnaire inviting comment from respondents. The comments received as answers to these sections provided valuable evidence to substantiate many of the findings of the research, and proved a benefit to the research as a whole. Generally, our findings observed some similarities and differences between survey results and those provided by the EMS literature.

Perhaps the most striking driver for EMS uptake by South African Automotive Industries was improving and achieving consistent compliance with some differences between SMEs and large companies. This confirmed earlier studies by Revell and Rutherfoord (2003); Rutherfoord et al. (2000) reporting a robust legislative, licensing and inspection system as the main trigger for EMS implementation by SMEs.

Extensive benefits such as improved customer relations 61 (about 75%) and improved competiveness 47 (about 58%) were accrued both by SMEs and large companies adopting formal EMSs. Additionally, the chapter revealed that low awareness of employees and cost constrains were the main hurdles to successive EMS implementation within the South African Automotive industry. They were cited by 61 (about 76%) and 46 (about 57%) of respondents respectively. This result is not different from those indicated in previous studies, such as the study carried out by Hillary (1998); Rowe and Hollingsworth (1996); Goodchild (1998); Pimenova and van der Vorst, 2004; Hitchens et al. 2003 who pointed to a low degree of awareness of supply chain issues, negative corporate attitudes, an unfavourable company culture, high certification costs and limited financial resources as the main barriers for EMSs implementation especially in SMEs.

The above prescribed recommendations, it is hoped, would set off the pace for government officials to incorporate effective and realistic incentives into future policy in order to eliminate the current hurdles to EMS implementation in the South African Automotive milieu and better encourage environmental compliance and improved performance while minimising costs both to businesses and the government. Thus, Government officials should incorporate the right mix of regulatory compliance monitoring, backed by effective punitive measures together with the aforementioned incentives in order to boost EMS uptake in South Africa and the continent as a whole.

Lastly it should be recognised that the results presented in this chapter outline the second part of a research project that attempts to identify possible drivers, benefits and implementation hurdles of ISO 14001 within the South African automotive industry. These results form a basis for a later stage of this research Project that will assess the experiences of external environmental auditors in evaluating the South African ISO 14001 certification system as presented in the next chapter.

SECTION IV

THIRD-PARTY AUDITING OF ENVIRONMENTAL MANAGEMENT SYSTEMS.

CHAPTER TEN

Auditing and Communicating Business Sustainability: A South African Perspective.

This chapter provides a timely assessment of the certification practices for ISO 14001 in South Africa. Through a number of extensive in-depth interviews, the chapter outlines the experiences of external environmental auditors in evaluating the certification system. The chapter presents, amongst other issues, how external environmental auditors interpret and apply central requirements of ISO 14001 and their views about the efforts of certified organisations and the different models that could be used to ease EMS implementation and certification.

10.1 Introduction

Many firms that have implemented environmental management systems (EMSs) and get certified according to the ISO 14001 standard have experienced a lot of barriers on the road towards certification (Hillary, 1999; Kehbila et al. 2009). The standard is generally perceived by opponents as bureaucratic (Johannson, 2000) and costly with modest environmental benefits (Baylis et al. 1997; Hitchens et al. 2003). It is further perceived as a way of working that often fits poorly into the organisational culture and decision-making structure of firms especially SMEs (Tilley, 1999; Gerstenfeld and Roberts, 2000; Hillary, 2004). In spite of this view, many businesses and some public agencies have implemented third-party certification of their environmental management systems in order to conform to internationally accepted business standards, including those dealing with environmental issues. Accordingly, businesses are expected to manage the effect that their activities have on the total environment more effectively and efficiently, and this means more than just green consciousness (Andrews et al. 2001). This international pressure has facilitated the establishment of the South African National Accreditation System (SANAS), which is a member of the International Laboratory Accreditation Cooperation (ILAC), and the International Accreditation Forum (IAF) (figure 10.1). This world-wide network, through multilateral

agreements, ensures that the competence of South African certification and inspection bodies as well as laboratories (testing and calibration) are assessed based on the same principles of harmonised ISO standards. From this premise, the SANS IS0 14000 Environmental Standard has been designed in harmony with ISO 14000 to ensure that South African enterprises are in accordance with international standards as depicted in figure 10.1.

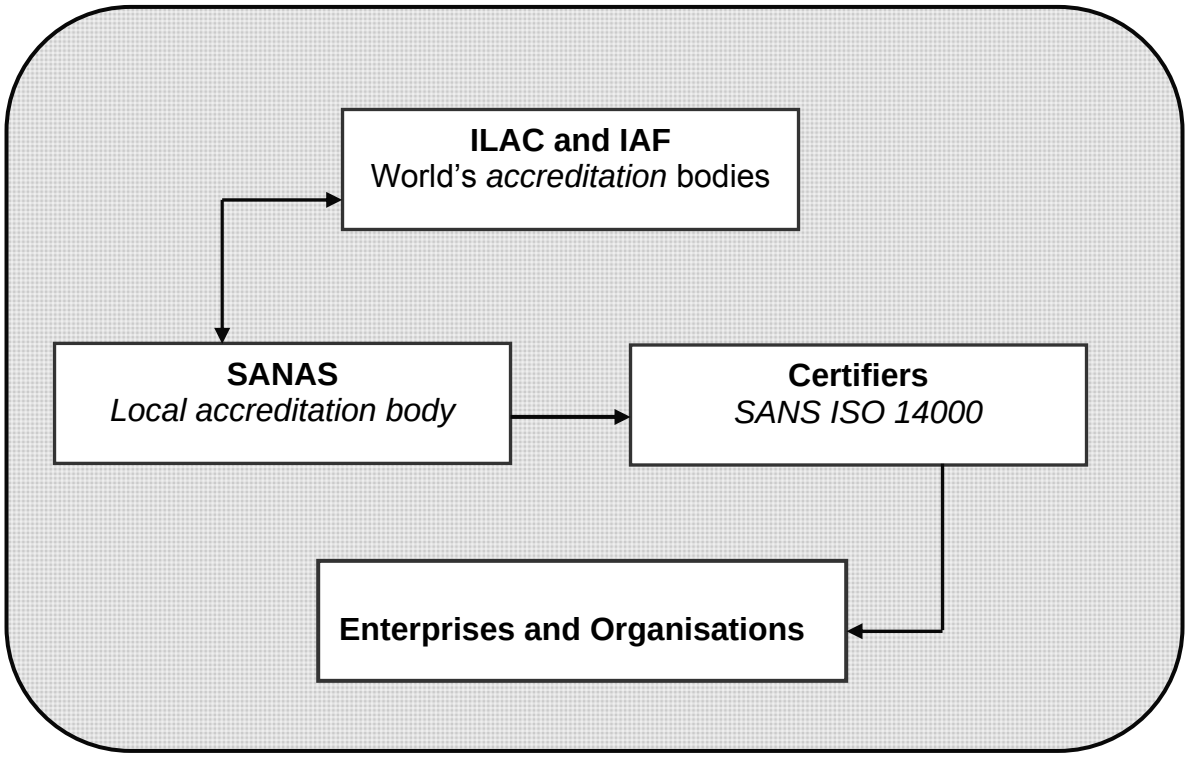

Figure 10.1 The South African certification scheme

In South Africa, where this research is focused, the use of third-party auditing and conformity certification of environmental management systems represents an important development for government and the public as well as for businesses and for the auditing industry itself. On that note, ISO 14001 has widely been accepted in the country with 530 organisations certified with the standard as of December 2007. This figure ranked South Africa first in the continent with substantially more organisations certified than the average for the rest of the African countries (figure 10.2) (ISO, 2007).

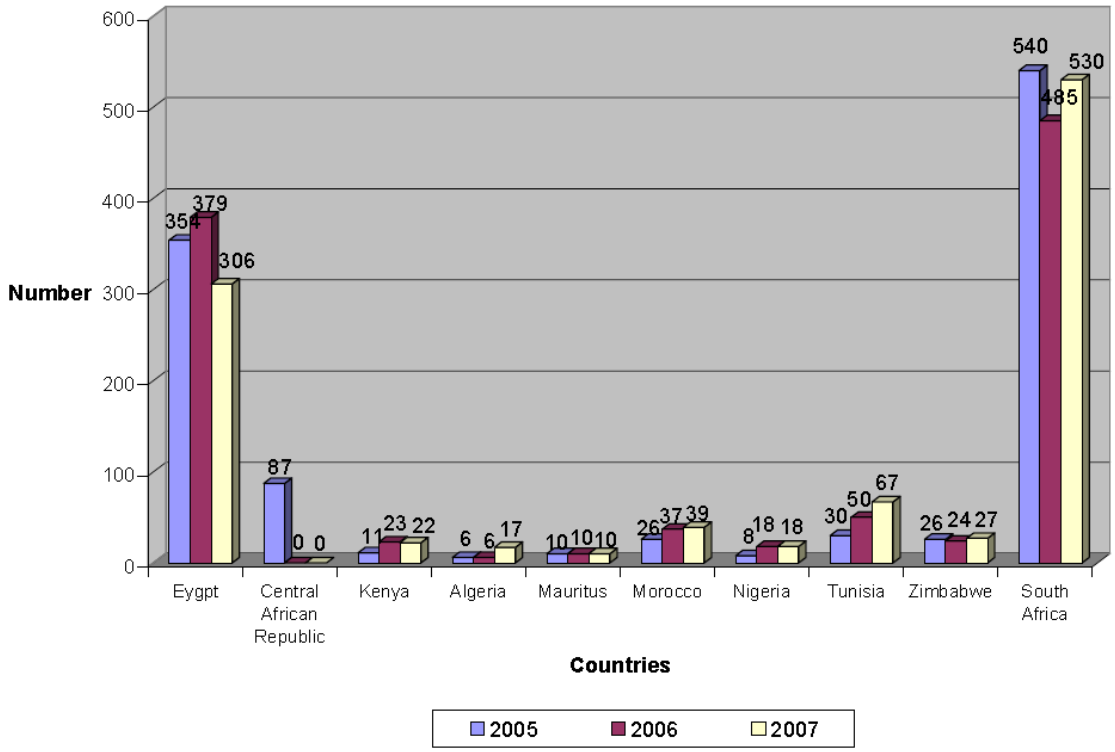

Figure 10.2 Top ten African countries for ISO 14001 certification
(Data obtained from ISO, 2007)

Despite the high number of organisations with certified EMSs in South Africa, compared to other African countries, third-party registration and auditing of EMSs are subject to conflicting and, in some cases, inappropriate expectations on the part of businesses, government agencies, environmental groups, the public and sometimes even members of the registration and auditing community. These concerns have so far received far less scholarly interest than their European counterparts, even though their role is not less important. Accordingly, there is a need for “real life” experience, in South Africa, about the challenges of ISO 14001 certification and the auditing community in evaluating the registration system and improving its credibility as it continues to grow and evolve. Against this backdrop, this chapter attempts to redress this gap in knowledge and awareness and provides some early data against which to benchmark future developments.

This chapter serves four purposes. The first is to evaluate the structure of the certification system as well as assessing external environmental auditors’ experiences in evaluating the system and improving their credibility as certification

continues to grow and evolve. The second is to ascertain how well ISO 14001 is adjusted to the needs of South African enterprises. The third is to investigate what influence external environmental auditors and certification bodies have on the implementation of ISO 14001 and their interpretation of the standards in the South African context. Finally, the models that these auditors and certification bodies use to cut the costs for small firms are of the greatest interest.

The chapter is structured as follows: it begins with a description of the methodology used to collect data. The section that follows will present and discuss the findings of the research. This section of the chapter therefore profiles the findings of extensive in-depth interviews vis-à-vis third-party auditing from the South African perspective. Responses have been divided into five major categories in order to facilitate the understanding of the findings. The chapter concludes by outlining the main findings of the research.

10.2 Research Methodology

This study was conducted as a case study (Yin, 1994; Merriam, 1998) using semi-structured interviews (Kvale, 1996), due to the explorative nature of the study and the multiple issues investigated. A qualitative approach was taken to interviewing in order to gain a better idea of the interviewee's opinions (Bryman, 2001). This was important in order to try and identify any potential aspects of the research that could be expanded on. To ensure that 'rich' data was obtained during the interviews it was crucial that the correct people were identified as potential interviewees. A search of the databases of the South African National Accreditation System (SANAS) revealed relevant contact details of only five accredited certification bodies authorised to certify organisations to ISO 14001: 2004 Environmental Management Systems. Initial telephone contacts were initiated in order to determine the certification bodies' willingness to participate in the research, at which time interviews were also scheduled.

The questions were designed to ascertain: (1) the current certification trend and mentorship programmes adopted by big companies to help their suppliers get certified, (2) auditors opinion on different models used to ease implementation and

certification of EMS in SMEs, (3) how and to what extent do external auditors influence enterprises' EMS, (4) the average costs of certification for two types of companies: SMEs and Large corporations.

The interview was initially piloted within one ISO 14001 accredited certification body and some minor changes were made to the structure and content of the questions. No recording of face to face conversations was made in order to ensure a free flow of information. However, notes were taken throughout the conversations and during telephone interviews. Some complementary questions were sent to all of the auditors after the interviews, which served as an additional source of information.

However, when analysing the results of this study, it should be recognised that it does not dwell on quantitative data analysis of EMS implementation in the corporate arena. Instead, in-depth interviews have been conducted with auditors of the five accredited ISO 14001 certification bodies, who are working with Industries, but not with managers in these Industries. Nonetheless, materials and examples have been drawn from previous studies to compare and validate the findings of the research.

Though the interviewed persons are experienced in auditing manufacturing companies, it is not evident that the findings of this study may reflect the average business community in South Africa, since their attitudes, knowledge and willingness to respond to certain questions were somewhat limited. Moreover, the qualitative nature of the study suggests that the results should be seen as contextual exploration, and used more as explanatory evidence, rather than the complete picture of reality. This is well in line with the purpose of the research; to provide insights and knowledge about the experiences of the five accredited ISO 14001 certification bodies in South Africa, their interpretation of the ISO 14001 standard and to further explore the potential use of supporting models to ease EMS implementation and certification in South Africa.

10.3 Results and Discussion

This chapter highlights the findings of in-depth interviews with five auditors from five different certification bodies in South Africa. All quotations and references are from the key informants, who have delivered their ideas and experiences from working with firms and their experience of the certification bodies. The findings have been divided into five categories developed during the interviews including: recent developments on EMS implementation, certification of enterprises, role of certification bodies, models to ease EMS Implementation and Certification and the costs for EMS certification and implementation. The key points raised under the five main categories are presented and discussed for each question in order to facilitate the understanding of the findings. The primary findings are discussed and reflected upon throughout the chapter.

10.3.1 Current Pressure on EMS Implementation

The first part of the interviews investigated the current trends of EMS Uptake in South Africa. All respondents pointed to European or North American customer requirements as well as government legislation as the current pressure on EMS uptake in South Africa. These findings are not different from those of Kehbila et al. (2009) who pointed to improving and achieving consistent compliance and improved competitiveness/customer relations as the major drivers and benefits for introducing environmental management systems within the South African Automotive industry respectively.

Another trend highlighted by the auditors is that small locally operating companies have little interest in EMS due to the perceived cost of implementing and maintaining the system. This submission is not different from those indicated in previous studies by Smink et at. (2006); Cockrean (2000); Goodchild (1998); and Hillary (1997) who pointed to the lack of financial and human resources as a main barrier to implementing a certified EMS in SMEs. Further, all the auditors were equally of the opinion that larger corporations are indeed encouraging their suppliers to integrate environmental codes into their day to day activities (the implementation of EMS policies). Indeed, this submission is buttressed by the findings of Kehbila et al. (2009) who pointed to environmental profiles and

performance indicators as the main supplier selection criteria within the South African Automotive Industry. One auditor stated that he has experienced mentor Programmes initiated by big enterprises to aid their suppliers to implement a certified EMS. He, however, argued that such a programme is usually confined to the EMS management representative identifying impacts and developing management programmes, which are usually restricted to emissions, not input materials.

10.3.2 Certification of Enterprises

The initial question was whether the existing EMS standards in South Africa are not well-suited to SMEs. Only two of the auditors provided answers to this concern. The first auditor remarked that understanding the benefits of a good management system is usually a barrier together with the perception that it is expensive with little return on investment. He further submits that consultants are not always good at assisting companies to implement simple EMS systems that address the needs of small businesses. Indeed, this view is buttressed by the submission of the second auditor who pointed to the “evangelical” approach of consultants, auditors and the excruciating requirements of accreditation bodies as the main hurdles to EMS implementation by SMEs. These submissions coincided with those of Hillary (1999) who concluded in her study that the degree of difficulty in obtaining the certification, and the associated costs, or, the amount of documentation and bureaucracy required were the main hurdles impeding easy implementation of EMSs in SMEs. It was interesting to note that none of the auditors have noticed any signs that second party certification is used instead of third party certification.

One of the auditors was quite optimistic that EMS uptake by SMEs could be facilitated by government paid consultants providing assistance to companies during the implementation process with nominal fees and subsidies. Another auditor argued that the EMS standard should allow for different ‘grades’ of the system, which should equally be recognised by auditors and accreditors. Such models, we argue, would be necessary to cut down the initial cost of obtaining certification by smaller firms thus improving international competitiveness. All the

auditors remarked that after the initial glow of achieving certification, some organisations do not find the EMS as useful as they expect and usually revert to business as usual with budget restrictions slowing or stopping the management system. Indeed, this observation supports the results reported by Palmer (2000) who equally pointed to a lack of financial resources as a major hurdle inhibiting environmental progress in enterprises. The auditors equally pointed out that organisations who understand IMS - Integrated management systems (QMS, EMS & OHS) - realise the potential cost savings as well as the return on investment. This submission has equally been observed by Turner et al. (2000) who concluded in their study that larger firms are likely to spread the cost of certification to ISO 14001 and other standards thus able to benefit from certification.

10.3.3 Role and Competence of Certification Bodies

The auditors were asked about the critical factors considered during the initial ISO certification audit of a company's EMS. One auditor did not answer this question. Four auditors stressed that the environmental policy, identification of aspects and impacts and their subsequent rating, and the establishment of programmes, objectives and targets linked to legal compliance (Clauses 4.2, & 4.3) are the critical issues considered during the initial ISO certification audit. A similar study conducted by Ammenberg et al. (2001) equally shows that many auditors focus on the environmental targets when controlling continual improvement. They further concluded that many of the auditors emphasised the relation between significant environmental aspects, environmental policy and the environmental objectives and targets. This perhaps reflects the fact that the assessment of environmental aspects and ambition in the policy determines how the targets should be formulated.

The interviewees were equally asked to comment on how they typically check or monitor ongoing implementation and EMS conformity to the standard. The answers provided varied from pre-assessment, document and site review, to a six month surveillance assessment, first advancement assessment, second advancement assessment, follow-up assessments and recertification at the end of

every 3 year cycle. The study equally revealed that upholding the reputation of certification bodies is fundamental in enhancing credibility, client demand and long term partnerships. As the auditors submit, such a status is achieved via a standardised system whereby customers complete evaluations on auditors and their services, peer evaluation of auditors and mandatory annual training on EMS and legal requirement updates. They further stated that a standardised system dealing with complaints and an appeal process for customers unhappy with any audit outcome is equally fundamental. Moreover, the recommendations provided by auditors are reviewed by qualified technical reviewers who ensure that the information within the audit pack is sufficient to uphold the original recommendation.

One question was whether certification bodies influence enterprises' EMS in practice. Just one auditor responded to this concern. He remarked that some certification bodies influence enterprises' EMS in order to get more business. He, however, echoed his disappointment that such a mal practice has not yet been ascertained by the accreditation bodies.

10.3.4 Models to ease EMS Implementation and Certification

This part of the interviews investigated the different models that could be used to ease EMS implementation and certification. Almost all the auditors had optimistic expectations regarding joint EMSs, group certifications, less/shared documentation and an incremental (step-by-step) certification procedure if the process is not compromised. However, one of the auditors acknowledges that environmental policies need to be specific to the nature of the operation. In this regard, he expressed concerns that shared policies may not be specific enough. He further stated that as long as the minimum requirements for documentation are adhered to, there is no problem with less paperwork. Indeed, continual improvement of environmental performance was a major concern to him.

An interesting comment was presented by three of the auditors who argued that a joint EMS may work if the nature of the companies, their operations and the environmental aspects that are to be managed are similar scope. However they

stressed that certification bodies should be careful to endorse such practices if the integrity of certification is compromised. Moreover, one of the auditors advocates that incremental certification is feasible if a firm were to certify a limited portion of its operations initially (using this as a case study or test), and then extends the scope of certification in the future. This auditor admits that such a process would initially require a stage one and two audit to certify the limited scope, with additional activities added to the certification during surveillance audits. Interestingly, he was quick to emphasise that an extensive scope may not be possible during a surveillance audit. In this case, undertaking a recertification audit may be necessary. Contrary to this submission, a third auditor argued that ISO 17021 provides for a two phase initial certification audit and any attempt to stretch it out further may severely impact credibility.

The auditors were given a brief description of the project: On the road to EMAS with ISO 14001 and project Acorn (see description in appendix C) and were asked to comment on them. Some of the auditors had optimistic expectations regarding both models. However, they stressed the need of awarding certification only to organisations with an EMS that complies with the ISO 14001 standard as a whole. Indeed, all the auditors acknowledged that no similar models exist in South Africa.

When asked about the prospect of launching such models (On the way to EMAS with ISO or Project Acorn) in the country, one comment was that the models are not required as ISO 14001 is not seen as an unattainable goal for organisations. A counter reflection was that such models would be necessary as the initial move towards obtaining certification is seen as daunting especially by the smaller firms. Indeed, this auditor seemed rather certain that incremental certification would enable smaller firms to progressively build on small successes before obtaining certification. According to some auditors, the prospects of the government adopting and making provisions for funding such models in South Africa would to a large extent improve international competitiveness. Indeed, they are of the opinion that similar models be adapted and implemented by the Department of Trade and Industry. Another opinion was presented by other auditors who argued

that funding such a system should be based on a business case and should be dependent on the full implementation of the process.

10.3.5 Costs for EMS Certification and Implementation

In this part of the interviews the average audit fee in United States dollars for two categories of firms were investigated: SMEs with up to 200 employees and large companies with more than 200 employees, as defined by DTI (2003). The auditors provided a variety of figures to this concern. They pointed out that the audit fees are influenced by certain factors such as risk, travel and accommodation. Indeed, the audit fee ranges from US$ 2,500.00 to US$ 7,500.00 for SMEs and US$ 7,500.00 to US$ 31,000.00 for large corporations. A similar study by Post and Altman (1994) with similar results showed that firms spent around US$10,000 to US$50,000 to get the certificate depending on their size. This focus on high certification costs and limited financial resources have equally been observed in various other studies particularly with SMEs, for instance studies by (Goodchild (1998); Hillary (1998 and 1997); KPMG (1997; Pimenova and van der Vorst, 2004; Hitchens et al. 2003). This reflects the fact that South African Automotive companies, especially SMEs, are generally unwilling and often unable to allocate their limited resources to activities that do not offer a direct benefit to their core business.

10.4 Chapter Summary

In this study, a number of interesting insights were provided about the current trends in EMS certification, the South African certification bodies' attitudes, impacts and experiences towards the certification of enterprises and how they perceive different models used to ease the implementation and certification processes. First, all respondents were very quick to highlight European and North American customer requirements as well as government legislation as the current pressure on EMS uptake in South Africa. Besides, a major issue revealed by this study is the perceived cost associated with implementing and maintaining a certified EMS especially with regards to SMEs. Thus, after initial EMS certification, some organisations are aggrieved by the system and usually revert to business as usual with budget restrictions slowing or stopping the management system.

Despite this focus on high certification cost, study results revealed that larger corporations are indeed encouraging their suppliers to integrate environmental management initiatives into corporate priorities as a way to sustain their competitive position in the global market place.

An interesting insight arising from the study is that consultants are not always good at assisting companies to implement simple EMS systems that address the needs of small businesses. Additionally, the paper revealed that government paid consultants providing assistance to companies as well as providing for different 'grades' of EMS certification has the potential to cut down the initial cost of obtaining certification by SMEs thus enhancing environmental performance and international competition.

According to the results of this study, the critical issues considered during the initial ISO 14001 certification audits are: environmental policy, identification of aspects and impacts and their subsequent rating, and the establishment of programmes, objectives and targets linked to legal compliance. Study results equally revealed that monitoring ongoing conformance to the standard is achieved by document and site reviews, a six month surveillance assessment, first and second advancement assessments, and recertification at the end of every 3 year cycle.

Study results equally revealed that a government funded programme for joint EMSs, group certifications, less/shared documentation and an incremental (step-by-step) certification procedure would enhance the uptake of EMS and improve international competitiveness if production processes and the specific nature of operations are not compromised.

CHAPTER ELEVEN

Summary of Dissertation Results

In this final chapter, the significant findings in all the aforementioned chapters of this dissertation are presented.

11.1 Analysis of Used Vehicle Trade Policy Options in sub-Sahara Africa

The major objectives of this chapter were to analyse used vehicle trade policy options of the major players in sub-Sahara Africa according to some fundamental dilemma in sustainable vehicle distribution and use and to assess each option against assessment criteria that makes the link between used vehicle trade and broader political objectives. In achieving these objectives, the study developed 24 criteria that were subdivided into five major criteria - environmental, economic, participation, political, technical and institutional criteria – to assess the leading contemporary domestic trade policy proposals (emission reduction actions) after lead gasoline phase out in sub-Sahara Africa. The study employs these criteria to establish benchmarks for measuring policy performance in curbing vehicle emissions simultaneously with core sustainable development priorities as well as discussing the implications of the leading alternatives.

In case after case, the study reveals that regulations proposed by the four key players are not optimal from a policy perspective and tend to focus only on a small set of criteria, ignoring the impacts of other major criteria. Moreover, several criteria seem not to be important for all the major players considered here, accounting for major differences in country proposals and unintended consequences with respect to the five major criteria. From this premise, the study concludes that the strategic perspectives of the leading domestic trade policy proposals have been constrained by a pronounced dilemma of synergies between

vehicle emissions reduction and core development concerns as the major players target emissions too narrowly.

11.2 Stakeholder Value Assessment, Scenario Analyses and Decision-support Tools for a Sustainable Road Transport in sub-Sahara Africa

This study proposes a Stakeholder-Assisted Representation and Policy Design Framework for road transport in sub-Sahara Africa based on inputs/information gathered from stakeholders. The framework provides the key roles of stakeholders and how they interact with one another with the ultimate objective of effectively mobilising technology and resources to curb road transport emissions while sustaining economic growth in the region. To achieve this goal, the study equally proposes four scenarios for road transport in sub-Sahara Africa. These scenarios comprise of the following trajectories: the Autumn Track to denote some modest sustainability advantages, the Spring Track to indicate high sustainability problems, the Winter Track to point to critical sustainability problems and the Summer Track to designate major sustainability advantages. The proposed scenarios are based on a combination of technology growth and environmental policies and concerns. Differences across scenarios are, to a large extent, related to per capita GDP and per capita emissions, which varies from low to high; technological change, which is seen to vary from fast to slow and policies, attitudes and preferences showing discrepancy from concerned to unconcerned.

By exploring and identifying the uncertainties adaptation strategies have been formulated to produce the fewest drawbacks, if not the greatest benefits for strategic planning purposes. From this premise, policy options such as emission standards and/or restructuring current energy systems towards renewable energy - biofuel carbon capture and sequestration projects - move events between scenarios along sustainable paths or trajectories. In moving forward, it is unlikely that one size would fit all as different adaptation commitments may prove more or less attractive to different countries in the region. In this respect, a road map has been proposed based on a menu approach where countries subscribe to a number of options, but are not bound to all. As the group of sub-Saharan African countries is very diverse, not all countries would necessarily take on the same

type of target at the same time. It thus enables policy makers to choose pathways that best align the regional interest in sustainable vehicle distribution and use with their own evolving national interests.

11.3 Uptake of Environmental Management Systems by South African Automotive Companies

Major issues emerging from this study on the uptake of EMS ISO 14001 within the South African automotive industry demonstrate that a majority of South African automotive companies have incorporated voluntary environmental initiatives into their corporate strategy as a vehicle to enhance environmental performance. On that score, the results of this study revealed a wide variety of corporate environmental knowledge and practices embedded within the South African automotive industry including: standardised environmental policies, ISO 14001 certification, environmental oriented supplier management and voluntary measures to improve ecological systems, which go beyond the improvement of industrial production.

However, the most striking finding was a lack of standardisation of the allocation of responsibilities on environmental issues as EMS responsibilities were managed by personnel from a wide variety of positions and departments: Quality managers, Managing Directors and Environmental Managers. Furthermore, EMS audit was one of the least widespread of all the activities implemented by companies without a certified EMS.

Nonetheless, study results revealed many measures to ensure continuous improvement of EMS including recycling/reuse techniques, improved energy saving and manufacturing technologies, reduce consumption of non renewable resources, annual review of aspects and impacts and setting objectives and targets to meet or exceed legislated requirements, advanced personnel environmental awareness training plan, constant engineering revision and replacement of chemical processes with more ecological friendly systems.

11.4 Drivers, Hurdles and Benefits of EMS Certification within the South African Automotive Industry.

The main objective of this study was to provide an insight into the behavioural patterns (drivers, barriers and benefits) of SMEs and larger South African Automotive industries in their quests to engage in environmental change. The three most frequently named drivers for introducing environmental management systems within the South African Automotive industry were improving and achieving consistent compliance, lowering day-to-day impacts on the environment and improving working and living conditions of employees. Extensive benefits such as improved customer relations and improved competiveness were accrued both by SMEs and large companies adopting formal EMSs. Additionally, the study revealed that low awareness of employees and cost constrains were the main hurdles to successive EMS implementation within the South African Automotive industry.

11.5 Auditing and Communicating South African Business Sustainability

This study has mainly been aimed at investigating the current trends in EMS certification as well as South African certification bodies' experiences towards the certification of enterprises. Major issues emerging from this study include:

- European or North American customer requirements as well as government legislation are the current pressure on EMS uptake in South Africa with small locally operating companies having little interest in EMS due to the perceived implementation and maintaining cost.
- Consultants are not always good at assisting companies to implement simple EMS systems that address the needs of small businesses. This is attributed to their "evangelical" approach as well as the excruciating requirements of accreditation bodies.
- After the initial glow of achieving certification, some organisations do not find the EMS as useful as they expect and usually revert to business as usual with budget restrictions slowing or stopping the management system

- The environmental policy, identification of aspects and impacts and their subsequent rating, and the establishment of programmes, objectives and targets linked to legal compliance (Clauses 4.2, & 4.3) are the critical issues considered during the initial ISO certification audit.
- Almost all the auditors had optimistic expectations regarding joint EMSs, group certifications, less/shared documentation and an incremental (step-by-step) certification procedure if the process is not compromised.
- According to some auditors, the prospects of the government adopting and making provisions for funding such models in South Africa would to a large extent improve international competitiveness.
- Audit fees are influenced by certain factors such as risk, travel and accommodation and range from US$ 2,500.00 to US$ 7,500.00 for SMEs and US$ 7,500.00 to US$ 31,000.00 for large corporations.

11.6. Chapter Summary

To effectively and efficiently minimise the pervasive and adverse impacts of the sub-Saharan African Automotive industry, a collaborative strategy between all stakeholders (policymakers/government agencies, credit institutions, companies, farmers, research institutes and NGOs) is absolutely mandatory. This necessitates the need for stakeholders to establish a shared vision and consensus as to the fact that a holistic approach is imperative to sustainable vehicle trade and manufacturing in the region.

FOOTNOTES

[1]Notes from Biopact: Towards a green energy pact between Europe and Africa. Available at http://www.biopact.com/site/goals.html.

[2]Obtained from personal conversation with a high profile personnel from Berlin's Ministry of Environment during a workshop on energy and sustainable development in Berlin. March, 2008.

[3]Biofuel review: Strong land use policy is key to developing South Afican Biofuels. Available at www.biofuelreview.com/content/view/902/

[4]From personal discussion with a member of Cameroon's bioenergy standards development task force. Ministry of Environment and Forest. Cameroon. May 2008.

[5]Remarks by a senior British cabinet minister during a BBC interview.

[6]D1 Oils and BP to establish global Joint Venture to plant jatropha. Comments by Chief Executive Officer of D1 Oils plc. Press Release, 29 June 2007

[7]Extract from the African Rural Energy Enterprise Development (AREED). A UNEP Initiative supported by the UN Foundation. Available at http://www.areed.org/

[8]Towards a green energy pact between Europe and Africa. Obtained from Biopact summary Transcript. Available at http://www.biopact.com/site/goals.html

[9]From personal conversations with the vice chairman of GREENERY Associations. North West Provice, Cameroon

[10]DaimlerChrysler, farmers see great future in Jatropha. Obtained from Amera Mex International Inc. News articles. Available at http://www.ameramexinternational.com/newsarticles.html.

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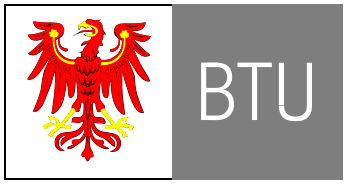
APPENDIX A. Questionnaire Survey



Brandenburg University of Technology Cottbus, Germany.

Faculty of Environmental Sciences and Process Engineering.
Chair of Industrial sustainability.

ENVIRONMENTAL MANAGEMENT SYSTEMS RESEARCH SURVEY

For my doctoral research at the Brandenburg University of Technology, Cottbus, Germany on the implementation of Environmental Management Systems in the South African automotive industry, we have designed a survey that seeks input from all automotive industries in South Africa.

The purpose of this survey is to unravel the voluntary environmental management initiatives within the South African automotive industry. It is for this reason that we are seeking your response to the questionnaire below.

The aggregate results (without any identifiers) and the subsequent analysis will then be available within my doctoral dissertation and upcoming publications. All those who contribute to the survey will be fully acknowledged in the publications.

Please try to answer all the questions and please provide further comments to better explain the situation in your organisation. Your timely completion of this questionnaire would aid the effectiveness of this research.

In order for us to make an effective evaluation, this assessment instrument is an open and pre-coded, multiple-choice questionnaire. Please try to answer all the questions and please provide further comments to better explain the situation in your local company. The information obtained is for academic purpose only and will be treated with the strictest confidence.

1. General Information

1.1 Name and address of head office of your local company

1.2 Please, what is your position in the establishment?

☐ CEO ☐ Environmental Manager ☐ Quality Manager ☐ Other_____

(Please include contact details for further Enquiries)

1.3 When did your local company go operational in South Africa?

1.4 Which stages of products' life cycle does your local company fall under? (Please tick or highlight - in another colour - all those applicable to your local company)

☐ Raw material extraction ☐ Design ☐ Manufacturing ☐ Sales

☐ Recycling

☐ Refurbishment ☐ Other

1.5 What are the three most productive business-lines, product groups/products of your local company?

1.6 a) What is the turnover – in US dollars - of your local company?

US $

1.7 How many employees does your local company have?

1.8 How many manufacturing plants does your local company have?

2. Setting of Environmental Goals

2.1 a) Does your local company have an environmental policy? (Please tick or highlight in another colour)

☐ Yes, published in a certified environmental report

☐ Yes, published in a non-certified environmental report

☐ Yes, unpublished

- ☐ No, because no relevant effect on the environment is exerted by the manufacturing plants and products of the firm
- ☐ No, because solely the Head office is responsible for environmental policy
- ☐ No, because all relevant environmental decisions are made on a case-by-case Basis

b) What difficulties did your local company came across in defining its environmental policy?

2.2 Does your local company set targets to improve its environmental performance?

Yes	No
☐	☐

3. Environment Management Systems

3.1 When was the implementation of an Environment Management system initiated in your local company?

3.2 What were the drivers for implementing a local Environmental management system in your local company? (Please tick or highlight - in another colour – all those applicable to your local company)

- ☐ Improve and achieve consistent compliance
- ☐ Avoid fines and expensive corrective actions due to compliance violations
- ☐ Lower day-to-day impacts on the environment
- ☐ Complements and informs academic curriculum with up-to-date industry tools
- ☐ Reduce environmental management and operating costs
- ☐ Improve working and living conditions for employees
- ☐ Improve relations with government agencies
- ☐ Enhance image and reputation
- ☐ Maintain positive community relations
- ☐ Quantify environmental performance and document trends
- ☐ Eligibility for local authority's Performance Track

3.3 a) Do you audit internally and/or externally the environmental management system of your local company? (Please tick or highlight in another colour)

- ☐ Certification ISO 14001

Completed	Partially	Planned
☐	☐	☐

☐ An external and internal audit is done (according to corresponding directions by the organisation)

☐ Only an internal audit is done according to corresponding directions by the organisation

b) If ISO 14001 certification has not yet been completed, which of its elements is your local company currently implementing? (Please tick or highlight - in another color – all those applicable to your local company)

☐ Policy

☐ Environmental Aspects & Impacts Identification

☐ Legal & Other Requirements

☐ Objectives & Targets

☐ Environmental Programme

☐ Structure & Responsibility

☐ Training

☐ Communication

☐ EMS Documentation

☐ Document Control

☐ Operational Control

☐ Emergency Preparedness, Response

☐ Monitoring & Measurement

☐ Non-Conformance & Corrective action

☐ Preventive Action

☐ Records

☐ EMS Audit

☐ Management Review

3.4 What benefits does the external certification/validation have for your local company? (Please tick or highlight - in another colour – all those applicable to your local company)

☐ Improved relationship with local authorities

☐ Improved reliability of legal standards

☐ Improved customer relations

☐ Improved stakeholder relations

☐ Improved employee acceptance

☐ Improved competitiveness

☐ Reduction of responsibility and expenditure of the central environmental management

☐ Other

3.5 Does your local company have a green procurement policy?

Yes	No
☐	☐

3.6 What reasons speak for intensifying environmentally oriented supplier Management from local suppliers? (Please tick or highlight in another colour)

- ☐ Reduction of supply risks
- ☐ Reduction of quality defects
- ☐ Cost reduction
- ☐ Improvement of logistic
- ☐ Improvement of environmental situation
- ☐ Other

3.7 Is the manufacturing process of your local factory different from those of similar factories of your company in Industrialised Nations? (Please tick or highlight in another colour)

- ☐ Yes, there is usually a lower vertical manufacturing scale
- ☐ Yes, usually a higher vertical manufacturing scale
- ☐ No, usually it is the same vertical manufacturing scale

3.8 a) Are there examples of voluntary measures by your local company to improve ecological systems, which go beyond the improvement of industrial production processes? (Please tick or highlight in another color)

Yes	No
☐	☐

b) If yes, which ones? (Please tick or highlight in another color)

- ☐ Measures to support biodiversity
- ☐ Measures to avoid erosion
- ☐ Measures to clean up of rivers
- ☐ Reforesting
- ☐ Other

3.9 What barriers did your local company have to overcome in the development of an environmental management system? (Please tick or highlight - in another color – all those applicable to your local company)

Internal Barriers:

- ☐ Lack of knowledge of certifier's system
- ☐ Cost constraints
- ☐ Lack of specialists in environmental issues.
- ☐ Lack of time
- ☐ Inconsistent top management support
- ☐ Low awareness of Employees
- ☐ Difficulty in dealing with environmental aspects
- ☐ Uncertainty in maintaining continual improvement

External Barriers:

- ☐ Difficulty in obtaining certification
- ☐ Bureaucratic work.
- ☐ Lack of support and guidance
- ☐ Associated costs
- ☐ Insufficient benefits and drivers.
- ☐ Institutional weakness

3.10 What measures is your local company planning to ensure continuous improvement of its Environmental Management System?

3.11 Comments

THANK YOU FOR YOUR COOPERATION!

APPENDIX B. In-depth Interview Questions

Third-party Auditing Environmental Management Systems in South Africa.

The following main questions were asked to external environmental auditors who participated in the in-depth interviews that were a part of this study. Sometimes follow-up questions were also asked.

1.0 Trends

1.1 What is the current pressure on enterprises to implement an EMS? Is there a big difference between different types of business sectors, large firms and SMEs? Are there any obvious trends right now?

1.2 Is it a trend that bigger corporations have eased the pressure on suppliers to have a certified EMS? Is it a trend that bigger corporations have a smaller number of suppliers?

1.3 Have you experienced any mentor Programmes by big enterprises to aid their suppliers implement an EMS? Please briefly describe the programmes.

1.4 Have you seen any signs that second party certification is used instead of third party certification?

2.0 Certification of enterprises

2.1 Are there great differences between different types and size of enterprises regarding their possibilities to implement ISO 14001?

2.2 Have you noticed if many small enterprises are hesitant to go for certification because they do not know whether they are going to need a certificate, or if the costs of certification outweigh the advantages that the certificate generates?

2.3 Many people have the opinion that the existing EMS standards do not fit small enterprises. What is your comment to that?

2.4 Many small enterprises feel a need to get certified, but that they cannot do so because it is too difficult and expensive to achieve ISO 14001 certification. How do you think this situation will be solved in the nearest future? How do you think the situation should be solved?

2.5 Is certification always reasonable for all types of enterprises, e.g. small service enterprises?

2.6 Have there been any measures taken to facilitate the certification of EMS especially for small and medium enterprises?

2.7 What do enterprises, both large and SMEs think after certification? Are they positive or negative?

2.8 What does your organisation do to aid small enterprises get certified and cut the costs of certification? Are there any limitations regarding what you can do due to SANAS guidelines?

2.9 Have you seen any examples of when large companies aid their suppliers to implement EMSs?

3.0 Role of certification bodies

3.1 What are the critical factors for you in the initial or original ISO certification of a company's EMS?

3.2 How do you typically check or monitor ongoing implementation and EMS conformity to the standard?

3.3 How do you assure yourself that you get honest, complete information from a firm (i.e., how do you and the client organisation deal with conflicts over access, information, or findings)?

3.4 What information, if any, do you provide firms that might help them improve their EMSs or identify problems with compliance?

3.5 What steps do you take to maintain your reputation?

3.6 What, if any, complaints do you encounter with firms?

3.7 What steps should be taken to improve ISO 14001 certification's overall effectiveness?

3.8 According to your opinion, do South African certification bodies require too much documentation from small firms? How much documentation is necessary for small firms?

3.9 Are there watertight walls in practice between consulting and certifying units of corporations? If not, what are the implications? The same individuals may work as consultants in one company and certifiers in another. What do you think of this?

3.10 How much do certification bodies influence enterprises' EMS in practice? I have understood that enterprises sometimes ask certification bodies whether they should put pressure on suppliers etc. Comments!

3.11 According to your opinion: Do consultants that work with enterprises attempt to adjust the EMS to fit the company, or it is their main aim to create an EMS that will please the views of the auditors at the certification bodies, in order to get a certificate?

3.12 Certification bodies also have a supportive function. Is this desirable? Do you feel that your professional role has changed and will continue to change? Is it necessary that you change your role and working methods when you work with small enterprises?

3.13 I have understood that sometimes certification bodies stress their supportive role in marketing. How is this done? How do you fulfil your supportive role? Is this an international trend?

3.14 I have heard complaints regarding the fact that certification bodies use their supportive role in marketing, but then they still work in a very strict, conformance-checking manner. Comment!

4.0 Models for ISO 14001 certification of enterprises

4.1 What does your organisation do to aid enterprises especially SMEs to get certified and cut costs of certification?

4.2 Do you see any problems with:
Less documentation
Shared documentation
Group certifications with common audits
Shared environmental policies
An incremental (step-by-step) certification procedure

4.3 What do you think of a model when a number of companies share a common EMS, or parts of it, although they are not located in a limited geographical area?

4.4 What do you think of an approach of incremental certification, where a firm would certify one part of her EMS at the time and then perform a final certification audit at the end?

4.5 Are there any differences between how useable different support models are for service- and manufacturing enterprises?

4.6 The auditors were given a brief description of Project Acorn and On the way to EMAS with ISO (See Appendix C) and were asked to comment on them.

4.7a Are there any similar models (On the way to EMAS with ISO and Project Acorn) currently being implemented in South Africa?

4.7b. If not, what do you think of the prospect of launching similar models (On the way to EMAS with ISO or Project Acorn) in South Africa?

4.8 What do you think of the Government adopting and making provisions for funding such models in South Africa?

5.0 Costs for certification of small enterprises

5.1 Can you estimate the average costs for the whole certification/registration process for large corporations (more than 200 employees) and for Small and Medium-Sized enterprises (SMEs) (less than or equal to 200 employees)?

APPENDIX C. Schemes to ease EMS implementation

As a way to get small firms more interested in ISO 14001, attempts have been made throughout Europe to create schemes where rewards are issued on the way towards final certification. Two of such schemes, one Swedish and one British, are described below:

C1. On the way to EMAS with ISO

In Sweden the competent body for EMAS registrations, The Swedish Environmental Management Council, has initiated a scheme, "On the way to EMAS with ISO." The scheme is based on a step-by-step process that allows an implementation speed that is based on the circumstances of the participating organisations. The participating organisations and their achievements will be presented on the Swedish Environmental Management Council's website. This means that the participating firm's customers can access information about the firm's environmental performance on the website of a credible organisation. Thus, the system offers rewards on the way towards certification since the participating firms can show their suppliers that they are progressing.

C2. Project Acorn

In Project Acorn, a British project that aims to facilitate EMS implementation in small firms, a six level scheme for implementation is developed, where firms are audited at every stage. The main project partners in Project Acorn are the British Standards Institution (a certification body) and ISO 14001 Solutions (a consultancy firm), and the project has received funding from the British Department of Trade and Industry. The six levels of implementation, based on the ISO 14001 standard, that are audited at every stage are:

1. Top management commitment, initial environmental review, initiating culture change and the continual improvement process.
2. Compliance with environmental legislation and addressing market and customer requirements.

3. Confirmation and management of significant environmental aspects and impacts.
4. Launching an effective EMS.
5. Checking, audit and review of the EMS. If the EMS is complete a certificate will be issued at this stage.
6. Data verification, public reporting and possible EMAS registration.

The participating firms can stay at any level they want, and they will achieve a certificate at each level. At every step, enterprises get assistance from a consultancy firm, with on-site support, a telephone help line etc. The firms also receive handbooks and other information material. The firms are offered assistance to work with performance indicators in their EMSs, which is often a problem for small firms.