



Cape Peninsula  
University of Technology

**THE BARRIERS AND OPPORTUNITIES OF RESOURCE EFFICIENCY  
AND CLEANER PRODUCTION WITHIN A SOUTH AFRICAN CONTEXT**

by

**ANDRE PAUL PAGE**

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**Supervisor: Dr Camaren Peter  
Co-supervisor: Dr Michael Twum-Darko**

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## **ABSTRACT**

This research study investigates how environmental tools such as Resource Efficiency and Cleaner Production (RECP) can contribute to sustaining and supporting economic growth in South Africa. Resource optimisation is crucial when considering the concept of sustainable development. It also contributes to addressing the challenges of global warming and climate change, which in turn threaten industrial growth and sustainability in the long term. The study places emphasis on the barriers that prevent industry from implementing RECP recommendations, and identifies opportunities that could potentially reposition businesses should they consider implementation. It also promotes other sustainability tools that are available through collaboration with international entities, and this could be of great benefit to the South African industry. Factors of unemployment and urbanisation restricts national growth to some degree, hence the study explores how RECP can contribute to job retention by introducing new resource optimisation methodologies for the manufacturing sector, Moreover, it examines the imbalance between the demand as well as limitations of these resources.

Through the compilation of data collated from questionnaires completed by industry, government and civil society participants, this study looks at achieving a balance between environmental sustainability and growth. It also looks at aligning this balance with the integration of specific economic and environmental policies, which also includes social aspects. What comes through significantly in this research is the lack of awareness within industry in terms of RECP, as well as the importance of prioritising the uptake of environmental initiatives to ensure that industry is compliant with the stringent policies and legislation designed by government to drive the sustainability process.

Consequently the study shows that communication between public and private sector, as well as the awareness raising and marketing of sustainability to consumers need to be improved. An analysis of the various government support mechanisms is conducted, in respect of how industry could potentially leverage growth and drive positive change within their businesses. In addition to RECP, emphasis is placed on other Sustainable Consumption and Production (SCP) initiatives and tools that could possibly entrench sustainable practices and help with their incorporation into their business strategies.

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## GLOSSARY

ARSCP	African Roundtable on Sustainable Consumption and Production
BUSA	Business Unity South Africa
CPUT	Cape Peninsula University of Technology
CAIA	Chemical & Allied Industries' Association
CDM	Cleaner Development Mechanism
CDP	Carbon Disclosure Project
CIP	Cluster Initiative Programme
CSD	Commission on Sustainable Development
CSIR	Council for Scientific and Industrial Research
CSR	Corporate Social Responsibility
DBSA	Development Bank of Southern Africa
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DST	Department of Science and Technology
DTI	Department of Trade and Industry
EGS	Environmental Goods and Services
EIA	Environmental Impact Assessments
EMS	Environmental Management Systems
EMCO	Executive Management Committee
GDP	Gross Domestic Product
GEEF	Green Energy Efficiency Fund
GEMI	Global Environmental Management Initiative
GEN	Global Ecolabelling Network
GHG	Green House Gases
GTF	Green Technology Fund
IDC	Industrial Development Corporation
IEA	International Energy Agency
IEEP	Industrial Energy Efficiency Programme
IPAP	Industrial Policy Action Plan
IPCC	Intergovernmental Panel on Climate Change
IWMP	Integrated Waste Management Plan
LCA	Life-Cycle Assessments
LCI	Life-Cycle Inventory
LCIA	Life-Cycle Impact Assessment



LCM	Life-Cycle Management
LCMP	Life-Cycle Management Programme
LCT	Life-Cycle Thinking
MCEP	Manufacturing Competitiveness Enhancement Programme
MEC	Minerals–Energy Complex
MSW	Municipal Solid Waste
NCPC–SA	National Cleaner Production Centre–South Africa
NDP	National Development Plan
NEGP	National Economic Growth Path
NEMA	National Environmental Management Act
NGP	New Growth Plan
NISP	National Industrial Symbiosis Programme
NPC	National Planning Commission
NSSD	National Strategy for Sustainable Development
NWMS	National Waste Management Strategy
PDCA	Plan Do Check Act
PIP	Productivity Incentive Programme
PSC	Project Steering Committee
RECP	Resource Efficiency and Cleaner Production
REIPP	Renewable Energy Independent Power Producer
SCP	Sustainable Consumption and Production
SME	Small and medium enterprises
SMME	Small, medium and micro enterprises
TEO	The Enterprise Organisation
UN	United Nations
UN-Habitat	United Nations Human Settlements Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
WCED	World Commission on Environment and Development
WISP	Waste Industrial Symbiosis Programme
WWF	World Wildlife Fund for Nature
WSSD	World Summit on Sustainable Development
ZERI	Zero Emissions Research and Initiatives

# CHAPTER ONE

## INTRODUCTION

### 1.1 Brief Outline

In the current era of global growth, national and regional economies of scale are subjected to two broadly defined change factors: (1) changes in the global economy and environment (UN-Habitat, 2011) and (2) changes in the global climate (IPCC, 2008). In South Africa it has become increasingly evident that key ecological and resource availability thresholds are being breached by the country's prevailing approach to growth and development, and results in high economic costs (Swilling & Fischer-Kowalski, 2010). As a resource-rich country, South Africa has benefited from the rise in commodity prices over the past decade, but suffered as they collapsed during 2008 as a result of the global financial crisis. This consequence is clearly an indication of how vulnerable local development is to changes in the global economy, and potentially to climate change and regional pressures.

Changes in the global economy are characterised by increasing resource limitations and price increases in resources such as water, energy and raw materials, which are critical for production. Global environmental changes that are the consequence of anthropogenic activities have also placed ecosystems and ecosystem services that are critical for supporting human existence and growth under immense pressure. Approximately 60% (15 out of 24) of the ecosystem services that are essential to human life are being degraded or used unsustainably, including fresh water, capture fisheries, air and water purification, and the regulation of regional and local climate, natural hazards and pests (Millennium Ecosystems Assessment, 2005).

Both the above-mentioned change trends present current production systems with potential challenges that involve meeting increasing demand through increased production and economic growth. However, these challenges will be difficult to overcome amid pressures such as rising costs of energy, water, transportation, and storage, as well as increased scarcities of key resources such as arable land, rare earth metals, oil and water (Millennium Ecosystems Assessment, 2005).

These changes influence economic development both globally and locally, and it is imperative for industrial users and policy makers to have structures in place to

ensure that natural resources are optimally managed and used. Changes in the global climate have invoked the need to reduce greenhouse gas emissions, and agreements to lower emissions and a global carbon economy are emerging in response. This has critical implications for production and economic growth in South Africa and economies across the world.

Economic growth in the South African economy is historically resource, energy and carbon intensive (Fine & Rustomjee, 1996), and dependent on the minerals–energy complex (MEC). South Africa’s growth slowed from 3.5% in 2011 to 2.5% in 2012, which shows a decline in eight of the ten major sub-sectors, excluding agriculture and construction (World Bank, 2013). South Africa is a good example of an economy caught up in the financialisation of the global economy, with debt-financed consumption serving as the key driver of growth. South Africa lowered trade barriers with Asia in 1996; this undermined the manufacturing sector as tariff barriers were lowered and cheap imports from Asia have increased as a result (Swilling, 2011).

Evidence suggests that without significant diversification of the SA economy, economic growth will likely be constrained in the long term (DSBA, 2011; NPC, 2012). In this respect, considering how the manufacturing sector will transition to cleaner production is a key consideration for the sustained growth of the South African economy (Lakhani, 2006).

This dissertation explores how Resource Efficiency and Cleaner Production (RECP) can contribute to facilitating the creation of new jobs, the retention of current jobs, and introducing new manufacturing methods for resource optimisation. It further identifies the mechanisms that are available to support a sustainable industrial sector. It seeks to shed light on how resource efficiency and cleaner production can contribute to improving the *resilience* of the manufacturing sector to global and local shocks and change factors (e.g. climate changes, oil price fluctuations, global economic uncertainties, and the global carbon economy).

It pursues these objectives by conducting a series of interviews with companies that have participated in the National Cleaner Production Centre South Africa’s (NCPC–SA) RECP programmes, with specific emphasis on sectors such as clothing, textiles, footwear, leather, agro-processing and chemicals. Interviews are conducted with government departments as well as organisations directly engaged with RECP in South Africa and internationally; these include local and international consulting

agencies, the United Nations Environmental Programme (UNEP), United Nations Industrial Development Organization (UNIDO) and others.

One of the key challenges that exists is the imbalance between the demand for increased production and industrial growth, and the extent of limited resources to address this need. In the next section these challenges and resource constraints are discussed in more detail, because they have direct negative implications on both economic and industrial growth, and governments are searching for new means to address these problems.

## **1.2 Challenges and Resource Constraints**

Human wellbeing and its improvement, now and for a larger world population in the future, is based upon the availability of natural resources such as energy, materials, water and land (UNEP, 2011a). An ever-growing human demand for resources, however, is putting tremendous pressures on biodiversity. We are living as if we have an extra planet at our disposal. We are using 50% more resources than the Earth can provide, and unless we change course, that number will grow very fast – by 2030, even two planets will not be enough (WWF, 2012).

Climate change not only affects and changes ecosystems in the medium to long term, but also puts severe pressure on sustaining both society and businesses, even though resources for production are limited. The ever-growing demand for resources far exceeds availability, and this continues to erode ecosystems and threaten biodiversity.

Global ecological changes are also significant as the availability and security of ecosystem services hampers the potential for the growth of human activities (Millennium Ecosystems Assessment, 2005). There is growing concern that the demand for natural resources is increasing too rapidly to sustain the consumption and production habits of mankind (UNEP, 2011a), and this hampers the ability of countries and regions to stimulate economic growth and meet global socio-economic and development needs (UN-Habitat, 2013).

Population increases and the challenge of urbanisation also place municipalities under tremendous pressure, and management of these resource limitations at times is recovered through rising costs to users. This has a stifling effect on human wellbeing, as the bridging process of balancing economic and social growth becomes more and more distorted.

Industrial growth is heavily affected and constrained by global resource limitations, such as the availability of materials for production, like water, electricity, transport, oil, etc. (Swilling & Fischer Kowalski, 2010). This is as a result of changes, most notably in climate and the global economy. Demographic change and economic development have also led to a rapid rise in the use of these resources (UNEP, 2011a) and economic activity invariably generates material residuals, which enter the environment as waste or polluting emissions (UNEP, 2010a). These sporadic changes inadvertently affect economic growth, which is influenced through rising energy prices, population growth and urbanisation, water scarcity, waste and pollution factors, and many others (IPCC, 2007).

What is clear, based on the above, is that there is a close relationship between human wellbeing, ecosystems, economic growth, resource limitations and pollution. Businesses strive to compete in both the global and local markets for market share, and production output becomes the overall driver for increasing margins. This inevitably takes precedence over resource optimisation of water, energy and materials within production processes, resulting in harmful waste pollution released into the atmosphere and environment.

The influencing factors to these challenges and resource limitations are discussed in more depth below, and emphasis is placed from both a global as well as national perspective, on concerns around climate change, energy, water, population growth and urbanisation.

### **1.2.1 Climate Change**

#### Global impacts:

Global climate change is a widely acknowledged threat to human existence and the planetary ecosystem, and is significantly contributed to by human activity. This is

caused by greenhouse gas (GHG) emissions from industry, transport, agriculture and other key economic sectors (UN-Habitat, 2011). Climate change refers to a change in the state of the climate that can be identified using statistical tests, and persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether owing to natural variability or as a result of human activity (IPCC, 2007).

Carbon dioxide and methane are key drivers of climate change. Climate change has directly and indirectly impacted the natural environment in various ways, such as the rise in sea levels and temperatures and the change in rainfall patterns; it directly affects other systems related to people, animals, health, water and food production (UN-Habitat, 2011).

There is a growing realisation in national governments and multilateral institutions that it is impossible to separate economic development priorities and consequences from environmental priorities and consequences. Many forms of development erode the environmental resources upon which they must be based, and environmental degradation can undermine economic development (WCED, 1987). Poverty is both a major cause and consequence of global environmental degradation.

Climate change can also be a source of opportunities to redirect the patterns of production and consumption of cities and individuals, at the same time enhancing their capacity to cope with hazards (Swilling, 2011). International collective action will be critical in driving effective, efficient and equitable responses at both global and local scale. These responses will require deeper international co-operation in many areas, most notably in influencing price signals and markets for carbon; spurring technology research, development and deployment; and promoting adaptation; particularly for developing countries (Stern, 2006).

Human activity and production processes invariably contribute to emissions that directly affect climate change, and managing these greenhouse gases across pollutant sectors becomes a difficult task for governments, as businesses pursue monetary objectives and neglect the importance of conserving the environment by applying resource-efficient processes. Governments need to address climate change and design programmes across the globe to leverage and encourage environmental and sustainable practices; this links the concept of economic development's close alignment with environmental performance.

Regional impacts:

Regionally, climate change may affect water supply, ecosystem goods and services, energy provision, industry, and services in cities around the world. It can disrupt local economies and strip populations of their assets and livelihoods. In some cases this leads to mass migration (UN-Habitat, 2011). Climate change is increasing the magnitude of many of the threats to urban areas already experienced as a result of rapid urbanisation (Swilling, 2010). Climate change can also reinforce inequalities and disrupt the social fabric of cities, which in turn can exacerbate poverty (UN-Habitat, 2011).

Impacts on South Africa:

South Africa is ranked 14<sup>th</sup> in the top 20 countries in terms of emissions (Letete et al., 2012). Reducing GHG emissions through sustainable resource efficiency practices could potentially result in the creation of jobs in the green sector, ensure economic growth, and alleviate poverty and inequality levels.

Sector studies of vulnerable areas in South Africa show that decreases in precipitation, coupled with higher temperatures, are likely to have a higher impact in the western areas of the country, with their high prevalence of water resources, agriculture and biodiversity (DEA, 2010).

Coal is the power source for the domestic South African economy, and is by far the biggest single South African contributor to global warming. This has increased carbon emissions five-fold since 1950, and should be placed high on the agenda of government's list of priorities to reduce greenhouse gases (Bond et al., 2009).

Evidence projected by the *Stern Review* (Stern, 2006) leads to a simple conclusion: ignoring climate change will eventually damage economic growth, and the benefits of strong, early action considerably outweigh the cost. Moreover, the ability to adapt to unforeseen changes as they occur – such as price fluctuations in water, energy and other materials – will be paramount in negotiating future production uncertainties.

## 1.2.2 Energy

### Global:

All evolving systems, life, economies, and civilisations require flows of energy through them to maintain their structure and allow growth (Korowicz, 2010). Climate change is likely to affect both energy demand and supply. The combination of urban population growth, changing local weather conditions, urban heat-island impacts and economic growth has the potential to substantially increase demand for energy (UN-Habitat, 2011). This will affect a broad range of economic activities, including trade, manufacturing, transport, energy supply and demand, mining, construction and related informal production, communications, real estate, and business.

Weather patterns have a huge impact on the demand for energy (IPCC, 2007). Winter seasons, as a result of changing climate conditions, have notably been colder than in previous years; this has proved to increase pressure on the amount of energy required for production processes in some of the more energy-intensive sectors.

The demand for oil will increase by 45% towards the year 2030. This is strongly affected by the rising costs of extraction across the globe, and the decline of quantity and quality of reserves (IEA, 2010). At the same time the world's population is growing alarmingly and urbanisation is feared to become an even further threat because of resource capacity constraints faced at both a global and national level.

Oil contributes to about 40% of global energy production. Peak oil is the point when global oil production has reached a maximum, and thereafter reaches a period of decline. Two-thirds of oil producing countries, including the USA and United Kingdom, have already passed their peak (Korowicz et al., 2010). The combination of growing demand and rising prices will severely undermine economic growth and poverty reduction measures (UNEP, 2011a). This has resulted in supply problems that directly and indirectly affect the financial and sustainability status of industries both globally and locally. On a global scale, governments develop and introduce renewable energy strategies to address the supply challenges, and formulate policies to guide investments. If the government of South Africa aims to maintain or improve the current growth rate, the generation of new, large-scale electricity is to be fast tracked.



### South Africa:

South Africa's Gross Domestic Product (GDP) growth is projected at 3.2% for 2014 and 3.3% in 2015 (World Bank, 2013), and together with population and economic growth, GDP is one of the biggest drivers of energy use in South Africa (Winkler, 2010). The high emission levels in South Africa relate to the high energy intensity of the economy, which depends on large-scale primary extraction and processing, particularly in the mining and minerals beneficiation industries (Fine & Rustonjee, 1996). Energy consumption patterns change as they move to cleaner, more convenient fuels, acquire more appliances and demand more energy (Winkler, 2010).

Over the past decade, electricity in South Africa has become a very expensive resource, and it is important that economic growth be balanced with the efficient use of this resource to minimise pollution and other environmental impacts. Electricity has undergone steep price hikes over the past two decades and in low-income households biomass energy remains a primary source of energy supply (UN-Habitat, 2014). For industry to transition from a resource-intensive economy to a cleaner energy and reduced emission environment requires major interventions, and government has introduced energy programmes and collaborated with international institutions such as the NCPCC-SA to assist with implementation (DTI, 2013).

South Africa is still a developing economy, and its energy-intensive nature and dependence on coal-driven energy sources have resulted in an extremely high carbon-emission level per unit of GDP compared with the rest of the world (Swilling & Fischer-Kowalski, 2010). This reliance on coal-driven resources in the very short term to meet the demand for economic growth may compromise the capacity for economic growth in the medium and long term. Even reversing policy distortions such as reforming energy subsidies—clearly desirable from an overall economic and environmental perspective—could raise tensions and cause economic losses in the short term if broader fiscal policies are not adjusted to help sustain incomes, particularly among poor households (UNEP, 2010b).

Investment in renewable energies is constrained by the domestic market structure, specifically since the state-owned power utility, Eskom, is both monopoly supplier and buyer of energy (Draper & Mbirimi, 2010). Eskom retails approximately 60% of electricity sales in South Africa to 40% of national consumers. Approximately 184 licenced municipalities, as well as a small number of private distributors, sell the remaining 60% to national consumers, with the majority being the residential sector

(DBSA, 2012). Urban energy security is threatened by increasing demand due to population increase, climate-related weather variation, as well as inadequate infrastructure and supply (UN-Habitat, 2014).

Some of the power stations in South Africa are reaching the end of their lifespan. The majority of these power stations are coal fired, and this has its own set of environmental concerns (Draper & Mbirimi, 2010). In 2005, Eskom commenced a capacity expansion programme which is expected to add approximately 17 120 MW to the current system capacity over the next seven years. The capacity expansion involves new coal-fired power stations, such as Medupi and Kusile, with capacity of approximately 4800 MW each, which will contribute 56% to the capacity expansion mix.

The renewable energy sector is one of the fastest growing sectors globally and nationally, with the potential of creating thousands of jobs. Private companies involved with power-generation projects either do so for their own needs or use this opportunity to sell back to the national grid. National government, through policies and programmes, fund projects of this nature and these are enacted through the Department of Trade and Industry, Department of Energy, and National Treasury. These incentive programmes support industry with implementation, include the carbon tax policy and rebates, and are structured to improve energy efficiency and reduce carbon emissions.

### **1.2.3 Water**

#### *Global:*

Fresh water is one of the planet's most valuable resources; it is an essential life-sustaining element that cannot be substituted (Koehler, 2008). As an indication of human demand on resources, approximately 71 countries currently experience some stress on blue water sources — that is, sources of water people use and don't return — with nearly two-thirds of these experiencing moderate to severe stress (SAB Miller & WWF, 2009). Pressure on water resources has profound implications for ecosystem health, food production and human wellbeing, and this is likely to be exacerbated by climate change (WWF, 2010).

With global pressures on water resources required for production, scarcity and a shortage of this resource could potentially be the result of poor management. Reusing or returning water within processes is the key to address internal industry challenges, and recycling initiatives are required to conserve this resource. Water conservation and efficiency require priority, and effective communication and awareness could potentially influence support to optimise the use of this resource.

The 2030 Water Resources Group estimates that global demand for water by 2013 will be 40% higher than it is today (UNEP, 2012c). By 2025, water stress will be a reality for half the world's population (SAB Miller & WWF, 2009). Almost 1 billion people do not have access to clean drinking water and 2.6 billion do not have access to "improved sanitation services" (UNEP, 2011b).

#### South Africa:

South Africa is one of the most water scarce countries in the world (DBSA, 2012), and with an average annual rainfall of 497mm, South Africa is a dry country (Swilling c& Fischer Kowalski, 2010). The main sources of water are surface water from rivers and dams, and this is sustained by rainfall (DBSA, 2012).

Water resources management clearly impacts on many other policy areas, for example, energy, health, food security and nature conservation (IPCC, 2008). Thus, the appraisal of adaptation and mitigation options needs to be conducted across multiple water-dependent sectors.

Water resource management in South Africa requires good policies to be put in place, and partnerships between government and industry are crucial in working towards sustaining this resource.

### **1.2.4 Population and Urbanisation**

The quality of life in cities and how cities draw on and manage natural resources available to them is strongly linked (Peter & Swilling, 2012). Global population increase is projected to reach 8bn by 2030 and 9bn by 2050 (UN-Habitat, 2011), accompanied by increased levels of urbanisation and concentration of demand in urban areas. The percentage of global consumption in cities and urban areas is

about 75% of global total, which results in resource scarcity challenges and price fluctuations on oil and food (Swilling et al., 2011).

With urbanisation comes not only the increased demand for resources, but also challenges such as inadequate housing, unskilled labour, increased unemployment and poverty, among others. This places heavy strain on local governments as they seek to address these problems.

In the 200 years leading up to 1950 (i.e. the industrial revolution), just over 400 million people were urbanised in what was referred to as the “first wave” of urbanisation. Current projections suggest that by 2050 more than 6 billion people (almost 70% of the total world population) will live in urban areas, in a second wave of urbanisation (Swilling et al., 2013). This increase in urbanisation is projected to have dire consequences for sustainability, and directly places concentrated pressures on food, water and energy supply within major cities.

With urbanisation on the increase, resource-efficient approaches are required to address constraints that prohibit regional growth. National governments drive support to their regional and local structures, as overall it contributes to national objectives. This is also instrumental in addressing any concerns that could potentially threaten society in terms of reinforcing inequality and poverty.

South Africa has the largest and most industrialised economy in Africa, and the 28th-largest economy in the world. Nearly two-thirds (62 percent) of its total population of 50 million live in urban areas (Turok, 2012). Approximately 5.5 million migrated to urban areas in South Africa between 1996 and 2001; that is at a rate of more than a million a year (Swilling et al., 2013). This has likely grown owing to the increase in urbanisation since 2001. Unsurprisingly, the over-riding feature of South African cities is economic, and inequalities have grown drastically over the past two decades (Pieterse, 2009).

South African cities face numerous threats and challenges as populations increase in urban areas. Two main reasons for population migration from rural to urban milieus are poor employment prospects and high poverty levels in rural areas. The question is how will major cities be able to sustain themselves if there is this rapid population growth? Will pressures of water, energy, food and basic service availability be addressed and become issues of overriding concern to municipalities?

The next section discusses all the aforementioned challenges and constraints, and highlights some of the issues that surround the concept of resource efficiency and cleaner production. These challenges examine cleaner technologies, renewable energy, policies and also the link between business strategies and Resource Efficiency and Cleaner Production (RECP).

### **1.3 Summary: The Resource Efficiency and Cleaner Production Challenge**

Improving resource efficiency is one of the main pillars of industrial efforts to tackle increasing resource prices and competition for scarce resources (UNIDO, 2010). Many companies are re-examining their core business strategies to ensure long-term survival in a greenhouse gas-regulated or carbon-constrained world. More and more companies are embracing so-called game-changing strategies—strategies that allow a company to leapfrog its competitors by creating new markets or reshaping old ones in such a way that they generate or sustain its domination (Draper & Mbirimi, 2010).

Industries are realising the importance of applying resource-efficient methodologies to their processes, as the cost of production resources such as water, energy, and materials has increased tremendously over the past decade. Businesses rely more on increased production through resource efficiency to support their strategy and harness economic competitiveness.

To cater for a rising world population, the eradication of poverty, and an increase in human wellbeing, further economic development is necessary (UN, 2011). Changes in the regulatory environment, including climate change mitigation policies (e.g. carbon tax and emissions targets), could potentially raise the cost of business for industries, especially if they are energy intensive (UN-Habitat, 2011).

If policies to regulate businesses that are resource intensive are introduced, it could potentially stifle economic growth and development. Participation in programmes could face resistance by businesses who pollute, and if this is not properly regulated, the result could potentially be business closures and retrenchments.

The renewable energy sector has over the years seen phenomenal growth in terms of investments and job creation, and with the demand growing and the shift moving to the use of greener technologies, the cost of these technologies is decreasing.

No less than \$280 billion in new investment flowed to new clean energy projects and companies worldwide, with the bulk deployed in Europe, the US and China (*ClimateScope*, 2012). The global economic downturn in late 2008 presented new opportunities and challenges. Investment opportunities in low-carbon goods and services may become increasingly appealing compared with risk associated with investing in traditional sectors. Many low-carbon solutions come at little or no additional costs—in particular those relating to improved efficiency—while the costs of renewable energy technologies are projected to decrease over time (UNEP, 2008; Draper & Mbirimi, 2010).

The New Economic Growth Path for South Africa at the global level responds to the 2008 economic downturn and also accelerates technological change. Nationally it seeks to accelerate employment creation, income growth and a decline in poverty (DTI, 2010). While efforts to control emissions will impose heavy costs—especially on relatively carbon-intensive economies like South Africa—they also lay the basis for major new industries. An investment of 2% of global Gross Domestic Product would more than pay for itself in the form of millions of new jobs, the development of new industries, health benefits from cleaner air, energy efficiency savings and a reduction in greenhouse gas emissions (Harvey, 2011). The development of the green sector will prove core to the shift towards decoupling growth from resource exploitation and ecological impacts, and hence to long-term sustainability (Swilling & Fischer Kowalski, 2010).

Resource efficiency and cleaner production is one way of achieving industrial growth and sustainability. South Africa is very energy intensive, and the cost of resources continues to rise. This limits industry sustainability and growth, and the ramifications could be detrimental in terms of economic development for South Africa as an emerging economy. It is therefore important for businesses to incorporate resource-efficient and cleaner production methodologies into their strategies, not only to address these resource challenges, but also to improve their corporate social responsibility towards society. RECP also drives the trend towards renewable energy and cleaner technologies. These fast-growing markets are leading transitions to job creation opportunities, more efficient ways of using resources, and also expansion of businesses.

The next section outlines the objectives of the research, and highlights why resource efficiency and cleaner production are considered a challenge to both industry and

governments. RECP assessment programmes cannot achieve success if no implementation takes place, and this dissertation provides insight into the incentives and support available to industry and businesses that embrace the concept.

#### **1.4 Problem Statement and Objectives of Research**

Over the years, development has been synonymous with economic growth, and was pursued at any cost (De Oliveira, 2012). Global resource use has shown an eightfold increase during the course of the 20<sup>th</sup> century, and resource use per capita has doubled (Swilling & Fischer-Kowalski, 2010). However, resource use and efficiency is at the forefront in policy discussions around the world, and focus is directed at resource-based, industry-based and services-based emerging economies (UNIDO, Green Industry, 2010).

South Africa falls within the industrialised category of countries, and hosts resource-intensive industries in all the major regions. This results in heavy pollution and environmental degradation, and government is obligated to put in place policies and regulations that will control resource use, drive economic growth, and at the same time reduce emissions. Introducing clean and more efficient production technologies can therefore play an essential role in emission reduction plans for firms in South Africa (as well as other developing countries).

Resource decoupling refers to decoupling the rate of consumption of primary resources from economic activity, which is equivalent to “dematerialisation” (Swilling & Fischer-Kowalski, 2010). Decoupling requires attention both to the amount of resource use linked with economic activity, as well as to the environmental impacts associated with this resource use at all stages of the life cycle (UNEP, 2011a). Reductions in overall resource consumption and poverty can only be achieved if radical changes are made to systems (closed loop flows and cascading flows) and technologies in pursuit of decoupling (Swilling et al., 2013).

A key concept in respect of achieving cleaner production is resource decoupling. Resource decoupling implies using less material, energy, water and land resources for the same economic output. If there is resource decoupling, there is an increase in resource productivity or, in other words, an increase in the efficiency with which resources are used (Swilling & Fischer-Kowalski, 2010). Approaches to improving

resource efficiency cover a range of technical complexities and scales, and can also influence the manner in which certain services are supplied (Swilling et al., 2013). For example, electricity interventions typically focus more on reducing demand from end users by encouraging efficient lighting and appliances, and reducing the need to use electricity.

Key drivers of raw material use that have proved to be much stronger than GDP are population numbers, a country's material use (the so-called domestic material consumption) and energy use (domestic energy consumption), which are inextricably linked to the number of its inhabitants (UNEP, 2011a).

*This* research study has emerged as a critical area of interest for the author of this dissertation, whose profession involves working closely with RECP processes. The author is currently employed at the National Cleaner Production Centre–South Africa (NCPC–SA) as a project manager, and has more than nineteen (19) years of industry experience. He has in his more than eleven (11) years at the NCPC-SA worked extensively in the agro-processing, textile and chemical sectors.

The NCPC–SA has conducted numerous assessments since inception in 2002, with the goal of providing technical assistance to improve the overall performance of industry and enhancing the capabilities within participating companies. This is achieved through employing the services of technical experts who are specialists in the field of RECP. Assessments are conducted with close involvement of company champions; this is to ensure that knowledge is imparted to the extent that implementation will be continued. This is key to sustaining businesses as they will have the requisite internal capacity and not require further direct involvement of the NCPC–SA.

Training initiatives in the form of capacity-building workshops are also held to equip individual company champions with skills to conduct their own internal RECP assessments. This is similar to quality assurance principles, an ongoing process of Plan, Do, Check and Act (ISO, 2008). The aim of these workshops is to improve understanding of RECP and provide a step-by-step approach on how to conduct an assessment. This also builds sustainable RECP capacity within participating companies.



However, on completion of the assessments and presentation of the recommendations to management, the role of the NCPC–SA would be to act in more of an advisory capacity. Additional assistance is to be sourced at the company's own expense if further intervention is required. This serves as a deterrent to successful implementation, and depending on the size and nature of the business, exorbitant investment costs could have deleterious consequences for change.

Although some of the recommendations specified the requirement of cleaner technologies in the form of costly capital equipment, others related to low-hanging fruit that could be implemented immediately without any effort and cost. Addressing these recommendations through gradual implementation programmes could reposition businesses to adhere to government's steps as they develop coherent policy frameworks to curb GHG emissions by 34% by 2020 and 42% by 2025, subject to the provision of adequate financial, technological and capacity-building support by developed countries (National Treasury, 2013b). Improvements in resource efficiency can be described as a relatively inexpensive decoupling strategy, as fewer resources are used to achieve the same goals, or the same number is used to achieve greater results (Swilling et al., 2013). However, such improvements do not fundamentally eliminate dependence on limited resources, and run the risk of being pursued without an understanding of the impact on total resource consumption.

Companies that have implemented some of the recommendations over the years have reported immediate paybacks and improvements. This can only be achieved if the workforce is involved in an RECP programme which responds well and tends to boost employee morale. This is typically showcased in case studies and is disseminated to stakeholders and industry.

Companies who do not implement the recommendations identify various reasons for not doing so. These include a lack of knowledge and expertise in the field of RECP, lack of internal capacity, lack of financial resources, as well as time constraints because of pressing customer deliveries and obligations.

Lakhani (2006) explores some of the reasons why a number of cleaner production processes have been unsuccessful in South Africa. These include the points listed below:

- Little attempt was made to measure the social and human health impacts of processes.

- Little research activity was performed on alternative supply chains and models.
- The underlying systematic challenges are neither fully understood nor properly taken into account.
- Very little attempt was performed to internalise the cost of externalities, including direct, indirect and perverse subsidies.
- There was generally no acknowledgement of issues of local population ownership and control of means of production by non-citizens of South Africa.

The main aims of the current study are to identify—within the South African context—(1) barriers that restrict businesses from implementing resource efficiency and cleaner production recommendations, and (2) opportunities that could help reposition companies in a more sustainable manner. That is, in a manner that will reduce the impact of their operations on the environment, facilitate the creation of new and the retention of current jobs, as well as introduce new manufacturing methods for resource optimisation. This study also seeks to (3) highlight which resources and assistance mechanisms are available to support industry, and (4) enhance the knowledge of stakeholders to improve the service delivered to sectors.

It pursues these objectives by conducting a series of interviews with companies that have participated in the National Cleaner Production Centre South Africa's (NCPC-SA) RECP programmes, with specific emphasis on sectors such as clothing, textiles, footwear, leather, agro-processing and chemicals. Interviews are conducted with government departments as well as organisations directly engaged with RECP in South Africa and internationally; these include local and international consulting agencies, the United Nations Environmental Programme (UNEP), United Nations Industrial Development Organization (UNIDO) and others.

Accordingly, it is also the intention of this research to assess RECP implementation in other countries, and to use the lessons learned into recommendations that might benefit the South African industry.

RECP programmes in many countries across the globe have reaped remarkably successful results during and after implementation, and the United Nations Industrial Development Organization (UNIDO) has just reviewed the effectiveness of these programmes with all Cleaner Production Centres across the world (Van Berkel &

Kothuis, 2008). RECP methodologies, as a tool of intervention, are used to improve not only the environmental performance of businesses, but also the entire triple bottom-line of companies (Van Berkel & Kothuis, 2008).

RECP processes include efficient use of raw materials, water and energy; the elimination of toxic or dangerous process input materials; and minimising the volume and toxicity of all emissions and waste at the point of generation (Kothuis, 2008). It is more important to focus on changing attitudes and behaviour, and these basic improvements are achieved through simple changes in housekeeping and internal management practices.

United Nations Industrial Development Organization (UNIDO) programmes are closely aligned to the Sustainable Consumption and Production (SCP) programmes of the United Nations Environment Programme (UNEP), and also shares the same sources of funding. The NCPC-SA also has other supporting and collaborative programmes associated with the Department of Environmental Affairs (DEA), the City of Cape Town's Local Economic Development Division, the Department of Trade and Industry's The Enterprise Organisation (TEO), the Department of Trade and Industry's Co-operatives Division, The Industrial Development Corporation (IDC) and many others.

To address the key research aims of this study, engaging these sources is of vital importance. Government institutions and the various departments have many programmes in place; these must be linked and aligned to address environmental issues and create impact. This will be interpreted through responding to the research questions in the next section.

## **1.5 Research Questions**

The research questions that are pertinent to this study are outlined as follows:

- To what extent is the lack of financial support a barrier to the implementation of resource efficiency and cleaner production in South Africa?
- How can RECP initiatives contribute to sustainable jobs in South Africa?
- To what extent are capacity constraints a barrier to the implementation of resource efficiency and cleaner production in South Africa?

- What opportunities and incentives are available in South Africa for resource efficiency and cleaner production initiatives?

These questions help highlight how RECP in South Africa can benefit industry through resource optimisation opportunities to enhance their processes, as well as provide insight into which government incentives are available to support the implementation of recommendations that result from this intervention. The target groups are agro-processing, clothing, textiles, leather, and footwear, as well as the chemical sector. The research questions will also explore what challenges industry faces in adopting resource-efficient and cleaner production methodologies, with the purpose of finding solutions to how these challenges can be met to support and sustain growth within the South African economy.

### **1.6 General Summary of Objectives and Method**

The dissertation adopts a case study research approach as its core methodology (Yin, 2003). A survey was conducted to ascertain why implementation of RECP recommendations is challenging, and also to provide direction on where and how industry can be sustained through resource-efficient interventions. Questionnaires were distributed to industry, civil society and government, and face-to-face interviews were conducted with management structures, environmental managers, government officials and employees at participating companies. Not only was information gathered from industry, but also from the service providers who, within their individual portfolios, are constantly involved with the intervention processes associated with RECP programmes.

A desired outcome of the current study is to introduce links with other international organisations and RECP implementation agencies where implementation barriers have been experienced, and identify mechanisms available from government and other organisations to support companies financially that have been constrained from introducing any cleaner technology improvements. Linkages need to be created to ensure alignment between business and government, as only a strengthened relationship will help transition ailing sectors in becoming more resource efficient.

Government comprises policy makers and drivers, and it is important that a renewed mind-set be introduced to strengthen the relationship between industry and

government. Policy segregation and clarification will enable businesses to understand the parameters they are permitted to work within, and government incentive programmes will be interrogated throughout this study to provide better insight into developing a more cohesive relationship.

It is of strategic importance that companies identify exactly what training will be required to increase their knowledge base on resource efficiency and cleaner production. The process of implementation must also be managed, and this information will be ascertained through case studies. Accordingly, this study will also inform the NCPC–SA on the types of training initiatives required to build capacity on RECP awareness and implementation.

The study also analyses how RECP through the implementation thereof, can yield economic and environmental benefits. One crucial objective is to understand the barriers as well as needs of industry, as this will help the NCPC–SA to improve its service delivery to industry and other stakeholders.

The next chapter discusses all environmental areas that are associated with RECP. Economic development is extremely important to governments, but supporting industry in becoming more resource saving orientated is imperative. For nations who strive towards a green economy, various platforms for support are required and many global initiatives have been very promising. The information in the section below include links to policies, programmes and global initiatives, and this is aimed at providing strategic guidance and creating opportunities for industry and governments to apply sustainable methodologies as they investigate alternatives to their current modus operandi.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter discusses the effect industrial consumption patterns have on resources such as water and energy, and how manufacturing, consumption and disposal impact the environment. Hence we realise the need for more thinking around decoupling in South Africa's quest in seeking sustainable growth for the economy; this is discussed in greater depth in Section 2.7. It also highlights the importance of urbanisation and how it potentially could negatively impact these limited resources, and outlines the issue of unemployment and the effect it has on some of the national policies of government such as the new growth path and green economy discussed in Section 2.14 and 2.2 respectively.

Various tools to align industry and entrench sustainable practices are also introduced, and these include life-cycle management (Section 2.4), eco-labelling (Section 2.6), environmental management systems (Section 2.5) and water foot-printing (Section 2.10), amongst others. These tools are imperative when setting medium - to long-terms goals within business strategies, and have the potential to contribute directly to the triple bottom line of companies.

The next section discusses in detail the concept of cleaner production as a tool to improve resource efficiency, how it is aligned with economic growth, and also the benefits associated through global initiatives as well as within a South African context.

#### **2.2 Cleaner Production in the 21st Century**

##### **2.2.1 Defining Cleaner Production**

Resource efficiency from a life cycle and value chain perspective requires reducing the total environmental impact of the production and consumption of goods and services, from raw material extraction to final use and disposal. Economic growth and social development cannot be sustained with our current consumption and production patterns. Globally, we are extracting more resources to produce goods

and services than our planet can replenish, while a large share of an increasingly urban world population is still struggling to meet basic needs (UNEP, 2010c).

Resource efficiency aims at ensuring that natural resources are produced, processed and consumed in a more environmentally sustainable manner, with specific emphasis on creating a green economy that uses cleaner investments and green jobs to address poverty alleviation (UNEP, 2011b). RECP strategies increase the productive use of natural resources, minimise generation of waste and emissions, and foster safe and responsible production. RECP also provides enterprises with a comprehensive strategy to improve the overall environmental performance and resource utilisation efficiency, which leads to economic, reputational, and regulatory benefits. Given the positive evolution in environmental regulations and norms in recent years by various stakeholders, elements of UNEP's RECP practices exist in many countries under concepts such as eco-efficiency, waste minimisation, pollution prevention, and green productivity.

Figure 1 below shows what RECP specifically works towards advancing:



**Figure 1:UNEP – Resource Efficiency for Business**

(Source: UNEP, 2015)

### **2.2.2 Cleaner Production and Economic Growth**

Economic growth and sustainable development from a global perspective is a very challenging task for governments. Addressing concerns such as unemployment, inequality and poverty has been challenging for South Africa, and this is further exacerbated by the problem of unsustainable environmental practices.

Economic growth is strongly linked to our pensions, government finances, economic and monetary structures, climate and energy policy, innovation, and research and development. In addition there are expectations of the smart economy (people thinking and working smarter, generating new ideas and getting more for less right across the economy), the health service (cost and efficiency in service), a green new deal (a package of policy proposals that aims to address global warming), globalisation, the rise of China, and our own futures, as well as those of our children (Korowicz et al., 2010). Through 200 years of globalising economic growth, we have come to embody its processes in how we live and understand the world.

The smart economy iterates what resource efficiency and cleaner production initiatives aim at elevating, and the principles are aligned to achieve this thinking.

Following the recession or global crisis in 2008–2009, there is much uncertainty around economic growth for developed as well as developing and emerging economies. Industry's production systems are unsustainable, and only if they produce more with less (i.e. decouple), will they become more sustainable (UNIDO, 2010). Enterprises can have negative impacts on their local environments, and in response to this there has been a rapid growth in legislation aimed at getting industry to "clean up its act". The new environmental services sector has through this expanded rapidly in the developed countries.

Climate change is an irrevocable fact of life with which we will have to live (Adger et al., 2003), and will most certainly influence future development strategies, especially in the developing world (Bates et al., 2008). In terms of the effects of climate change, the future is becoming increasingly clear (Podesta & Ogden, 2007). The expected greenhouse gas emissions scenario developed by the Intergovernmental Panel on Climate Change (IPCC) portrays a world in which people and nations will be threatened by massive food and water shortages, devastating natural disasters, and deadly disease outbreaks (IPCC, 2007).



The important question is how do we balance the consequences of climate change with current economic development strategies? Do we continue exploiting the limited resources available for financial gain, or do we entrench a culture that will reduce the threat to future generations through more sustainable practices that address environmental degradation and pollution adequately? What strategies are available to address the needs of society, and how effectively can these contribute to economic growth?

### **2.2.3 Cleaner Production Options and Benefits**

Cleaner production is a preventative strategy to minimise the impact of production and products on the environment. The principal actors of cleaner production are the companies which control the production processes, and they are influenced strongly by their customers such as private, public or other companies, and politics such as laws, regulation and taxes (Fresner, 1998).

Greater resource efficiency and resource recovery, enabled through smart public policy, can for instance reduce waste flows associated with rising living standards. The scope for recovering waste is large, as currently only 25% of all the waste is recovered or recycled, while the world market for waste, from collection to recycling, is worth an estimated US\$ 410 billion a year (UNEP, 2011b).

The interdisciplinary cleaner production approach encompasses a range of options can be used (Fresner, 1998):

- Good housekeeping with materials and energy.
- Training of employees, better logistics, improvement in data availability and communication between departments.
- Substitution of raw and auxiliary materials with less harmful ones that can be used more efficiently or can be recycled internally or externally.
- Modifications of products to eliminate production steps with large environmental impacts.
- Process modifications to minimise waste and emissions.
- Internal recycling.
- Introduction of waste into external recycling networks.

Cleaner production is a philosophy that encompasses an understanding that production must be clean, from “cradle to cradle” (fully and safely recyclable), beginning with the very materials that were used in the first place (Lakhani, 2006). This means that if we do not begin with a sustainable product that uses a sustainable process, based on sustainable materials and sustainable water and energy use, we will never genuinely reach sustainable development.

This chapter places emphasis on various aspects such as the importance of the green economy and what it aims to achieve in practicality. It also outlines in detail the various environmental mechanisms and tools that are broadly used to assist in transition to this envisaged green economy within a South Africa context.

There is abundant evidence that the global economy still has untapped opportunities to produce wealth using less material and energy resources (UNEP, 2010d). Greening the manufacturing sector implies extending the useful life of manufactured goods by means of greater emphasis on redesign, remanufacturing and recycling, which constitute the core of closed-loop manufacturing.

RECP as shown in Figure 2 below has been applied in many countries, sometimes under different, but related approaches, and promoting RECP as a comprehensive environmental strategy requires the following:



**Figure 2: UNEP – Resource Efficiency for Business**

(Source: UNEP, 2015)

#### **2.2.4 Implications for South Africa**

South Africa has set its short-, medium- and long-term vision for contribution towards an environmentally sustainable, climate-change resilient, low-carbon economy and a just society. The vision is outlined in the Cabinet-endorsed National Strategy for Sustainable Development and Action Plan (2014), New Growth Path (2020) and National Development Plan (2030). This is supported by various sector policies and strategies including the Integrated Resource Plan, Industrial Policy Action Plan, Environment Sector Green Economy Implementation Plan, National Biodiversity Strategy and Action Plan, and the National Climate Change Response White Paper (UNEP, 2013). Therefore based on the Cabinet-endorsed vision for South Africa, a simple but yet very strategic implementation plan is required to be put in place to

ensure that action is taken to address the sustainability challenges of the nation. This will be outlined through steps as discussed in the green economy in the next section.

### **2.3 The Green Economy**

Today's economic wealth, as traditionally defined and measured through GDP, is often created through the over-exploitation and pollution of our "common" natural resources, from clean fresh water, to forest, to air—all essential to our own survival (UNEP, 2011b). Leaders increasingly understand that making progress towards a more sustainable economy requires an absolute reduction in resource use at a global level, while human wellbeing demands that economic activities should expand and environmental impacts diminish (UNEP, 2011a).

A green economy is one that results in "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (UNEP, 2011b: page 1). In its simplest expression, a green economy is low carbon, resource efficient, and socially inclusive. In a green economy, growth in income and employment should be driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services.

Governments setting mandates for transitioning to a green economy face a challenging task overall, as the social component and wellbeing of the population need to be aligned with the reduction of resource use and pollution to create some balance. The green economy as a priority is high on the agenda for the South African government, and both environmental initiatives and social programmes are deemed very important.

Investment for transitioning into a green economy is critical, as it could potentially benefit both governments and industry. The return on investment could be lucrative, as it will contribute to sustainable businesses and job creation in the green industry, while simultaneously reducing unemployment and environmental impacts through resource efficient processes. It will also provide a footpath for municipalities to deal with the huge constraints of urbanisation and the concomitant resource implications.

Resource efficiency and cleaner production can therefore be seen as key drivers in pursuing green economy status, and investment is critical to ensure that this

becomes a pillar in the transitioning process. For example, improvements possible through a green economy would result in near full recycling of e-waste, which currently is at an estimated level of 15% (UNEP, 2011b).

Resource scarcities and externalised cost constraints need to be managed profitably and for the benefit of society as a whole, and this can be achieved through resource efficiency in production and its economic benefits, and sustainable consumption on the demand side of the equation (UNEP, 2010d).

A green economy includes the many other benefits our environment provides for people, and this includes the adaptation to climate change, poverty alleviation, and the potential to serve as a basis for a sustainable economic model (UNEP, 2010d). This integration can be achieved by including nature-based solutions to climate change, valuing the many benefits nature provides to people, and including such values in economic decision-making.

To make the transition to a green economy, specific enabling conditions will be required. These enabling conditions consist of the backdrop of national regulations, policies, subsidies and incentives, international market and legal infrastructures, trade, and aid protocols. At present, enabling conditions are heavily weighted towards, and encourage, the prevailing brown economy, which, inter alia, depends on fossil fuel energy (UNEP, 2011b). For example, price and production subsidies for fossil fuels collectively exceeded US\$ 650 billion in 2008, and this high level of subsidisation can adversely affect transition to the use of renewable energies. In contrast, enabling conditions for a green economy can pave the way for the success of public and private investment in greening the world's economies.

At a national level, examples of such enabling conditions are changes to fiscal policy, reform, and reduction of environmentally harmful subsidies; employing new market-based instruments; targeting public investments to “green” key sectors; greening public procurement; and improving environmental rules and regulations as well as their enforcement. At an international level, there are also opportunities to add to market infrastructure, improve trade and aid flow, and foster greater international cooperation (UNEP, 2011b).

Policy and regulation infrastructure is very important when guiding industry towards a greener economy, but incentives are also crucial as a draw card. These will allow

better buy-in from industry, as they provide a platform of understanding that governments through the provision of incentives are keen to support the transition.

Resource efficiency and cleaner production are critical to re-thinking how we transform old industrial zones and centres to new modes of production that are cheaper, cleaner and more efficient. Core to resource efficiency and cleaner production are closing and cascading material flow loops, which means that more efficient use and re-use of critical and scarce resources can be engendered. As such, resource efficiency and cleaner production are critical to actualising transitions to green economic development.

A key concept for framing the challenges we face in making the transition to a more resource-efficient economy is decoupling. As global economic growth bumps into planetary boundaries, decoupling the creation of economic value from natural resource use and environmental impacts becomes more urgent (UNEP, 2011b).

The two core themes expected to define the scope of the RIO+20 conference negotiations in June 2012 were (1) the green economy in the context of sustainable development and poverty eradication, and (2) an institutional framework for sustainable development. Institutions and actors are the basic elements of governance and it is essential to explore the appropriate governance framework that may be useful in promoting the green economy in Africa (Afful–Koomson, 2012).

Most economic development and growth strategies encourage rapid accumulation of physical, financial and human capital, but at the expense of excessive depletion and degradation of natural capital, which includes our endowment of natural resources and ecosystems (UNEP, 2011b). The fuel price shock of 2008 and the related skyrocketing food and commodity prices reflect both structural weaknesses and unresolved risks in the global economy. The causes of these crises vary, but at a fundamental level they all share a common feature, namely the gross misallocation of capital.

The first national green economy summit of 2010 held in South Africa committed the country to working together to pursue and explore the opportunities “towards a resource efficient, low carbon and pro-employment growth path” (UNEP, 2013). The shift towards a stable economy supplemented by conditions that ensure distributional

equity, establishes sustainable levels of resource throughput and emission, and provides for the protection of critical natural capital (DEA, 2010).

Strategic goals in moving towards a green economy in South Africa (DEA, 2010), focus on:

- increasing the contribution of the Environmental Goods and Services (EGS) to employment and GDP;
- reducing the resource intensity of the economy (including energy and carbon);
- promoting cleaner technologies and investing in sustainable infrastructure; and
- promoting sustainable livelihoods and building local economies.

In 2011, nine nationally prioritised green economy programmes were agreed upon between the South African Department of Environmental Affairs and United Nations Environmental Programme (UNEP, 2013). These include:

- Resource conservation and management.
- Sustainable waste management practices.
- Water management.
- Environmental sustainability: greening & legacy, major events & tourism, research, skills, financing, and investments.
- Green buildings and the built environment.
- Sustainable transport and infrastructure.
- Clean energy and energy efficiency.
- Agriculture, food production, and forestry.
- Sustainable consumption and production.

In the green tech sector, the emergence of decentralised technology options holds promise for resource efficiency and cleaner production opportunities, as global investment in renewable energy grew by more than 60% year on year between 2004 and 2007, and by 200% in solar energy (DEA, 2010).

Therefore based on the national priority programmes set for the green economy in South Africa and which are strongly linked to the strategic goals of the Department of Environmental Affairs, it can be seen that resource efficiency is very high on the agenda as a key driver to pursue sustainability. This can be achieved through the

implementation of more effective sustainable consumption and production practices, and these are discussed in more detail in the next section.

## **2.4 Sustainable Consumption and Production**

All economic activity occurs in the natural, physical world, and it requires resources such as energy, materials and land. In addition it invariably generates material residuals that enter the environment as waste or polluting emissions (UNEP, 2010a). Sustainable consumption and production (SCP) was one of the key priorities identified at the Rio Earth Summit in 1992, and it was realised that consumption and production patterns in both developed and developing countries needed to change drastically. This can only be achieved through absolute decoupling of material use from growth in economic activities (UNEP, 2012c).

Resource consumption is expected to increase in both developed and developing countries, and global transformation in production patterns for increased resource efficiency and investment in the use of renewable resources is required (UNEP, 2012c). One of the main reasons for the environmental impacts of consumption and production assessment was to understand the relative importance of specific resource limitations and environmental problems. The assessment also explored the ways that production and consumption affect the environment and resources (UNEP, 2010a).

Globally, industrial growth has been driven over the years by goods supply and availability of resources needed for production. The use of these resources has been to the detriment of society and the environment. The increase in demand for goods and services has inadvertently also put pressure on the supply chain, which as a result also applies pressure on already limited resources.

Changing unsustainable consumption and production has been one of the overriding issues in the work programme of the Commission on Sustainable Development (CSD) since Rio (UNEP, 2005). The success of efforts to eradicate poverty and manage the natural resource base for economic and social development will depend upon fundamental changes in global consumption and production patterns.



The key principles of sustainable consumption and production (UNEP, 2012c) are defined as:

- improving the quality of life without increasing environmental degradation, and without compromising the resource needs of future generations;
- decoupling economic growth from environmental degradation by:
  - reducing material/energy intensity of current economic activities, and reducing emissions and waste from extraction, production, consumption and disposal; and
  - promoting a shift of consumption patterns towards groups of goods and services with lower energy and material intensity without compromising quality of life;
- applying life-cycle thinking, which considers the impacts from all life-cycle stages of production and consumption processes; and
- guarding against the rebound effect, where efficiency gains are cancelled by resulting increases in consumption.

Based on these principles, sustainable consumption and production may be summarised as a process of economic development that improves quality of life while reducing environmental impacts over the full life cycle. It also takes into account the full economic implications of the economic activities involved (UNEP, 2012c).

It is important to work with specific industrial systems, and to identify and understand their constraints and opportunities. Industrial systems might not always mean that solutions are readily feasible to address resource efficiency and cleaner production interventions, but the traditional model of industrial activity should be transformed into a more integrated model, namely an industrial ecosystem (Erkman, 2013). Industrial ecology is a new development strategy, optimising all resource and energy flows (not only waste).

A better understanding of industrial ecology is in eco-industrial parks, where “firms practice ... eco-efficiency to reduce their waste streams and improve the quality thereof, so that these wastes can become valuable resources for another company” (Van Berkel, 2005:271). This practice realises industrial symbiosis, and a materials flow analysis can, for example, pinpoint sources of materials inefficiency, which can then be addressed using various principles and tools.

More recently, and in addition to the current resource efficiency and cleaner production initiatives, South Africa has been directly or indirectly involved with various industrial focused projects relating to industrial symbiosis and also life cycle thinking programmes. Life -cycle approaches is discussed in more detail in the next section, but it is critical to note and understand the importance of using life-cycle thinking to create a sustainable link within the value chain.

## **2.5 Life-Cycle Approaches**

Sustainability has three dimensions, namely economic, environmental and social. In the business community, the term “triple bottom-line” was coined to explain the importance of achieving sustainability practices (UNEP, 2007b).

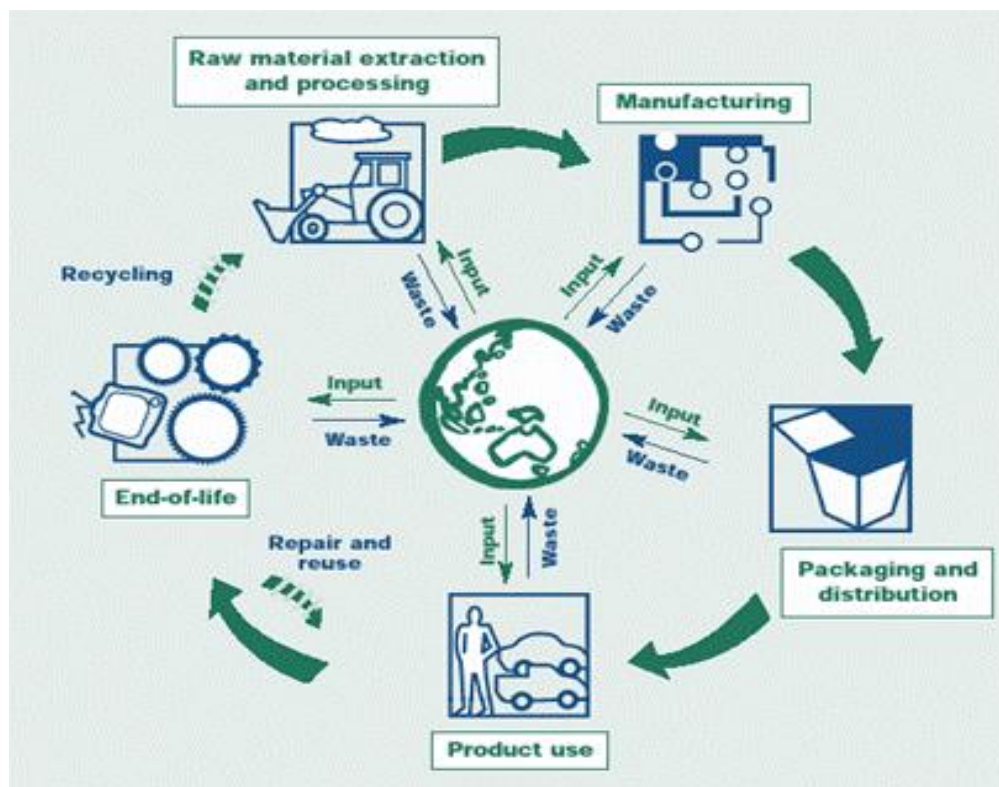
All products have a life cycle: this entails being produced from raw material, transported to stores, purchased by consumers, and then eventually disposed of. During the individual phases within the life cycle, products interact with the environment, economic and social systems, and this will be in the form of extraction, cost of production, and the workforce to ensure production and transportation.

Between the 1980s and 1990s, pollution prevention measures were implemented for economic benefit. These included measures such as cleaner production to reduce resource use, emissions and waste, and also environmental management systems to enhance image recognition and improve stakeholder relationship practices (UNEP, 2007b).

Businesses now embrace life-cycle approaches as they identify both opportunities for and risks of a product or technology, all the way from raw materials to disposal. To do this there is a continuum of life-cycle approaches from qualitative (life-cycle thinking) to comprehensive quantitative approaches (life-cycle assessment studies). People, companies and governments use these various life-cycle approaches in anything from day-to-day shopping, selecting office supplies for the workplace, engineering a new product design, or developing a new government policy (UNEP, 2004).

There are a number of stages in the life cycle (UNEP, 2005), and these are listed in Figure 3 below:

- a) Product design
- b) Raw material extraction and processing
- c) Manufacturing of the product
- d) Packaging and distribution to the consumer
- e) Product use and maintenance
- f) End-of-life management: reuse, recycling and disposal



**Figure 3: Stages of a products life cycle – Australian Government**

(Source: UNEP, 2012b)

During every stage of their life cycle, products interact with other systems, and to make a product, substances, energy, labour, technology and money are required, while other substances are emitted to the environment. Products can interact with the environmental (extraction or addition of substances, land use), economic (the cost to produce a product, implement technology, the profit to sell) and social domain (employment, worker rights). The relations between the environmental, economic and social domains are therefore quite dynamic (UNEP, 2005).

Life-cycle approaches promote:

- awareness that our selections are not isolated;
- making choices for the longer term;
- improving entire systems; and
- making the right decisions and informed selections.

Manufacturing represents a key stage in the life cycle of material use, which begins with natural resource extraction and ends with final disposal (UNEP, 2011b). The life-cycle approach militates against shifting problems from one cycle of the stage to another, as well as from one geographical area and environmental medium to another; it also facilitates the split into analysis and practice (UNEP, 2012b). These life-cycle approaches are becoming more prevalent across the globe, as the outcomes of these interventions contribute positively within the value chain.

These approaches are discussed in more detail in the section below, and include life-cycle thinking, life-cycle management, life-cycle assessment, life-cycle inventory, and life-cycle impact assessment.

### **2.5.1 Life-Cycle Thinking**

Modern society imposes an enormous impact on the Earth. Indeed, it is often contended that if the world's inhabitants' total consumption equalled that of those in industrialised countries, it would require the resources of more than two earths (UNEP, 2012c). As the world population continues to grow from 7 billion today to a predicted 9 billion in 2050, so too grows the need for natural resources to meet the water, food, clothing, shelter and other basic human needs of an additional 2 billion people. In addition, all the resources that we are harnessing in the name of producing goods and services for human consumption eventually end up as waste at some point and in some form, either in the air or water, or on the land.

Life-Cycle Thinking (LCT) integrates existing consumption and production strategies, and is applied to the daily decisions we make at our homes and workplaces, decisions about creating services and how we develop our communities. Citizens, businesses, and governments are finding ways to promote life-cycle thinking and balance the impacts of their choices (UNEP, 2004). Overall, life cycle thinking can

promote more sustainable rates of production and consumption and help us use our limited financial and natural resources more effectively.

Life-cycle thinking expands the established concept of cleaner production to include the complete product life cycle and its sustainability (UNEP, 2007b). The main goal of life-cycle thinking is to reduce a product's resource use and emissions to the environment, as well as improve its socio-economic performance throughout its life cycle.

Life-cycle thinking also has the ability to affect government policy positively, as it applies when governments design policy, negotiate voluntary agreements with industry, and decide where to invest resources, commission new office buildings, or purchase paper for offices (UNEP, 2004).

Measuring potential life-cycle impacts of decisions can help governments to:

- inform government programmes and help prioritise these programmes based on life cycle information;
- make policies more consistent among consumers, producers, material suppliers, retailers, and waste managers and also among different policy instruments (such as harmonising regulations, voluntary agreements, taxes, and subsidies);
- purchase products and services which are “environmentally preferable”, reduce the impact government operations have on the environment and support regional and global markets for “preferable” products and services;
- promote pricing products and services to accurately reflect the costs of environmental degradation, health problems, erosion of social welfare, and impacts at other life-cycle stages; and
- introduce take-back systems to establish recycling-based economies according to the hierarchy of reduce, reuse and recycle.

It is therefore of strategic importance for governments to integrate life-cycle methodologies into policies that will support a closed-loop approach in terms of sustainable procurement, and also boost the economy to some degree in elevating locally industry with production opportunities. The next section of life-cycle management serves as an extension phase of life-cycle thinking, and these tools are all implicit in endorsing resource-efficient and cleaner production practices and methodologies.

### **2.5.2 Life-Cycle Management (LCM)**

The journey towards sustainable development requires that businesses, governments and individuals take action, that is, change consumption and production behaviours, set policies and change practices (UNEP, 2007b). Businesses have to find innovative ways to be profitable and at the same time improve the environmental performance of production processes and products.

Life-cycle management (LCM) has been developed as an integrated concept for managing the total life cycle of products and services towards more sustainable consumption and production patterns. The Life-Cycle Management Programme (LCMP) also creates awareness and improves skills of decision makers by producing information materials, establishing forums for sharing best practice, and implementing training programmes.

Life-cycle management is described as a system/framework for improving organisations and their respective goods and services. Decisions taken at all levels of an organisation will influence the overall impact a product has throughout its life cycle (UNEP, 2007b). Key drivers for implementing a life-cycle approach are business strategy, market requirements and requirements from the finance sector, national legislation, regional regulations, and international agreements.

The framework of life-cycle management therefore is integrated at all levels of the organisation: in marketing, purchasing, research and development, product design, strategic planning, corporate reporting, and management (UNEP, 2005). To reach these levels, life-cycle management will have to remain flexible, and in terms of implementing it, concepts, programmes and techniques (tools) are all required. A life-cycle framework addresses improvements to technological, economic, and environmental organisation, and occasionally to the social aspects of an organisation and the goods and services it provides.

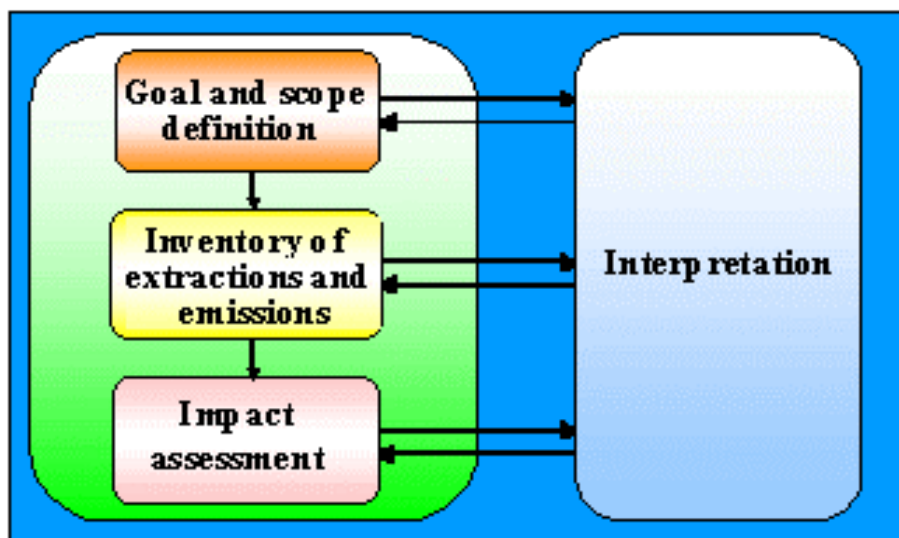
### **2.5.3 Life-Cycle Assessments**

Life-Cycle Assessments (LCAs) have been designed as tools for systematic evaluation of the environmental aspects of a product or service system through all the stages of its life cycle (ISO, 2006). The purpose of life-cycle assessments is to

specify the environmental consequences of products or services from cradle to grave (UNEP, 2005). The effort to use a life-cycle perspective, that is, to examine the environmental impacts of products, processes, facilities or services, from resource extraction, through manufacture to consumption, and finally to waste management, is reflected in the use of formal methods such as life-cycle assessment (Ayres & Ayres, 2002).

Life-cycle assessment is defined as the “compilation and evaluation of the inputs, outputs, and potential environmental impacts of a product system throughout its life cycle” (UNEP, 2005: page 22). However, life-cycle assessment is also important for technology choices, and setting technologies into a product-related chain perspective. Life-cycle assessment is increasingly used at a strategic level for business development, policy development, and education (ISO, 2006), and it contains four methodological phases, as seen in Figure 4:

1. Goal and scope definition
2. Life-Cycle Inventory Analysis (LCI)
3. Life-Cycle Impact Assessment (LCIA)
4. Life-Cycle Interpretation



**Figure 4: The four phases of LCA**

(Source: UNEP, 2005)

#### **2.5.4 Life-Cycle Inventory**

The purpose of the Life-Cycle Inventory (LCI) programme is to improve global access to transparent, high-quality life-cycle data by hosting and facilitating expert groups whose work results in web-based information systems. This is the stage where all data is collected for the unit processes, and mathematical relations are used to relate the data to the functional unit of the study (McGlade, 2012). This is a process referred to as “normalisation”.

In the case of qualitative water assessments, input-output balances, based on the hydrology and water use by the different economic stakeholders, are set up during the inventory analysis phase, which are similar to the ones used in water registers and water accounting approaches.

#### **2.5.5 The Life-Cycle Impact Assessment**

The Life-Cycle Impact Assessment (LCIA) Programme is to increase the quality and global reach of life-cycle indicators by promoting the exchange of views amongst experts whose work results in a set of widely accepted recommendations (UNEP, 2005).

The life-cycle impact assessment aims to evaluate the life-cycle inventory table with regard to environmental impacts. Categories of environmental impacts are selected, for example climate change, human and eco-toxicity, and acidification (McGlade, 2012). The inventory analysis results must then be assigned to the different impact categories—a process called classification.

The life cycle of products takes into consideration process flows of energy, water, materials and waste. It evaluates processes within the value chain in terms of the potential environmental impacts, and establishes means to reduce these impacts and lessen the impact on society, businesses and the environment (McGlade, 2012). Resource efficiency and cleaner production methodologies have the ability to ensure the reduction of resources such as energy, water, materials and waste, but applying life-cycle techniques achieves a more technical outcome in terms of the costing and associated values.



Even though resource efficiency and cleaner production interventions aim at optimising resources and reducing waste, life-cycle methodologies have an integrated approach to creating the link along the value chain. South Africa has during 2015 participated in a life cycle management pilot project initiated by the United Nations Environmental Programme, and this is focused specifically on utilising a tool called the Capability Maturity Model (CMM). This tool broadly assesses businesses using environment, social and economic criteria, and basically proposes strategic interventions that could potentially provide guidance in terms of strengthening in the area of sustainability.

The next section covers eco-labelling, which is another sustainable consumption and production tool; it describes in detail how this instrument, through a life-cycle assessment approach, is able to guide products in becoming more environmentally friendly.

## **2.6 Eco-labelling**

Pollution costs for businesses are normally integrated into higher product prices because of the “polluter pays” principle (UNEP, 2007a). An eco-label is a label which identifies overall environmental preference of a product (i.e. goods or service) within a product category based on life-cycle considerations (GEN, 2004), and encourages decreased emissions and reduced environmental impact. The extra cost is passed on to the consumer in a price premium (UNEP, 2007a).

Eco-labelling refers specifically to the provision of information to consumers about the relative environmental quality of a product. This has become a useful tool for governments in encouraging sound environmental practice, and for businesses in identifying and establishing markets for their environmentally preferable products (GEN, 2004). Eco-labelling is considered potentially the most important method to assess the overall environmental impact of products, processes or services, and life-cycle assessment is the key instrument or tool in doing this (Royal Society of Chemistry, 1998).

Eco-labelling also serves as guidance to consumers who choose products for environmental reasons. Eco-labelling, through the various labels available, also

encourages production to be more environmentally friendly, and this in turn stimulates export of these products.

This environmental labelling tool provides guidelines for the use of environmental labels and declarations, and these communicate information on environmental aspects of products and services to encourage the demand and supply of those products and services that cause less stress on the environment, and are especially relevant for the needs of consumers (UNEP, 2005).

Eco-labels are important market-based instruments that influence the behaviour of consumers and industries in favour of environmentally friendly products and the processes that produce them. It is important for producers of environmentally superior products to have an incentive to use environmental marketing techniques such as eco-labelling to differentiate their products (Janisch, 2008). Businesses may be motivated by gaining extra market share, improving their public image, or pre-empting mandatory labelling requirements.

Under the EU Eco-label scheme the “product life-cycle” is divided into the following stages:

- Pre-production
- Production
- Packaging/Distribution
- Utilisation
- Disposal

For each of these stages, environmental effects were considered according to the following criteria, which are referred to as “environmental fields”:

- Waste relevance
- Noise
- Air contamination
- Water contamination
- Effects on eco-systems
- Consumption of energy
- Consumption of natural resources
- Soil pollution & degradation

Development and marketing of environmentally friendly products are key to supporting the shift towards sustainable consumption and production patterns. However, this could be either an opportunity or an obstacle for African products, depending on the level of preparedness by the region (Janisch, 2007a). Africa can benefit from the development of an African labelling scheme that could be instrumental in expanding Africa's market access by securing mutual recognition from other regionally recognised labelling schemes such as the European Union (EU) Ecolabel.

There are widely acknowledged benefits of eco-labelling for producers who are certified, and this could include potential for premium market prices, access to new markets, safeguarding of existing market channels, preferred supplier status, etc. Eco-labels are meant to communicate and promote environmental benefits through their positive influence on consumers to make informed purchasing decisions, and manufacturers use their product logo to communicate their good environmental practices to consumers (UNEP, 2007a).

Nevertheless, this practice should be accompanied by institutional and regulatory policies that will help to differentiate justifiable environmental claims from fraudulent marketing slogans. Such a mechanism encourages industries to promote continuous improvement of their production processes, thereby reducing their impact on the environment. Eco-labelling is also considered a useful vehicle for raising environmental awareness in some cases, by highlighting the available alternatives in specific product categories.

Even though life-cycle methodologies and eco-labelling could harness sustainable practices within the value chain, environmental management systems, discussed in the next section, serve as a further tool that businesses and organisations can use to increase and continuously improve their internal environmental performance in this globally competitive world.

## **2.7 Environmental Management Systems**

The environment has become an important factor in the decision-making process of companies around the world (GEMI, 1996). Environmental issues at the same time are becoming more complex and interconnected (GEMI, 1996), and businesses are

seeking independent certification of their environmental management practices. Traditional ways of addressing environmental issues—in a reactive, ad-hoc, end-of-pipe manner—are proving to be highly inefficient (Pauli, 2011). As competition increases within the expanding global market, environmental laws and regulations are setting new standards for business in every region of the world (GEMI, 1996).

Good environmental performance is not just a legal or moral obligation, but also makes good business sense. Reducing pollution means increasing efficiency of resources, and improving health and safety conditions results in a more productive workforce. Supplying goods and services that respect the environment helps to expand markets and improve sales. In short, companies may become more competitive when they practise good environmental management, and ISO 14001 has proved to be the key certification for corporations wishing to demonstrate their environmental performance (Pauli, 2011).

Environmental management systems distinguish between five different decision steps (ISO, 2006), and these include:

- a) Environmental policy
- b) Planning
- c) Implementation and operation
- d) Checking and corrective action
- e) Management review

An Environmental Management System (EMS) specifies how an organisation can formulate an environmental policy and objectives, taking legislative requirements and information about significant environmental impacts into account (UNEP, 2005). The objective is continuous overall improvement of the organisation.

The problem remains that even a nuclear waste processing plant can obtain certification, as ISO 14001 certifies that a plant is “environmentally managed” as long as dioxin is discharged according to the law, and a programme is in place to reduce it (Pauli, 2011). Over the years it has become obvious that industry welcomes and is prepared to pay for an external audit to confirm its sustainable practices even beyond ISO 14001, and through this has emerged the thinking of Corporate Social Responsibility (CSR).

What is crucial though, is that organisations and businesses assess viability and introduce programmes and tools that will improve their environmental performance. This must also be aligned with resource use and depletion, and with economic growth in general. The next section discusses decoupling and describes its inherent synergy with resource efficiency and cleaner production.

## **2.8 Decoupling**

Human wellbeing and its improvement, now and for a larger world population in the future, is based upon the availability of natural resources such as energy, materials, water and land (UNEP, 2011a). Demographic and economic development has led to a rapid rise in the use of these resources.

Between 1900 and 2005, global material resource use increased almost twice as fast as the rate at which the global population grew (Swilling et al., 2013). Industrial processes and operations are strongly associated with environmental impacts and resource use, and this has detrimental impacts on air pollution (CO<sub>2</sub> emissions), land degradation and biodiversity losses through biomass use (Swilling & Fischer Kowalski, 2010). Industrial mining, processing and transportation are some of the biggest soil pollutants, and also involve heavy energy consumption. This results in waste generation, and sometimes waste that is highly toxic.

Economic growth through industrial expansion in many developed and developing countries has resulted in detrimental consequences to both humans and the environment. Water and air pollution, and the overuse of resources to increase profitability, therefore take precedence over preservation of natural resources, and this places heavy pressure on national and local governments that strive to introduce and implement more sustainable approaches.

Most material resources are scarce in economic terms, and this provides the basis for determining their price. But a few material resources, such as wind, sunshine or tidal energy, are so abundant that they cannot possibly be depleted (UNEP, 2011a). Their economic price is determined not by their supply, but rather by the cost of converting them into forms that can then be applied to other uses (for example, wind farms, solar panels, or tidal energy generators).

Beyond resource scarcity, the extraction of resources, the manufacture of products, their consumption, and the disposal of wastes and emissions (in other words, the use of resources over the whole life cycle), are associated with substantial environmental impacts (Swilling & Fischer Kowalski, 2010).

The notion of decoupling opens up a new way of thinking about the relationship between the rate of economic growth and the rate of resource consumption and its associated impacts (Swilling, 2011). There are two types of decoupling: “resource decoupling”, which refers to decoupling growth rates from resource extraction, and “impact decoupling”, which refers to decoupling growth rates from environmental impacts.

The concepts of resource efficiency or productivity are also used to express changes in the amount of resource inputs used to generate economic outputs (UNEP, 2012c). Decoupling waste from economic growth and rising living standards is central to resource efficiency (UNEP, 2011b). However, all forms of decoupling involve an improvement in efficiency, and it is not necessarily the case that increased efficiency will lead to all forms of decoupling (UNEP, 2012c).

In South Africa many challenges restrict growth, and decoupling clearly presents an opportunity to positively create an environment of efficient resource use. Electricity demand and pricing within South Africa has risen drastically over the past few years, and many concerns have surfaced because of South Africa’s slow economic growth. Resource efficiency and cleaner production through energy efficiency initiatives have therefore become important for sustaining businesses and increasing competitiveness. This topic is discussed in more detail in the next section.

## **2.9 Urbanisation**

The first urbanisation wave from 1750 to 1950 resulted in an increase in the number of urban dwellers in Europe and North America from 15 million to 423 million. The second urbanisation wave will take less than 100 years, from 1950 to 2030, and is taking place in developing countries where the urban population is projected to grow from 309 million to a staggering 3.9 billion people (Peter & Swilling, 2012). The global population will increase from 6 to 9 billion, and the bulk of this increase is located in

Africa and Asia, which will be home to the additional 3 billion people expected on this planet by 2050 (Swilling & Anneke, 2012).

South Africa has the largest and most industrialised economy in Africa, the twenty-eighth largest economy in the world, and nearly 62 percent of its total population of 50 million live in urban areas (Turok, 2012). Urban division and exclusion constituted the ultimate paradigm during the apartheid era, and when South Africa embarked on its ambitious democratic transition in 1994, there was great anticipation that ways would be found to undo this paradigm of urban division—the apartheid city (Pieterse, 2009).

The design, construction and operation of urban infrastructures to provide key services such as piped water; sanitation; waste removal and processing; electricity for light, warmth and productive activity; and mobility for people and goods will directly determine how resources in the form of water, nutrients, materials and energy pass through the system and in what manner (Swilling et al., 2013). It is worth imagining the difficulty of navigating a future in which resources have dwindled, the cost of goods, transport, water and energy has spiralled, the oil peak has come and gone, climate refugees stream towards cities in every region of the world, and droughts, floods and extreme events cost billions—exhausting national, local and provincial government treasuries (Peter, 2010).

Urbanisation has a huge influence on economic growth and job creation, and contributes to the poverty levels of countries. This places tremendous strain on resource availability, and the next section discusses energy efficiency, which currently is one of the highest priorities for government to address.

## **2.10 Energy Efficiency**

In many countries energy efficiency is also seen to have national advantages in terms of building the economy, because it can be used to reduce the level of energy imports from foreign countries, which in turn will reduce the rate at which domestic energy resources are depleted. The reduction of energy use, according to the International Energy Agency (IEA), automatically reduces direct energy costs, resulting in financial cost saving to consumers (IEA, 2010).

In the United States alone, the electric power industry is responsible for emitting approximately one-third of all greenhouse gas emissions. Largely, these emissions come from the combustion of fossil fuels to create electricity, and any solution that seriously seeks to address concerns about climate change, energy security, and rising energy costs, will need to make energy efficiency a priority in a portfolio of solutions (Mims et al., 2009).

Improved energy efficiency in specifically buildings, industrial processes and transportation could reduce the world's energy needs in 2050 by one-third, and help control global emissions of greenhouse gases. This can only occur if the energy savings offset any additional costs of implementing an energy-efficient technology. Reducing energy use is also seen as a solution to the problem of reducing emissions (IEA, 2010).

Industrial processes are extremely inefficient, and it is important that cost-saving measures be put in place to divert the burden from both businesses and governments. The control of emission levels to the atmosphere has placed tremendous pressure on governments, and investment in renewable technologies is key to redirecting industry to adhere to and comply with legislative requirements.

Rapidly growing and developing countries will account for an overwhelming 85% of energy demand growth by 2020. China, for example, represents one-third of the total growth, owing to high demand for cars and appliances from its burgeoning middle class and the sustained pressures of industrial energy demand. Another fast-growing region is the Middle East, where oil revenues are boosting GDP growth and energy subsidies encourage energy-intensive development (McKinsey Global Institute, 2007).

Manufacturing in terms of resource use is responsible for around 35% of global electricity use (UNEP, 2011b), and various industries generate steam and electricity for subsequent use within their facilities. When electricity is generated, the heat that is produced as a by-product can be captured and used for process steam, heating, or other industrial purposes.

South Africa is ranked among the top 20 countries measured by absolute carbon dioxide (CO<sub>2</sub>) emissions, with emissions per capita in the region of 10 metric tons per annum (National Treasury, 2013b). Green investments in energy efficiency over the

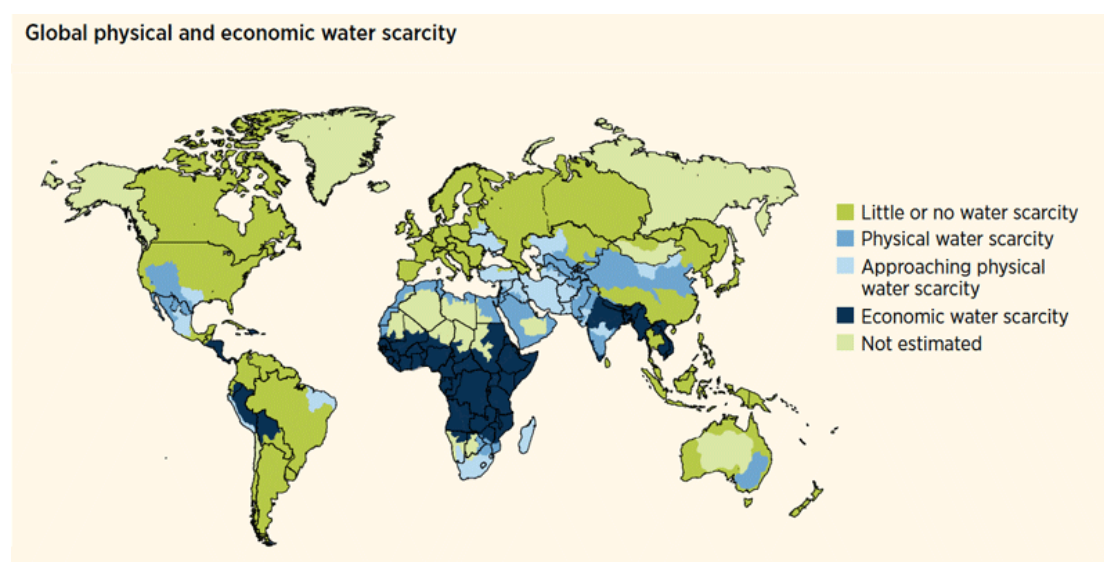


next four decades could reduce industrial energy consumption by almost one half, compared with business as usual (UNEP, 2011b), and through a strategy such as this, South Africa could reduce its GHG emissions, and at the same time work towards ensuring economic growth, increasing employment, and reducing poverty and inequality (National Treasury, 2013b).

Since the turn of the century, energy cost has drastically increased, hence the heavy focus on reducing the use of this resource. However, not much emphasis has been placed on water, and because South Africa is an arid country, this topic is discussed in more detail below. Water should not only feature as a priority on the agenda of government, but also be considered as a very important resource that has the potential to cut short the existence of life on the planet.

## 2.11 Water Resources and Foot-printing

Humanity's key challenge over the coming decades will be to meet the energy, land, water and material needs for up to 9 billion people, while keeping climate change, biodiversity loss and health threats within acceptable limits (UNEP, 2012c). Water is a vital resource. However, the spatial distribution of water resources and human use is creating massive water-scarcity problems for humans and ecosystems (UNIDO, 2010), and this global scarcity is shown in Figure 5 below.



**Figure 5: Global physical and economic water scarcity**

(Source: UNESCO, 2012:125)

Different countries use and pollute vastly different volumes of water, and this places critical differing levels of water stress on national water resources. Poor management of water resources compromises sustainable development, and water must be well managed to ensure good health for human beings. This strain will become more noticeable with increased human population and economic growth, and will be further affected by the effects of climate change (UNIDO, 2010).

These challenges require a range of solutions specific to each situation, and a key factor in determining which solution is most appropriate will be the availability of data and information on how much water is available and how it is being used (UNEP, 2012c).

Overshadowing climate change are concerns about the impending global crisis in water, population growth, economic development, and urbanisation. These trends are leading to increased water consumption. Adding to current water stress levels is that regions that already receive little water will receive even less. Globally it is estimated that 15% of worldwide water use is already industrial, and that level is set to grow with industrial development (UNIDO, 2010).

Manufacturing is currently responsible for about 10% of global water demand and this is expected to grow to over 20% by 2030, thereby competing with agriculture and urban use (UNEP, 2010d). Agriculture consumes a large amount of available water; therefore there is a need to improve the efficiency potential of water. Like the rest of our economies, if industries are to continue functioning, they need the ecosystem services the natural environment offers us—clean water, clean air, and the mineralisation of wastes (UNIDO, 2010).

Water foot-printing is also becoming a popular way of understanding the total water input to consumer products such as beverages, food and clothes (SAB Miller & WWF, 2009). In the case of products, the basic information provided by water footprints can be used by the private sector to perform a risk assessment. This can be used as a planning tool, to identify hotspots in supply chains or to couple it with tools like life-cycle assessment methods to perform benchmarking of other products (UNEP, 2011c). With individuals or the inhabitants of a given region or country, the basic information provided by water footprints can be used by governments, academia, NGOs or other organisations for awareness raising or for understanding changes and trends in consumption patterns as related to water resources.

Just as the carbon footprint concept has assisted businesses and consumers in understanding the level of greenhouse gas emissions created by their activities, so water foot-printing creates awareness of how and where this precious resource is used (SAB Miller & WWF, 2009).

The world has witnessed a massive increase in water demand over the past century, driven by the force of industrialisation, economic development and population growth. This increase in global water demand is leading to increased tensions and challenges around the effective management of finite local freshwater resources in many parts of the world, where industry, agriculture and local communities compete for this precious resource (CDP, 2012). A significant challenge in establishing “sustainable water management” is to quantify decoupling, particularly in terms of developing accurate measures of water use and their impact on ecosystems (UNEP, 2012c).

We all live at the water’s edge, whether we are at the end of a pipe or on the bank of a river. Even though less than one per cent of water on Earth is currently accessible for direct human use, there is enough water available to meet human and environmental needs (WWF, 2010). The challenge, though, is to secure enough water of good quality in a way that doesn’t destroy the very ecosystems from which we take our water supply—rivers, lakes and aquifers.

Economic and industrial growth in many developing countries has resulted in resource depletion that outweighs the availability of these resources to a large extent, and the following section highlights the severe consequences this has on the planet and its resources. SA is a water-scarce country, and requires higher levels of water efficiency in various sectors such as industry, mining, power generation, agriculture, etc.

## **2.12 Natural Resources**

Industry, especially in developing countries, has a severe impact on the environment, affecting rivers, groundwater, air quality and land use. Environmental management in developing countries lags behind industrial growth, with resulting pockets of severe local pollution caused by the daily operations of these industrial businesses.

Of much greater long-term impact are global environmental threats, which reflect the natural environment's growing inability to absorb the wastes that are the by-products of global economic growth (UNIDO, 2010). Climate change is the most prominent example of such threats, and there are other signs that the world's absorption capacity is being stretched to breaking point; changes in our production and consumption patterns are thus required.

Natural resources are being depleted at faster rates than ever; this highlights the need for global audits and actions to reverse such depletion (Jegatheesan et al., 2009). More coordinated efforts by various organisations are essential to quantify reserves and demands in such audits to enable the development and implementation of strategies for sustainable recovery, usage, and recycling of natural resources.

As one of the objectives of sustainable consumption and production, decoupling, which is the process of reducing the resource intensity of and environmental damage relating to economic activities, ensures continued economic growth through sustainable use of material, energy and ecosystem resources (UNEP, 2012d). Leapfrogging, which is another objective of sustainable consumption and production, refers to the adoption of modern technologies, and this is more relevant to renewable energy technologies.

Economic activities generate huge volumes of waste through vigorous industrial processes, and the next section discusses opportunities to minimise or suggest opportunities to recycle or convert waste into energy. For South Africa, this will be extremely challenging, as the country is a resource-intensive economy that is historically heavily reliant on its minerals energy complex (Fine & Rustonjee 1996).

### **2.13 Waste to Energy**

Gunther Pauli (2011) cites Lynn Margulis's words, "waste of one is food for another belonging to another kingdom". Efficient waste management programmes help protect human health and the environment and preserve natural resources, while solid waste also impacts climate change (United States Environmental Protection Agency, 2002). Waste generation increases with population expansion and

industrialisation, and countries in Asia, Latin America, and Africa account for nearly 40 percent of annual methane emissions from landfills.

The twin processes of urbanisation and industrialisation are positively correlated with waste generation and energy consumption, and global reliance on fossil fuels has contributed not only to new challenges of global warming, but also to price volatility and relentless depletion of finite reserves (Gumbo, 2013). Municipal Solid Waste (MSW) generation rates are influenced by economic development, the degree of industrialisation, public habits, and local climate, and this supports the general trend that the higher the economic development, the higher the amount of municipal solid waste (World Energy Council, 2013).

Population growth and global urbanisation, along with economic growth in developing countries, are huge contributors to solid waste production. But with good management and control, municipal solid waste has the opportunity to become a precious resource for generating energy.

The African continent is endowed with several renewable energy sources and with its very low oil reserves and heavy dependence on coal, the need for innovation in renewable energy is more urgent than ever (Gumbo, 2013). Energy recovery from waste and residues can save significant GHG emissions (UNEP, 2009), and “municipal organic waste and residues from agriculture (both crop production and animal husbandry) and forestry provide significant energy potential which is still largely unused” (UNEP, 2009:20).

South Africa faces many waste governance challenges, and this ranges from strategic waste management at national government to basic operational challenges at local government level. The primary method of waste disposal in South Africa is still landfilling, and incineration is a common practice. South Africa is also involved to some extent with the extraction of methane gas from landfills, composting, agricultural waste, and water-treatment facilities, but the dissemination of these activities has proved to be very poorly coordinated and managed to encourage better waste management practices.

Waste-to-energy technologies consist of any waste treatment process that creates energy in the form of electricity, heat or transport fuels (e.g. diesel) from a waste source (World Energy Council, 2013). These technologies enable the conversion of

the energy content of different types of waste into various forms of valuable energy, and power can be produced and distributed through local and national grid systems. Several types of biofuels can be extracted from the organic fractions of waste, to be then refined and sold on the market.

Waste-to-energy initiatives have the potential to create employment, but there is also the fear that landfill jobs/pickers will be affected and will result in further unemployment. The increase in urbanisation through population migration, discussed in the next section, therefore militates against job creation opportunities and creates further challenges for government.

## **2.14 Unemployment**

Discussions on unemployment have always been a very sensitive issue within government and industry-related bodies. Unemployment has a two-pronged definition: a narrow definition (those that did not work in the last seven days but actively looked for work), and a broader definition (this includes the narrower definition, as well as those who were not working but would accept a suitable job if one were offered, even though not seeking work).

Manufacturing currently accounts for 23% of global employment (UNEP, 2010d). Waste generated is highly correlated with income, and as living standards and incomes rise, the world is expected to generate over 13.1 billion tons of waste in 2050, which is about 20% higher than the amount in 2009 (UNEP, 2011b).

South Africa is considered the economic hub of the African continent, but the one component that underpins slow growth is the unemployment issue. “High unemployment in South Africa is thus attributed to an underperforming formal sector and to the inability of the unemployed to enter informal labor markets” (Davies & Thurlow, 2009:1). While South Africa will find it difficult to compete in low-skills manufacturing because of its high cost structure, many countries on the continent can compete as production costs rise in East Asia (NPC, 2012).

Skilled, semi-skilled and unskilled labour is the determinant factor on unemployment, and this creates the disparity that has burdened South Africa for years. The South

African government's New Growth Plan (NGP) places a heavy emphasis on job creation and reducing the unemployment rate, and sets a target of 5 million jobs by the year 2020 (DTI, 2010).

The problem of high youth unemployment is a global phenomenon, and youth (15–24) make up nearly half (47%) of the world's unemployed, even though they are only 25% of the world's working-age population (Lam et al., 2008).

South Africa has an acute problem of youth unemployment that requires a multi-pronged strategy to raise employment and support inclusion and social cohesion. High youth unemployment means young people are not acquiring the skills or experience needed to drive the economy, and this inhibits the country's economic development and imposes a greater burden on the state to provide social assistance (National Treasury, 2011).

A sustainable increase in employment will require a faster-growing economy and the removal of structural impediments, such as poor-quality education and spatial settlement patterns that exclude the majority. These are essential to achieving higher rates of investment and competitiveness, and expanding production and exports (NPC, 2012).

The New Growth Plan identifies a number of job drivers, which include agriculture, mining, manufacturing, tourism and other high-level services that can create substantial employment. It proposes both sectoral interventions and a package of macroeconomic and microeconomic policies designed to ensure that the economy becomes both more competitive and employment friendly.

Government regulation and pricing policies play an important role in guiding industries and consumers on a more resource-efficient path (UNEP, 2011b), and the next section covers some of the South African policies that provide strategic guidance to industry.

## **2.15 South African Policies**

The South African government, as part of the transformational process, has unveiled many policies and strategies to grow the economy of the country and at the same time address hankering concerns relating to unemployment, poverty and inequality. This section discusses some of these national policies that aim to address specifics in terms of sustainable development, industry development (financial, environment and legal interventions), strategies to address waste issues and ensure compliance, job creation, and reduction of inequality and poverty, as well as developing further the current capabilities that exist. These policies have been designed to address both the national challenges that exist and also to align South Africa with the global strategies and policies put in place to deal with transformation.

### **2.15.1 Industrial Policy Action Plan 3 (IPAP3)**

The main purpose or strategic objectives of the South African Department of Trade and Industry as per the mandate on its website (DTI, 2015), is to:

- facilitate transformation of the economy to promote industrial development, investment, competitiveness and employment creation;
- build mutually beneficial regional and global relations to advance South Africa's trade, industrial policy and economic development objectives;
- facilitate broad-based economic participation through targeted interventions to achieve more inclusive growth;
- create a fair regulatory environment that enables investment, trade and enterprise development in an equitable and socially responsible manner; and
- promote a professional, ethical, dynamic, competitive and customer-focused working environment that ensures effective and efficient service delivery.

These objectives address the specific needs and focus areas around the following:

- Economic empowerment
- Small, Medium and Micro Enterprises (SMMEs)
- Industrial Development
- Trade, Export and Investments
- Financial Assistance
- Legislation and Business Regulations



Special-purpose vehicles or agencies are therefore in place to ensure that certain desirable outcomes are met to uplift industrial developmental areas and other key strategic objectives. In the case of industrial development, the Industrial Policy Action Plan (IPAP) 2 was put in place with the intent of expanding production in certain value-add sectors. The IPAP 2012/13–14/15 (DTI, 2013) represents the fourth annual iteration of the Action Plan, and key achievements registered to date in sectors such as Automotive, Clothing, Textiles, Leather and Footwear, and Business Process Services demonstrate that well-designed industrial policy interventions can and will work for South Africa.

In addition to substantial progress with respect to some of our key sector strategies, the implementation of successive iterations of IPAP has put in place the necessary critical transversal platforms to unlock growth and employment generation in a range of other sectors (DTI, 2013). Of particular importance are the following:

- The amendment of procurement regulations to designate key sectors for domestic production in relation to public procurement, particularly in relation to public infrastructure expenditure.
- On-going re-orientation of the Industrial Development Corporation (IDC) to provide appropriate financing instruments for priority IPAP and New Growth Path (NGP) sectors.
- Agreement and announcement of the Manufacturing Competitiveness Enhancement Programme (MCEP) aimed at upgrading value-adding and labour-intensive manufacturing sectors.
- Much greater strategic alignment of trade and competition policy with industrial policy.
- Greater and more concerted effort to tackle customs fraud, illegal imports and products that do not meet mandatory standards.

### **2.15.2 New Economic Growth Plan**

South Africa has been burdened with high unemployment levels that have negatively impacted economic growth, and all this has undoubtedly affected crime, inequality, and poverty levels that have drastically increased over the years. Inequality has largely been associated with unemployment, and the legacy of apartheid has become synonymous as well as the main reason why wealth distribution in South Africa has been unevenly spread among its citizens.

In response to these challenges, the New Growth Path was designed with the purpose of creating decent jobs, and reducing inequality and poverty by transforming the South African economy through improved labour absorption performance and taking into account growth factors. The New Growth Path for South Africa must provide bold, imaginative and effective strategies to create the millions of new jobs South Africa needs (DTI, 2010). Through combined macroeconomic and microeconomic interventions, the strategy sets out critical markers for employment creation and growth and identifies where viable changes in the structure and character of production can generate a more inclusive and greener economy over the medium to long run.

The New Growth Path requires addressing key trade-offs, and it is imperative that:

- Government employ and prioritise its own resources to support employment creation and equity;
- business take on the challenge of investing in new areas;
- business and labour work together with government to address inefficiencies and constraints across the economy and partner to create new decent work opportunities.

### **2.15.3 National Waste Management Strategy**

Waste has always been a global concern, considering that industrialisation focuses on production and consumption, and whatever waste is produced is rejected as useless. According to Rogers and Banoo (2004), minimising waste to South African industry and government means “improved efficiencies of existing operations, introduction of recycling activities to recover value from waste, and redesigning the products and services so as to avoid waste within the consumption life cycle”.

In the manufacturing sector, recycling of materials such as aluminium requires only 5% of the energy for primary production (UNEP, 2011b).

Waste management within industry has also been a very contentious matter, as this has received mixed attention, with some businesses addressing this as a priority, while others do not make the necessary effort to see and understand its financial importance and environmental benefits. Figure 6 below shows the waste management hierarchy and approach to waste, and this model is widely used.



**Figure 6: The Waste Management Hierarchy**

(Source: UNEP, 2011b:293)

Waste management in South Africa faces numerous challenges and the objective of the strategy is to provide a plan to address them (DEA, 2011). These main challenges include:

- A growing population and economy, which means increased volumes of waste generated. This puts pressure on waste management facilities, which are already in short supply.
- Increased complexity of waste streams because of urbanisation and industrialisation. The complexity of the waste stream directly affects the complexity of its management, which is compounded by the mixing of hazardous wastes with general waste.
- A historical backlog of waste services for, especially, urban informal areas, tribal areas and rural formal areas. Although 61% of all South African households had access to kerbside domestic waste collection services in 2007, this access remains highly skewed in favour of more affluent and urban communities. Inadequate waste services lead to unpleasant living conditions and a contaminated, unhealthy environment.
- Limited understanding of the main waste flows and national waste balance because the submission of waste data is not obligatory and where available is often unreliable and contradictory.
- A policy and regulatory environment that does not actively promote the waste management hierarchy. This has limited the economic potential of the waste management sector, which has an estimated turnover of approximately R10

billion per annum. Both waste collection and the recycling industry make meaningful contributions to job creation and GDP, and they can expand further.

- Absence of a recycling infrastructure which will enable separation of waste at source and diversion of waste streams to material recovery and buy-back facilities.
- Growing pressure on outdated waste management infrastructure, with declining levels of capital investment and maintenance.
- Waste management suffers from a pervasive under-pricing, which means that the costs of waste management are not fully appreciated by consumers and industry, and waste disposal is preferred over other options.
- Few waste treatment options are available and so they are more expensive than landfill costs.
- There are too few adequate, compliant landfills and hazardous waste management facilities, which hinders the safe disposal of all waste streams. Although estimates put the number of waste-handling facilities at more than 2000, a significant number of these are unpermitted.

Industry compliance has also been a very challenging issue, and understanding the value of waste to support sustainability within their business strategies has become more and more the approach taken.

The National Waste Management Strategy encourages the private sector to:

- take responsibility for their products throughout the products' life cycles;
- institute cleaner technology practices and minimise waste generation;
- establish systems and facilities to take back and recycle waste at the end of their products' lifecycle;
- develop waste management technologies to ensure that all the waste produced in the country can be managed according to the waste management hierarchy;
- prepare and implement industry Waste Management Plans; and
- comply with licence conditions and regulations.

This strategy also supports the NCPC–SA and its RECP Programme to successfully introduce its current Waste Industrial Symbiosis Programme (WISP), which is a programme that will build networks of businesses by identifying mutually profitable

links or “synergies”, so that under-utilised and under-valued resources from one business (materials, energy, water, logistics, assets and expert knowledge) are used by another, as well as the Industrial Eco-Innovation Project which targets and assists companies within industrial parks to exchange, wherever possible, generated waste from one company that could be used as an input raw material for another. This has proved successful within the United Kingdom, and replication is in the infancy stage at present.

#### **2.15.4 National Development Plan**

Since 1994, South Africa has transformed without any conflict and dispossession from apartheid to democracy. This transformation process has not come without a price, as 22 years into democracy South Africa remains a highly unequal society with high unemployment levels and where some people live in inexplicable poverty. The legacy of apartheid has cemented a culture where the racial divide still dominates, and still serves as the driver of opportunities for the poor majority. The National Development Plan (NDP) was therefore developed to address and eliminate poverty and reduce inequality by the year 2030.

South Africa can realise the goals of the National Development Plan by:

- drawing on the energies of its people;
- growing an inclusive economy;
- building capabilities;
- enhancing the capacity of the state; and
- promoting leadership and partnerships throughout society.

As a middle-income country, South Africa needs to use its knowledge and innovative products to compete (NPC, 2012). On its own, a more competitive cost of production will not be sufficient to expand the global presence of South African industry, and this applies to both new industries and traditional sectors such as mining. Innovation is imperative for a middle-income country to develop.

The NDP objectives for South Africa aim to address poverty and eliminate inequality, and the RECP programme could potentially contribute directly by creating more sustainable businesses through SCP initiatives that could improve their

environmental performances (assessments and LCAs) and result in job creation (internship programme).

### **2.15.5 National Climate Change Response Strategy for South Africa**

Expected greenhouse gas emissions in the near future, if not controlled and managed effectively, potentially have the ability to create a world where people and nations will be threatened by food and water shortages. Wealthier countries and individuals will be better able to adapt to the impacts of climate change, whereas the disadvantaged will suffer the most (Podesta & Ogden, 2007).

South Africa is the envy of the world with its climate, ideally suited to energy from sun and wind, backed up by biomass and biogas. Currently Eskom produces 40GW of power and seeks to double that by 2030 (Rabinowitz, 2012).

South Africa is a mega-diverse country of immense natural beauty that is blessed with an abundance of natural mineral, fossil and renewable resources. As a water-stressed developing country, it is also still dealing with the legacy of apartheid, the challenges of poverty and unemployment, the gap between rich and poor, low levels of education and the endeavour to deliver basic services to all its people (DEAT, 2004).

Based on the conclusions of the Intergovernmental Panel on Climate Change (IPCC) in its 4<sup>th</sup> Assessment Report, the South African government regards climate change as one of the greatest threats to sustainable development, and if not unmitigated, has the potential to undermine the Millennium Development Goals and its own developmental goals.

The objectives in the National Climate Change Response Strategy for South Africa (DEAT, 2004) include the following:

- Making a fair contribution to the global effort to achieve the stabilisation of greenhouse gas concentrations in the atmosphere at a level that prevents dangerous anthropogenic interference with the climate system.
- Effectively adapting to and managing unavoidable and potential damaging climate change impacts through interventions that build and sustain South

Africa's social economic and environmental resilience and emergency response capacity.

These objectives will be addressed by implementing strategies as outlined in the National Climate Change Response Strategy, and this is directly supported by RECP initiatives spearheaded by the mandate of the NCPC-SA as the sustainability vehicle of government. These initiatives are designed to address issues of climate change and environmental degradation concerns, and result in specific outcomes, including the reduction of greenhouse gas concentrations.

Reducing greenhouse gases and improving environmental performances have not been considered priorities for industry, and this can only be because the focus and importance of production and profits have taken precedence. Incentives in the form of the Carbon Tax Policy were therefore designed as part of a "carrot approach" and strategy of government, and this is discussed in the next section.

#### **2.15.6 Carbon Tax Policy**

With the global increase in material resource use and despite a fourfold increase in population, biomass's share of total material use has dropped significantly from three-quarters to one-third, indicating a significant growth of non-renewable resources over the past century (Swilling et al., 2013).

Environmental challenges, such as climate change, and air and water pollution, occur when the assimilative capacity of a particular environmental resource is exceeded. Society is affected by the resultant pollution, and the polluter is often not held accountable for the costs of such pollution. In economic theory, this is defined as a negative environmental externality, and therefore a market failure, because the costs of pollution are not reflected in the final prices of the goods and services.

To correct market failures and include these external costs in the price of goods and services, and hence ensure efficient and environmentally beneficial outcomes, the government intervenes by way of regulations or market-based instruments to influence the decision-making processes of producers and consumers (National Treasury, 2013b).

Therefore the National Treasury is in the process of sifting through a number of comments, including those of Business Unity South Africa (BUSA), in response to a policy paper released earlier in which it proposes a tax rate of R120/tonne of carbon dioxide equivalent, increasing at 10% a year during the first phase from 2015 to 2019. The Department of Trade and Industry argues that any carbon tax would have to take into account key structural features of the domestic economy to avoid the “real risk of shrinking or even closing existing energy-intensive sectors (Creamer, 2013a).

Several studies modelling the broad macroeconomic impact of a carbon tax for South Africa have been undertaken by, for instance, the World Bank, DEA (University of Cape Town for the Long-Term Mitigation Scenarios study), University of Pretoria, and National Treasury (Carbon Tax Policy Paper, 2013). All these studies indicate that the transition to a low-carbon, climate-resilient economy will depend on the current structure of the economy; the incentives for technical and behavioural changes; the way in which revenue is recycled; and the extent to which energy, transport, industrial and trade policies are coordinated with environmental policy.

BUSA also argues that the imposition of a carbon tax on the electricity sector would simply raise costs for the economy, without necessarily reducing emissions from the sector (Creamer, 2013a). This somehow has a two-pronged approach, and that is having detrimental consequences in terms of RECP receptiveness within industry, especially considering that huge businesses are setting internal targets to reduce their emissions. This could result in rising costs that could have negative implications for implementation of recommendations after assessments have been completed. On the other hand, industry through the RECP programme, can realise how they could reduce their resource costs and be more profitable at the same time, and through this intervention also reduce their greenhouse gas emissions and qualify for the Carbon Tax Policy.

The Carbon Tax Policy therefore serves as a mechanism to encourage businesses and industry to reduce their carbon emissions, and this will contribute towards achieving the country’s sustainable development goals, which are discussed in the next section, and that address concerns around poverty, inequality, economic development, ecosystems, etc.



### **2.15.7 National Strategy for Sustainable Development**

Sustainable Development has been one of the core discussions in South Africa since government's commitment at the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002. During a time that countries globally are experiencing high-energy demands, climate-change challenges and increased poverty levels, sustainable development strategies have become imperative to address issues such as human wellbeing and quality of life, which have been affected by inequality and poverty.

South Africa is an emerging economy and some significant progress has been made over the past 15 years to further grow this stable economy. But there are still significant challenges that need to be addressed in a manner that adheres to the principles of sustainable development (DEA, 2010). The development indicators are clustered into ten themes, and these are economic growth and transformation, employment, poverty, inequality, household and community assets, health, education, social cohesion, safety and security, international relations, and good governance.

The five strategic priority areas for action and intervention that are necessary to reach the desired state of sustainable development described in the national vision reflect a systematic and integrative approach and seek to transcend traditional divisions and sectors (DEA, 2010). These priority sectors, "pathways" to achieving sustainable development, are as follows:

- Enhancing systems for integrated planning and implementation.
- Sustaining our ecosystems and using natural resources efficiently.
- Economic development via investing in sustainable infrastructure.
- Creating sustainable human settlements.
- Responding appropriately to emerging human development, and economic and environmental challenges.

South Africa's current economic development path is based primarily on maximising economic growth – as measured by the gross domestic product (GDP), particularly through mining, manufacturing, and agricultural activities. This has resulted in an energy-intensive economy and an erosion of the resource base (DEA, 2010). Economic growth is closely aligned with the priority sectors of the government's industrial policy action plan, and addressing these sectors within a national context to

support the close linkages between economic growth, resource limitations, pollution, and human wellbeing. This requires strategic RECP interventions in the form of technical assistance, financial assistance for implementation, and innovative technologies to enhance competitiveness and support the sustainability of industries.

The challenges associated with sustainable development are particularly difficult in developing countries, where complex trade-offs between economic, social and environmental objectives must often be made (Nahman et al., 2009).

Achieving the development goals of the National Strategy for Sustainable Development can be considered a daunting task if the challenges that South Africa face are not clearly understood. Economic growth can only be achieved if the social and environmental objectives are achieved, and the NSSD can be supported in many ways by increasing environmental awareness through RECP programmes, which in turn can create stability in the social arena through job creation and business sustainability in terms of resource savings.

The next chapter discusses the research methodology used for this study, how the questionnaires were designed, and what the summarised responses were. It also highlights some of the limitations and ethical considerations that could impose on a study of this nature.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

The literature review in chapter 2 identifies some mechanisms that could potentially support and help address the challenges of the research questions that are highlighted in section 1.5. The carbon tax policy that is due to come into effect in 2017 is one measure that speaks directly to the financial implications of RECP implementation, and other cost saving interventions such as energy efficiency, water footprinting, life cycle approaches, environmental management systems, etc, can all contribute to sustaining or creating jobs, reducing unemployment and positively redirecting the economy.

However, to ensure that all this is effectively introduced and change happens, internal as well as external capacity needs to be advanced in the areas of resource optimisation. Based on the literature review this can be strengthened through adequate training in life cycle thinking, adopting sustainable consumption and production practices, and being able to understand on how to address the various elements that negatively impact the environment. Governments various policies also provide incentives through its Industrial Policy Action Plan, as well as the Carbon Tax.

Peter Drucker's "The Changed World Economy" (1986) is an exceptional source of theories and hypotheses. Drucker claims that the world economy has changed significantly from the past. He points to the "uncoupling" between the primary products (raw materials) economy and the industrial economy, a similar uncoupling between low labour costs and manufacturing production, and the uncoupling between financial markets and the real economy of goods and services (Yin, 2003). To test these propositions might require different studies, some focusing on the different uncouplings, others focusing on specific industries, and yet others explaining the plight of specific countries. Each different study would likely call for a different unit of analysis. Drucker's theoretical framework would provide guidance for designing these studies and even for collecting relevant data.

This dissertation draws on case study methodology (Yin, 2003) to identify and account for barriers and opportunities relating to RECP in South Africa. It also explores how these barriers and opportunities could create a more sustainable

platform for industry, and provide guidance for compliance with the stringent environmental regulations that are emerging.

There are three principal ways of conducting explanatory research, namely a search of the literature, interviewing experts in the subject and conducting focus- group interviews (Saunders et al., 2009). In this dissertation, case study methodology (Yin, 2003) is drawn upon, in particular, in order to ensure that questionnaires were robustly and rigorously formulated and the interview process objectively conducted. Results of the interviews were then tested against findings in available literature (both South African and global), and other evidence where possible. Interview results were thus not treated as empirical findings, but rather as heuristic guidelines that aided further inquiry into the subject.

### **3.1. Sample and Method**

Samples were drawn from a strategically selected group of companies within the clothing, textile, leather and footwear sector, the chemical sector and agro-processing sector. This was to ensure accurate geographical representation and a spread of companies, which are important because of the cultural and ethical differences that might exist between provinces.

After consulting the database of the NCPC–SA to access the names of companies that had previously participated in the three sector programmes mentioned above, as well as the names of those participating in current projects, management of these companies was contacted personally to discuss and sell the purpose of the research. This was followed by submitting the questionnaire either via e-mail or by faxing it to companies who had agreed to participate, with a call to confirm receipt of the questionnaire.

Questionnaires were constructed for three crucial groups consisting of industry, government, and consulting agencies. The reluctance to complete questionnaires within the SMME environment is well known, and this was overcome by physical engagement or continuous interaction telephonically. The advantage of this method is that cohesion can be strengthened through engaging with associations through seminars, conferences and workshops.

### 3.2. Design

A research design is the logic that links the data to be collected (and the conclusions to be drawn) to the initial questions of the study. In addition, the case study design needs to maximise four conditions relating to design quality: (a) construct validity, (b) internal validity (for explanatory or causal case studies only), (c) external validity, and (d) reliability (Yin, 2003).

Through a survey, primary data was gathered through established networks within industry and government, while secondary data was collated through international stakeholders within industry, environmental organisations and any other RECP-related role players. Through this qualitative approach the literature review in Section 2 highlights the various sustainable consumption and production tools as well as policy drivers for resource efficiency and cleaner production that may be of relevance to South Africa.

One key component investigated were the objectives of the various sponsors or donors since the introduction of RECP initiatives, and what the relevant individual accomplishments have been over the years. RECP programmes in many countries across the globe have reaped remarkably successful results during and after implementation, and UNIDO has reviewed the effectiveness of these programmes with all cleaner production centres across the world (Van Berkel & Kothuis, 2008). This was crucial in ascertaining whether industry-specific needs had been met and whether a more structured strategy might be needed to ensure that interventions have greater impact.

The approach used during this gathering of data period, which had incorporated a pre-consultation process to ensure buy-in, was to either directly distribute the questionnaires to the various stakeholders, or engage with them on an individual basis. Communication before questionnaire distribution was vital to ensure that all relevant information was collected from participating stakeholders, because the recommendations subsequent to publishing the final document would be crucial to all resource efficiency and cleaner production bodies in South Africa.

The questionnaires were designed to extract information from the stakeholder groups inclusive of industry, government and civil society, and these were specifically packaged to gain insight into: (1) why the lack of financial support is a barrier to

RECP implementation, (2) how this initiative could contribute to sustainable job creation, (3) why capacity constraints are considered barriers to implementation, and (4) what incentive opportunities are available to businesses participating in RECP initiatives.

Each set of stakeholder group's questions was uniquely designed to gain an understanding of each individual group's responses to the key concepts surrounding the research questions; the majority of these questions were either similar, or had commonalities, and were interlinked with the questions posed to the other groups. For example, the questions posed to industry were very specific as they interrogated industry's awareness of (a) the concept of RECP and what their perceptions of the methodology were, (b) what the level of technical capability was within their companies and what they thought could progress them to the next level of competence in this area, (c) their knowledge of whether incentives were in fact available to assist with implementation and how the RECP programme could create jobs, and (d) what initiatives outside of RECP (of which they knew) existed to provide a platform of environmental excellence.

The questions for civil society were more directed at the technical aspects from a service provider perspective, to understand whether this was an area that required attention or had sufficient capacity to assist industry. Government, on the other hand, is considered the key driver and support mechanism to not only enhance the environmental performance of industry, but also provide a platform of economic excellence to ensure sustainability outweighs the barriers that may exist.

Questions were therefore designed to gain insight into whether government understood the needs of industry, whether there was any financial assistance available to industry for implementation of RECP assessments, and to explore how cohesively state departments were working with one another.

Questions focussed on extracting information on the following:

- The types of recommendations to both small and large companies and whether these recommendations were applicable to the specific environment of operation.
- The types of training provided to company champions during the assessment phase and what were actually the requirements of industry.

- Government incentive programmes currently in place and what was actually required to assist companies with implementation of cleaner production in the future.
- The knowledge and understanding of RECP within industry and government.
- The importance of RECP and business sectors as a priority to governmental departments such as the Department of Environmental Affairs and the Department of Trade and Industry.
- The legal parameters for industry to operate within and comply with, considering the global environmental expectations for climate change, global warming and pollution prevention.

### **3.3. Ethical Considerations**

To apply and maintain a high degree of integrity, it should be noted that all participation was voluntary, and that industry, government and civil societal entities could withdraw at any given time. No information would be divulged to any other party and the confidentiality of the data provided by participants was guaranteed, with the intention of serving the future needs and purposes of both industry and government in terms of resource efficiency and cleaner production activities in South Africa.

A further concern was the influence of management at companies where the questionnaires were distributed, as employees are sometimes not allowed to participate and engage directly with external individuals, owing to the perception that certain confidential information might be shared without management's permission or knowledge.

Authorisation from management of the NCPC-SA was therefore granted to draft and submit letters to selected individuals that had previously participated in the RECP programme, and this was to assure especially industry participants that all information would be treated as confidential and that no mention of the company would be made.

Furthermore, ethical clearance has been granted by the Faculty of Business Research Ethics Committee and the Higher Degrees Committee at the Cape Peninsula University of Technology (CPUT) to proceed with this study.

### **3.4. Limitations and Challenges**

Because of the difficulties experienced in engagement with companies in the past, and especially with SMMEs, which are mostly operated by owners, it was sometimes very difficult to extrapolate information when distributing questionnaires before conducting the assessment.

The owner either performs operational, human resource and financial duties all on his/her own because of financial constraints in employing additional staff or is forced to use family members to manage these individual departments. This places strain on management, and could considerably affect the response time from participating companies. It was therefore imperative that a three-to-four week period was granted to respondents, and that continuous monitoring on a weekly basis be done.

The design of questionnaires was of vital importance as the questionnaires were used to extract the correct information from participants. They were designed and self-administered by the author of this dissertation. Three questionnaires were constructed to ensure that information relevant to each group was gathered, and these were distributed to industry inclusive of large companies and the SMME sector, government stakeholders and other organisations within the field of resource efficiency and cleaner production.

The survey collected opinions and data from 14 questionnaires completed by industry participants, 5 from government stakeholders, and 7 from other organisations as well as resource efficiency and cleaner production-related entities. Note that while these do not constitute statistically significant surveys, the design of questionnaires and interviews, as well as those who were targeted, ensured that the factors that are most salient to this study were extracted with a reasonable degree of confidence. These were then cross-referenced and tested against the broader body of literature and empirical evidence (i.e. both global and local) where these were available.



Cases within various sectors were comparatively analysed to assess the phase of implementation and the inhibitive factors that had prevented companies from introducing recommendations within their business, as well as how government had formally provided financial assistance to these companies.

It is important that industry be exposed to their environmental pollution limitations, and questions reflected strongly on referential direction and guidance to provide companies with conclusive ideas on ensuring compliance. A list of companies was selected, and a sequence of interaction with companies was prepared with timeframes to ensure that an effective process of engagement took place.

The information-gathering process was of utmost importance as it identified areas of weakness and challenges hampering resource efficiency and cleaner production implementation, as well as key incentive mechanisms available to support industry on ascertaining their short- and long-term environmental goals. Information sharing is the key to success for any organisation, but a mythical perception exists that industry is very resistant because of concerns that competitors might gain access to this information. Government has also restricted the sharing of information as a result of political conflicts and tensions between ministries, which sometimes deteriorate within the tiers of local and provincial government.

Elaboration on certain key focus issues such as the key challenges faced and project failures experienced is limited because of political agendas and levels of cooperation among developing and developed countries. The relationship between countries in the developing world still needs to be harnessed to the extent that the level of trust can be strengthened. Developed countries, however, have become the catalyst in assisting poorer communities because of their endeavours to fund and support projects within these countries.

## CHAPTER FOUR

### RESULTS

This section presents the information provided by the respondents within the three target groups, and based on the responses, some salient elements were identified as either barriers or opportunities that could have a potential influence on RECP in general. These areas are discussed in detail below. The following key elements were identified from an analysis of the questionnaires:

- A. The levels of awareness raised concerns that the RECP programme was not familiar to many.
- B. The level of expertise of service providers to validate the specific outcomes as initially presented or marketed to industry.
- C. Internal expertise within companies to ensure sustainable practices and implementation.
- D. The priorities of industry to ensure alignment of resource optimisation to business imperatives to meet triple bottom-line criteria.
- E. In-depth promotion of incentive programmes for industry to ascertain viability of RECP assessment recommendations and meet capital investment requirements beyond the boundaries and limitations of companies.
- F. Responsiveness to cleaner technologies to revitalise and shift industry in using more efficient equipment to reduce costs and at the same time increase profitability.
- G. The receptiveness to international initiatives that might help boost industry and make it more competitive within the global economy of trade.

The tables and responses highlighted below are crucial to understand what the barriers and opportunities for RECP within South Africa are, and to also ascertain what the understanding of each group is and to help elevate or redirect energies relating to certain key aspects, such as the importance of decoupling, economic growth, sustainable consumption and production, and others. It should also be noted that certain respondents could respond with both a YES and NO, as they could partly agree and disagree with respective questions, because of having both biased and unbiased views.

Below are the tables of respondent groups as received, and just below are areas of discussion that require further intervention and support to some degree.

**Table 1: Industry Responses**

QUESTION	YES	NO
1. Were you aware of the concept Resource Efficiency and Cleaner Production (RECP) at the time of engaging with the NCP-CA?	5	9
2. Did you find the RECP assessment a useful and value-adding initiative for your business?	14	
3. Was sufficient clarity provided on the processes and formalities by the RECP team throughout the assessment?	14	
4. Was the service provider employed to conduct the assessment adequately equipped in terms of expertise and knowledge?	14	
5. Did you find that the employees within your business were aware of the cleaner production assessment and the concept of RECP?	7	7
6. Do you think that sufficient training was provided to your internal champion?	8	5
7. Were the RECP recommendations identified during the assessment, feasible for implementation?	14	2
8. Did the assessment meet the needs and expectations of management?	14	
9. Were any of the recommendations implemented?	11	6
10. Did the company have internal resources/manpower to manage the implementation process?	9	4
11. Were any recommendations specific to the need for cleaner technologies?	9	7
12. Are you aware of any government incentive programmes that exist to assist with implementation?	10	4
13. Have you tried accessing these incentive programmes?	5	8
14. Having participated in an RECP assessment, do you think that it has added value to your bottom line?	13	3
15. Do you think that RECP initiatives have the potential to	11	3

create additional jobs within your business?		
16. Are you familiar with other environmental concepts such as Eco-labelling, Life-Cycle Management, Environmental Management Systems, Life-Cycle Assessments, Life-Cycle Thinking, Carbon Foot-printing, etc.?	9	5
17. Do you think that government understands the needs of industry?	5	8

**Table 2: Civil Society Responses**

QUESTION	YES	NO
1. Are you familiar with the NCPC-SA and its programmes?	7	0
2. Are you familiar with the concept Resource Efficiency and Cleaner Production (RECP)?	7	0
3. Have you ever participated in RECP projects of any nature?	6	0
4. Do you think that within the global RECP environment there are adequate technical support structures in place?	4	3
5. Do we have adequate technical support structures in place within South Africa?	5	2
6. Do you think that RECP initiatives have the potential to create additional jobs within industry?	5	2
7. Are you familiar with other environmental concepts such as Eco-labelling, Life-Cycle Management, Environmental Management Systems, Life-Cycle Assessments, Life-Cycle Thinking, Carbon Foot-printing, etc.?	7	0

**Table 3: Government Responses**

QUESTION	YES	NO
1. Were you aware of the concept Resource Efficiency and Cleaner Production (RECP) at the time of engaging with the NCPC-SA?	4	1
2. Are you actively involved with projects relating to the NCPC-SA and other RECP initiatives'?	5	0
3. Do you consider industry's environmental performance as important as economical performance in terms of sustaining	5	0

industry?		
4. Do you think that the projects and initiatives undertaken by the NCP- SA are effective and of value to support industry?	5	1
5. Is any financial support available from your department to assist industry with implementation of RECP assessment recommendations?	4	1
6. Are you aware of any other government incentive programmes that exist to assist with implementation of RECP?	2	3
7. Do you think that RECP has added value to industry over the past few years?	5	1
8. Do you think that RECP initiatives have the potential to create additional jobs within the South African industry?	5	
9. Are you familiar with other environmental concepts such as Eco-labelling, Life-Cycle Management, Environmental Management Systems, Life-Cycle Assessments, Life-Cycle Thinking, Carbon Foot-printing, etc.?	5	0
10. Do you think that government understands the needs of industry?	4	1

Therefore based on the questionnaires and responses of each target group and to also grasp the understanding of each group, the various elements identified will be discussed in detail within the section below. Note that where reference is made to the numbers of yes or no responses obtained in the following sections, these are not considered as statistically significant accounts, but are merely being reported upon as the outcomes of this study, and remain restricted to this study alone.

#### A. Awareness

##### 1. Programme Awareness

Promoting resource efficiency and cleaner production nationally to industry can be challenging if the programme does not reach all involved stakeholders. Some of the priority sectors identified in the industrial policy action plan have achieved more success in terms of penetration, while others have seen less participation. This also reflects the dominance in certain provinces, for example, clothing and textiles in the

Western Cape and KwaZulu-Natal (agro-processing being fairly big in the Western Cape), with mining and chemicals having a huge presence in Gauteng. Energy and resources are therefore deployed to elevate industries and businesses in the three main GDP contributing provinces, and lesser concentration and projects take place in smaller provinces in terms of economic contribution.

Based on the completed questionnaires returned, it is important to note that 16 were aware of the NCPC-SA and the offerings of the organisation, whereas 10 had no idea that the programme existed.

Industry reflected the greatest lack of awareness of the RECP programme, with 9 of the 14 having no knowledge of the programme. Civil society, on the other hand, seemed well aware of the programme, whereas 1 of the 4 government respondents acknowledged that she had no knowledge of the NCPC-SA's existence.

Government survey responses also indicated familiarity with the NCPC-SA, as some departments had been directly involved with the inception and establishment of the programme in 2002 (refer to Appendix C, A.1). Another indicated that he had been the manager of the programme.

It is important to note that government designed this programme to assist industry technically, and at a national level the objectives had been discussed and agreed to among all the relevant departments. Communication to provincial and local governments therefore became part of the deliverables of the programme, with industry awareness taking place through associations and other stakeholder forums.

This is crucial in extending the footprint of the programme across South Africa, and engaging with industry bodies in collaboration with government becomes key to successful awareness creation. Opportunities and platforms such as this prove to be impactful as the understanding of programme awareness is better received and has far more depth and reach in terms of numbers.

Awareness can therefore be considered instrumental to the success of the RECP programme, and effective marketing could be key to penetrate industry and promote the importance as well as the benefits of adopting methodologies that could result in resource optimisation.

## *2. RECP Concept Awareness*

The responses around the familiarity of the concept of RECP received from the civil society group highlighted that they were much more aware of the topic as they operated within the environmental field. Civil society also responds positively in terms of NCPC–SA recognition and awareness, as some members of civil society have either been directly or indirectly involved with programmes relating to RECP locally or abroad. One participant stated that globally, RECP is enjoying increased attention and a number of multilateral agencies provide support for it (refer to Appendix B, A.6).

This is supported through the green economy report that allocating up to 2 percent of global GDP (approximately US\$ 65 trillion in 2011) over the next 40 years to jump-start a green transformation of the global economy would generate as much growth and employment as a brown economy, and outperform the latter in the medium and long run, while yielding significantly more environmental and social benefits and reducing the risks of global climate change (UNEP, 2013b).

Of the five government respondents, four had been aware of the programme, but one acknowledged that she was not aware of it until she had been formally introduced to members of the NCPC–SA. This though is a common finding, as some departments within national government were not aware that the programme existed, other than the Department of Environmental Affairs and the Department of Trade and Industry.

Of the 14 industry responses to whether employees within the business were aware of the assessment and the concept of RECP, seven confirmed that they were, whereas the other seven admitted that they had only become aware after the respective project managers had engaged with them. One civil society respondent indicated that RECP was not a support mechanism in itself, but that the NCPC–SA provided this support to industry in implementing RECP (refer to Appendix B, A.2). Another indicated that companies are generally production focused and often do not have the time or budget to analyse innovative alternative RECP approaches, as well as not being exposed to the latest developments in technology.

It is important to note that project managers within the NCPC–SA have undertaken activities to increase awareness, and some level of direct intervention was initiated through various means of engagement such as the Cape Clothing and Textile Cluster

as well as through contact with eThekweni Municipality and other platforms where presentations were delivered (refer to Appendix A, A.1). This has proved to be a key component in the awareness campaign in both the recruitment drive as well as in transferring knowledge relating to resource efficiency and environmental improvement programmes of government.

What is evident in assessing the above, is that the awareness component of the RECP programme and concept is severely lacking among respondents in the CTFL, agro-processing and chemical sectors. This can be identified through the better response of civil society respondents who clearly expressed their knowledge and involvement within the RECP domain. Government, on the other hand, seems to be on the same wavelength as civil society, as they were involved with the establishment of the NCPC-SA in 2002.

The NCPC-SA, through its project managers, also seems to have been instrumental in gaining access to industry, but this does not seem to have been enough, considering the input from respondents who admitted that they were unaware of the centre or the programme until approached by the NCPC-SA.

#### *B. Service Provider Expertise*

Of the 14 industry respondents on the level of service provider expertise, all confirmed that consultants were adequately equipped to conduct the assessments at their individual plants. One industry respondent indicated that concepts were clearly explained and backed up with detailed workings on current costs, recommended alternatives, projected savings and the capital investment required to realise those savings, and that a detailed final presentation was given outlining the outcome of the assessment (refer to Appendix A, B.6). Another respondent highlighted that the service providers demonstrated a deep understanding of their subject matter, for example, good knowledge of the tanning industry, and that they also explained their process and associated results in an “easy to understand” way.

A respondent from civil society emphasised a lack of willingness to be innovative, and apathy regarding implementing changes. Senior management within a company was required to make this an operational requirement to constantly try to improve efficiency (refer to Appendix B, A.13). Furthermore, another implied that on a



technical level, there is no common structure that acts as technical radar to describe clean technologies, and every consultant has to work on his/her own little exchange of experiences (refer to Appendix B, A.6).

One civil society participant demonstrated the effectiveness of the NCPC–SA that has trained and technically equipped many consultants in general principles of RECP, as well as in specific systems' optimisation training such as steam, compressed air, etc. (refer to Appendix B, A.8), while another highlighted the numerous private sector consultancies that offer the same service, with the NCPC–SA playing a pivotal role in supporting them.

There are four main groups of service providers that play a role in the South African energy services market (GreenCape, 2017), namely:

- consultancy service providers
- technology suppliers
- energy service companies (ESCOs)
- engineering procurement contractors.

Supporting suggestions (refer to Appendix B. A.10) were also made to strengthen the service-provider base, and priorities included the following:

- Knowledge of business decision making at management level.
- Knowledge of economic challenges.
- Competencies to convince companies to follow up and support the implementation process.

In evaluating the above responses, there seem to be adequate competent service providers within the RECP domain, and this is supported by industry feedback in the completed questionnaires, whereby it highlights that adequate, clear and concise information was provided to management. One respondent noted that clear and concise information was provided, along with graphs and slides, and continuous discussions between the service providers and company representatives strengthened the ability to implement the recommendations more amicably (refer to Appendix A, B.6).

A shortfall, however, is the point raised by one industry participant, stating that the finer details around the anaerobic digester were not clear, and this vagueness

resulted in the recommendations provided being delayed. On the other hand, adequate training has been provided according to civil society respondents, and the courses provided by the NCPC–SA has been supportive to service providers in providing a more holistic and in-depth assessment to industry.

It is important to note that the RECP intervention could vary from company to company and sector to sector, and the depth of the assessment is very dependent on the expertise of the service provider and needs of the company. This therefore necessitates that service providers have more sector-specific engagements to gain technical understanding and expertise.

This will stimulate and support the interrogation of technical offerings, and also provide a platform and opportunity to interact with experts and debate constructive options to improve, which will then also strengthen the programme's objective of satisfying the needs of clients.

### *C. Lack of Internal Technical Expertise*

Technical personnel and training for internal champions based on the response from industry, highlighted that eight agreed that sufficient training had been provided across sectors, whereas five felt that not enough was done to meet their expectations. Internal environmental programme committees—according to industry questionnaires completed—reflected that businesses are conscious of the environment and the impact that global pressures have on industry and the economy.

In terms of recommendations, the majority of options identified by industrial participants acknowledged that most of them were feasible for implementation. However, the time and cost of implementation were important. Even though all participants indicated that the RECP assessment met the needs and expectations of individual companies, one participant indicated that they lacked the internal resources to manage implementation in terms of the themes of water, energy, materials, and waste (refer to Appendix A, D.10).

Of the 13 respondents on internal capacity to manage the implementation process presented in the tables above, nine indicated that they were adequately equipped, whereas four mentioned that they had little or no resources. One civil society

questionnaire respondent identified the lack of implementation training within the Industrial Energy Efficiency Programme (IEEP) of the NCCPC-SA, and contended that this was a costly exercise to do, owing to the detailed level of design and liability issues arising from this level of professional advice (refer to Appendix B, A.8). Another barrier highlighted that is specifically true for South Africa, according to this respondent, is the need for more project management capacity, and more consistent orientation to implementation plans.

The IEEP has provided training to hundreds of individuals, including service providers and company champions, and has proved its value by the number that has acquired accreditation to intervene at the level required by industry.

One civil society respondent indicated that key individuals had been identified and were part of an awareness and feedback meeting with management. He also mentioned that numerous people had been identified from all areas of the organisation, especially areas where the assessment had the greatest impact. Meetings involved employees who held supervisor and management positions, and he stated that any awareness information should not only be provided to management, but also to individuals at lower levels such as supervisors and key line operators (refer to Appendix A, C.8).

What comes out strongly from respondents in industry is that company champions lack the expertise and training as indicated above in Table 1, and even though the environmental consciousness is present or does exist, the importance of a dedicated source to implement the recommendations seems to be a hurdle that needs to be crossed. It is of utmost importance that all employees who are directly affected by the RECP assessment be part of all meetings and be made aware of the interventions that are taking place at the plant.

To ensure that an intervention of this nature is impactful and implementation is followed through to create a more environmentally conscious platform, a collective approach and team effort are required. Identifying individuals at all levels within industry is therefore a crucial aspect to be considered as contended by civil society, and this is imperative as it lays the foundation for implementation to be managed.

In conclusion it can generally be surmised that there is a pressing need in South Africa for resources, skills and training, project management, and effective engagement at all levels of organisations.

#### *D. Industry Priorities*

Of the four completed government questionnaires, all acknowledge the importance of industrial environmental performance in comparison with economical performance, as it is crucial to sustaining industry. Of the three industry sectors interviewed, participants brought to the fore the importance of *awareness raising and training for personnel to prepare themselves for the regulative and legislative mandates* that could be anticipated, as well as the *financial and implementation support* required. This includes drafting of policies, and recommendations of how these policies can be reflected in Quality Assurance programmes and job descriptions (refer to Appendix A, E.18).

Guidance in terms of environmental legislation and imminent legislation changes are also important (for example, the Air Quality Emissions Act licence requirements), and this needs to be done to alert companies (due diligence) and not to prescribe things, which ultimately is the responsibility of government enforcement agencies. Guidance is also required on the development of Integrated Waste Management Plans (IWMPs), and the need for carbon foot-printing assessments as South Africa gears towards the development of the Carbon Tax in 2015.

In terms of RECP intervention, supporting *job creation* within participating businesses, approximately 11 of the 14 respondents seemed positive that this was happening. Reasons for this positivity (refer to Appendix A, F.20) include:

- *savings on cost* that makes more money available for business expansion
- available positions for waste matters;
- RECP initiatives helping to become a low-cost producer with potential increasing volumes, and the possibility of creating more jobs; and
- implementing energy savings that positively affect the bottom line, protect existing jobs, and in turn stimulate growth and employment, and *boost competitiveness*.

Section 2.14.2 discusses government's strategy within the new growth path to create and grow employment, and it also emphasises the need to change the structure and character of production to generate a greener economy over the medium to long term (DTI, 2010). Some inputs to the job creation component include a participant (refer to Appendix A, F.20) stating that savings and increased efficiency do not necessarily translate into more demand or higher capacity, and another mentioning the risk of adding to their already high cost structures.

Industry participants shared their views that government partially understands the needs of industry, and this is because of the existence of various support programmes. This includes Department of Industry (DTI) initiatives like the Productivity Incentive Programme (PIP) and the Cluster Initiative Programme (CIP), the Manufacturing Competitiveness Enhancement Programme (MCEP), Green Energy Efficiency Fund, and the Development Bank of Southern Africa's (DBSA) Green Fund (refer to Appendix A, F.22).

There is a need for a legislative framework and a concerted information campaign to persuade industry to adapt to and invest in RECP initiatives to ensure environmental sustainability (refer to Appendix C, B.6). An example of this is the National Environmental Management Waste Bill: Section 2.14.3 highlights the purpose and importance of this piece of legislation, through recycling activities and the recovery value from waste to redesigning opportunities.

Industry participants highlighted the lack of understanding of government in respect of training. It is crucial that Government needs to work more closely with industry to understand its needs and establish partnerships. Industry participants also noted that environmental legislation departments need internal resources to assist industry with implementation and know-how. This is because the current status quo advises industry to employ the services of consultants because of uncertainty of how to proceed, but at the same time industry is penalised for poor environmental performance.

Local industry competing against imported products is also highlighted as a constraint, and it is suggested that government subsidise or incentivise local manufacture to support local producers. One interesting contribution from industry participants was the suggestion that municipalities acquire greater skills and resources to assist industry in monitoring progress and resolution of disputes.

Government needs to introduce and create an environment where investors express interest in South Africa as a potential opportunity, and this will force businesses to operate more efficiently (refer to Appendix A, E.22).

Even more important are industries that provide input materials to labour-intensive downstream producers, for example, textiles and leather, because they supply the clothing and footwear manufacturers (refer to Appendix B, A.11). Another recommendation identified is more advanced sustainable intervention and approaches besides RECP in the textile sector, and this includes foot-printing, LCM, eco-innovation, etc.

Focus, according to another civil society respondent, has to be placed on those industrial sectors that are important for South Africa, and this could be economic importance, employment importance, environmental importance, etc., and energy and funds should be directed at medium and large companies, and less at SMEs.

Companies also need to be exposed to what is happening in similar sectors in other developing countries. This could be achieved through knowledge exchange such as study tours and networking between companies in similar sectors; new technology updates should also be a compulsory requirement (refer to Appendix B, A.14).

Government tends to create challenging environments for businesses in prescribing specific codes for payment grades, and does not always provide sufficient facilitation in using local expertise rather than importing from elsewhere. The National Development Plan in Section 2.14.4 argues that more competitive cost of production is not sufficient to expand the global presence of South Africa, but that it is imperative that innovation comes to the fore to strengthen this capability even further (NPC, 2012). On the positive side, there is considerable funding and institutional support available to industry, such as that managed through the Industrial Development Corporation (IDC), and this shows that government is receptive to the needs of industry (refer to Appendix B, A.16).

RECP also leads to increased demand for recycling and for cleaner technologies, according to one civil society respondent, and this creates jobs as an alternative technology, for example, in energy-efficient equipment, thereby increasing the demand for sustainability managers over a period of time (refer to Appendix B, A.17).

Industry greening is seen as a major component of the green economy, which has been adopted by most economies of the world to counter the 2008/9 economic melt-down (refer to Appendix C, A.4). Green jobs are seen to be the solution to high unemployment rates, and industry's environmental performance is key to energy and resource efficiency, which generates resource security. Industrial sustainability is dependent on resource security, as without resource security there will be no investor certainty and no investment in industry. This will result in the collapse of many industries because of poor access to quality resources.

The cost of doing business has escalated, for example, through levies, taxes, abatements and fines, and the end-of-pipe solution has proved to not be the best solution (refer to Appendix C, A.5). Thus industry needs support on identification and prioritisation of improving business competitiveness, while minimising environmental impacts.

New jobs will include energy, water, materials and waste managers, who will ensure that these resources are utilised responsibly throughout the enterprise. In-house industry trainers and private consultants should also be offering training and advocacy in sustainability capacity building, measuring and verification. Practitioners must also be in place to certify efficiency improvements for soil, water and air specialist, and also business advisors to facilitate access to government incentives.

Industry highlights the importance of government partnering and working more closely with companies to understand their needs and provide assistance in terms of their meeting environmental needs and complying with legislation. This is imperative as highlighted in Section 1.2, as resource depletion and waste production are approaching critical levels where essential resources such as water and energy are concerned. The aggressive methods used by industry for extraction influence how national governments formulate, implement and enforce policies that categorically prescribe and dictate how effectively and at what rate the shift from high- to low-carbon intensive economies will occur.

Also the importance of attracting investors will harness the thinking of businesses to evaluate their environmental performance strategies and reposition themselves to operate more efficiently, and in turn create jobs in pursue of government's New Growth Plan. This, according to industry, can also be achieved through supporting local producers and providing some subsidy or incentive mechanism to allow them to

become more competitive, and at the same time could potentially increase demand for cleaner technologies as quoted by one civil society respondent. This will create jobs as an alternative technology.

#### *E. Incentive Programmes*

RECP implementation could potentially be seen as costly to businesses that don't have access to incentives or mechanisms of financial assistance, and of the industry questionnaires completed on the awareness of incentive programmes, 10 of the 14 indicated that they were aware, whereas 4 were not aware of the programmes. Only 5 of the 14 had tried accessing these, while 8 had not done so at the time of completing this questionnaire.

The ones that knew of the respective incentive programmes, had either heard of them through the NCPC-SA or the Industrial Development Corporation (IDC). Only 5 of the 13 companies interviewed had tried accessing these incentives, with some being eligible for the Eskom and IDC incentives. The other 60% mentioned that they were either following up or had not been successful (refer to Appendix A, E.17).

The majority of participants who had not tried accessing these incentive programmes highlighted reasons such as government departments being difficult and the process being very time-consuming, not being aware of what was available, and application forms being complicated (refer to Appendix A, D.17). This is an area that requires a tremendous boost, as the incentives are made available to industry by government to assist individual companies with implementation and ensuring continuous internal improvement based on the intervention made initially.

One civil society participant specifically touched on the aspect of implementation, and identified the importance of available financial resources at the beginning of the project (refer to Appendix B, A.13). Of the government questionnaires completed, two of the five mentioned that they were aware of incentive programmes that existed, whereas three contended that they were not aware of such programmes.

One government respondent noted that available incentive programmes include the Green Fund, Manufacturing Competitiveness Enhancement Programme (MCEP), Manufacturing Incentive Programme (MIP) Cluster Incentive Programme (CIP), Productivity Incentive Programme (PIP), and a new incentive scheme made available



by National Treasury and announced in 2012, which supports investment in replacing inefficient plants and equipment with cleaner and more efficient technologies (refer to Appendix C, B.7).

Another highlighted the availability of the Green Economy and Industry Greening Policies aimed at developing the skills component through education at different levels and focusing on daily energy, water and materials usage, along with recycling and reuse responsibilities (refer to Appendix C, B.8).

Incentive programmes to assist industry are readily available, based on the responses from two government participants, whereas three indicated that they were not aware of any of these mechanisms. Considering the responses from industry, it should be noted that some are not familiar with these programmes, which clearly indicates that to some degree marketing of these available mechanisms has either not been successful, or the methodologies and stakeholder approaches have not clearly been defined and should be re-evaluated to create a more impactful strategy of dissemination. Silos of government communication also serve as barriers, as some national, provincial and local departments were not aware of incentive programmes that existed to support RECP implementation within industry.

Of those industry participants that are aware of the incentive programmes to assist with implementation of the RECP recommendations, some place heavy emphasis on the tedious application process and the lack of governmental support to complete these applications. The importance of collaboration and interaction between government, industry and even RECP service providers is crucial in terms of capturing the successes of assessments concluded at participating companies.

#### *F. Cleaner Technology recommendations*

Of the completed questionnaires received, 8 of the 14 industry respondents indicated that recommendations specific to cleaner technologies were made, whereas 6 felt that none were made in this regard. One respondent felt that more than half of the recommendations included the introduction of cleaner technologies, and this required some substantial investment cost in terms of the industry competencies.

With regard to viability, one company respondent highlighted the value of pursuing alternative cleaner technologies, but had a concern about raising finance, especially for cleaner technologies (refer to Appendix A, D.15). One other respondent, however, received the cleaner technology recommendation with open arms by investing in implementation (refer to Appendix A, D.15). One civil society respondent suggested that a cleaner technology database of what is feasible and how it is applied be introduced, and also examining some technology matching exercises with overseas sectors and how they survived (refer to Appendix B, A.10).

Cleaner technologies have become an important mechanism that can be used to enhance the competitiveness of industry, as they have the potential to elevate performance and address the shortfalls that exist within most of the economic priority sectors within South Africa.

#### *G. Other Environmental Initiatives*

Of the seven industry respondents questioned on whether they knew of the existence of other environmental programmes, all replied that they were unaware of any. Government and civil society respondents all expressed their knowledge of other environmental programmes, with some mentioning initiatives such as eco-labelling, environmental management system ISO 14001, carbon foot-printing, water foot-printing, ISO 50001 energy management systems, and life-cycle management, amongst others.

One industry participant indicated that they were already applying King III protocols, another following OEKO-TEX<sup>®</sup> label requirements, and one was in the process of getting an environmental management programme, ISO 14001 (refer to Appendix A, E.21). Eco-labelling as mentioned in Section 2.5, has the potential of encouraging production to be more environmentally friendly, and this in turn stimulates the facilitation of trade in these products (Royal Society of Chemistry, 1998). On the other hand, another participant had reviewed environmental concepts, and understood how it affects the sustainability of their business.

According to a civil society respondent, supporting industry in improving their environmental performance can be done through links with RECP intervention and other benefits that would allow companies to reposition their products and brands

better in the market, for example, labelling, corporate social responsibility, environmental reporting, and using techniques such as foot-printing to show in concrete numbers the opportunities for actions which can also be used as a basis for monitoring (refer to Appendix B, A.14).

For example, as mentioned in Section 2.10, it states that water foot-printing is fast becoming a popular way of understanding the total water input to consumer products such as beverages, food and clothes. This enables businesses and consumers to understanding the level of greenhouse gas emissions created by their activities, as well as create awareness of how and where these precious resources are used (SAB Miller & WWF, 2009).

Furthermore, one civil society respondent stated that it is normally assumed that companies are sensitised to the issues of resource efficiency, sustainability, etc., but the life-cycle approach is the most important one to improve environmental performance of industries. This not only brings industries into the path of sustainability, but if companies think and adopt a life cycle approach, they recognise the overall importance of resource efficiency, including life-cycle costing (refer to Appendix B, A.18). Section 2.4 supports this by stating that life-cycle approaches ensure the prevention of shifting problems from one cycle of the stage to another. This implies that life-cycle assessments are important for sustainability (UNEP, 2005).

One civil society participant stated that all environmental programmes/initiatives have their place in industry and companies will be at different levels in using these tools and techniques. The way to promote these initiatives to industry is through highlighting their benefits. This, for example, can be done through eco-labelling and its marketing strength; Life-Cycle Assessment, looking at the full value chain; Life-Cycle Costing highlighting the cost of operating inefficiently; and environmental management systems formalising the impacts on a day-to-day basis and providing stability to mitigate these impacts.

According to government questionnaire participants, environmental initiatives such as life-cycle management, eco-labelling, life-cycle assessments, environmental management systems, and carbon foot-printing, all result in access to sensitive markets which will promote trade and this essentially means growth (refer to Appendix C, C.12). Section 2.5 supports this to some degree; with eco-labels for

example, producers of environmentally friendly superior products can use these as an incentive to differentiate their products, gain extra market share and also improve their public image (Janisch, 2007b).

Bearing in mind that the results of the questionnaire and interview processes were not statistically significant, their qualitative interpretation needs to be grounded in experience, empirical evidence and available information. In this respect, the next chapter interprets the results of the research by making use of the author's experience in the field, as well as by referencing the findings of other bodies and studies. Moreover, chapter 5 interrogates each element individually in order to ensure that the information collated is reliably packaged for the identification of possible solutions.

## CHAPTER FIVE

### SUMMARY OF RESULTS

Chapter four identifies and summarises the crucial elements that influences RECP and the implementation thereof, and these elements directly or indirectly exposes the vulnerability of sustainability specifically on the environment and surrounding society. Aligning potential solutions in the form of effective government marketing and communications, incentives, training, sustainability projects, and also providing clean and innovative technologies, has proven to be challenges that needs to be addressed, and overcoming this could support the upliftment of industry and the economy.

The completed questionnaires broadly indicate that policy and legislation adherence has become more stringent, and by providing good policy frameworks for RECP projects and other environmental programmes, support will be provided to create a platform to encourage sustainable consumption and production practices.

However industrial support through effective policy communication such as Industrial Policy Action Plan, New Economic Growth Plan, the New Development Plan and Carbon Tax as discussed in section 2.14 above, can prove useful in repositioning and strengthening the offerings of government departments in terms of RECP. These platforms could be pivotal in raising awareness and understanding the importance of resources. Pertinent concerns and challenges could potentially be addressed with businesses should collaborative engagements take place with vehicles such as associations and NGO's.

It is clear when perusing the completed questionnaires, that **awareness raising** within industry is lacking, hence the poor uptake and understanding with regard to the National Cleaner Production Centre South Africa (NCPC-SA) and Resource Efficiency and Cleaner Production (RECP) methodologies and approaches in the CTFL, agro-processing and chemical sectors.

This does not necessarily mean that the concept of RECP is non-existent, as it appears indirectly in many forms or terminology such as lean manufacturing, world-class manufacturing, continuous improvement, etc.; this has been covered

extensively in many businesses in respect of the extent to which it affects human behaviour.

What came to light as a challenge, based on the response of industry is that the involvement of employees was not considered important and a priority during the RECP assessments, and this prevents cooperation during the implementation process. This challenge has been a bone of contention in terms of acknowledgment by industry, but is extremely critical to ensure the sustainability of South African industry and certain sectors that have suffered severely over the years. Strengthening internal technical expertise by actively participating in the project lifespan becomes the bridging link to ensure successful understanding and implementation of recommendations.

The **expertise of service providers** on the other hand also need to be reviewed from a diversity perspective, as packaging an overall range of service to industry is regarded as best value adding. Therefore besides the RECP intellect to enhance the resource aspirations of industry, service providers require other crucial components to holistically be able to satisfy the needs of businesses, and this includes introducing extended assistance through projects such as life cycle assessments, water-footprinting, waste to energy solutions, and many more that will help alleviate and address urbanisation and unemployment challenges. These additions to the NCP-SA's service delivery arm could also positively influence economic growth and ensure that proper sustainable platforms are put in place.

Environmental resource economics has much to offer in helping to overcome the challenges associated with sustainable development in developing countries. However, the developing country's context needs to be taken into account before applying environmental resource economic tools and methods. In particular, the unique and often complex socio-ecological context of developing countries needs to be considered and integrated into policy and management prescriptions (Nahman et al., 2009).

South Africa can benefit from rapid growth in developing countries that should lead to an increased demand for commodities and the expansion of consumer markets. At the same time, these trends pose challenges for middle-income countries as a result of greater competition in manufacturing and certain information technology-enabled services. The rise of emerging markets also increases international competition,

placing downward pressure on the wages of low-skilled workers in tradable sectors (NPC, 2012).

Synergy between businesses and government is required to move to a more sustainable pathway, but this requires alignment of **industry priorities** from both. The feedback of respondents is captured and discussed in detail above from different viewpoints, and it is crucial to communicate the feedback from each to all affected parties. This will create one vision and eradicate the distortions and barriers that exist that prevent growth and development.

Scenario analysis can help to provide better future direction to industries, while eco-industrial parks could improve the efficiency of usage of available resources and waste products through synergies among different industries on a regional basis. Sustainable manufacturing within industries such as micro-machining, cement and leather could further reduce consumption of natural resources (Jegatheesan et al., 2009).

The National Business Initiative Private Sector Energy Efficiency Programme had assisted approximately 950 companies with fully – funded energy efficiency assessments from 2013 – 2015, and also helped facilitate the strategic energy management action plans and energy savings opportunities for 37 large companies, as a strategic priority. This was funded by the United Kingdom (UK) Government Department for International Development.

To support government's mandate to create and sustain jobs, financial assistance through monetary **incentives** becomes an imperative, and this also helps strengthen the relationship between industry and government as these partnerships can be seen as a solution to resolution and disputes that could arise.

**Cleaner technologies** effortlessly could then be acquired to improve efficiencies, and this could potentially influence positivity for businesses in terms of improved competitiveness locally and globally, and at the same time attract interested investors.

Even though businesses are conscious of the environment and the impact that global pressures have on industry and the economy, this is not sufficient to sustain

businesses that wish to reduce their environmental impact, as the expertise associated with change is an essential component to ensure survival.

The NSSD reviewed, in Section 2.14.7 above, highlights the five strategic priority areas for action and implementation. To achieve sustainable development in the area of sustaining our ecosystems and use of natural resources efficiently, it is imperative that current consumption and production patterns be addressed to seek more sustainable outcomes to ensure that our ecosystems and natural resources are preserved and utilised wisely.

This challenge with the lack of internal capacity somehow restricts the implementation process from taking place, and this is one area addressed through the training courses of the NCP- SA, which focus on methodologies and practical approaches to assist industry in this regard. Therefore to induce a culture whereby RECP and environmental performance of companies are crucial to survival, various platforms to alleviate inadequacies are required. Grassroots-level participation is therefore required to understand all the needs and constraints of industry, and also greater awareness to demonstrate the long-term strategic focus of government with respect to future legislation (refer to Appendix A, E.22).

A priority for RECP interventions is resource-intensive industries located within South Africa. These includes mines, and in some cases smelters, agriculture, and forestry. Cognisance needs to be taken with regard to urbanisation and its consequences in terms of knowledge and experience within sectors, and also how this detrimentally affects the skills base within sectors that play a major role within South African industry.

**Other environmental initiatives** such as life-cycle thinking and methodologies are without a doubt very important, and industrial processes and operations are strongly associated with environmental impacts and resource use. Decoupling therefore opens up a new way of thinking about the relationship between the rate of economic growth and the rate of resource consumption and its associated impacts, as well as the use of resources over the whole life cycle such as extraction, manufacturing, consumption, and disposal (Swilling & Fischer Kowalkski, 2010).

Globally, the United Nations has introduced many programmes within the sustainable consumption and production domain; however, 40% of participants seem to be



unaware of these programmes, while some show interest in wanting be involved with various programmes, and others are already involved with similar programmes within their businesses. The amended ISO 14001:2015 standard for instance, stipulates a need to conduct LCA's and companies with this certification and those wanting to implement this standard in their businesses will be doing so as to conform to the standard.

As indicated in Section 1.4 above, many low-carbon solutions come at little or no additional cost, in particular those relating to improved efficiency, while the cost of renewable energy technologies will come down over time. Supporting the challenge of available financial support, the Climate Scope report released during the Rio+20 United Nations Conference on Sustainable Development, highlights that no less than \$280 billion in new investment flowed to new clean energy projects and companies worldwide, with the bulk of that deployed in Europe, the US and China (Draper & Mbirimi, 2010).

Based on the results in this section, it is obvious that climate change inevitably has major consequences for economic growth both nationally and globally. This potentially requires that industries reposition their individual businesses to minimise resource inputs and maximise outputs to be able to survive and become more competitive in the global village. Policy is crucial to drive growth in this area, and through national government and international guidance and funding, specific interventions need to be put in place to address issues relating to resource efficiency, sustainable job creation and poverty, amongst others.

Clear legislative from government on energy efficiency and a framework for greenhouse gas emission reduction as well as timeframes for enactment of policies and regulations is also needed, and this could potentially also contribute to the level of desired improvement. Addressing this through the multiple complexities of resource industries within South Africa can be challenging yet possible, and these individual aspects are proposed and discussed in depth in the next section of recommendations.

## CHAPTER SIX

### CONCLUSIONS AND RECOMMENDATIONS ON THE WAY FORWARD

If industry were to survive the challenges, manufacturing needs to behave like a metabolism, producing and consuming like any digestive system in nature does. This means transforming from one to the other, producing and consuming matter and energy (Pauli, 2011).

It is therefore imperative at a global level to address consumption and production patterns, considering the rate at which climate change, global warming, increasing oil prices, increasing food prices, water scarcity, and other economic and environmental factors are influencing this imbalance that will deter the sustainable development scenario experienced worldwide.

Climate change and global change impacts have both direct and indirect implications for the economic performance of industry within South African. This has contributed to the struggle that many sectors have experienced in remaining competitive in both the local and global markets. Government, as policy makers, have over the past few years introduced many support mechanisms to assist and improve the environmental, economic and social performance of businesses.

For manufacturing to behave like a metabolism, that is producing and consuming like any digestive system (Pauli, 2011), and taking the step towards sustainability by embracing so-called game-changing strategies (Draper & Mbirimi, 2010), innovative thinking and initiatives are required to ensure the repositioning of businesses to become more environmentally and economically driven.

The drive towards sustainability has prompted many companies to re-examine their core business strategies to ensure long-term survival in a greenhouse gas-regulated or carbon-constrained world (Draper & Mbirimi, 2010).

South Africa faces many limiting environmental resource economic challenges such as the shortage of skilled environmental resource economic practitioners, as well as capability and capacity constraints within government departments, research councils, and academic institutions (Nahman et al., 2009). Increasing service provider capacity and expertise requires further-education platforms, and this should

be provided as a basis to increase the numbers. There are a number of job drivers including agriculture, mining, manufacturing, tourism, and other high-level services that can create substantial employment (NPC, 2012).

Resource efficiency and cleaner production therefore need to become more prominent in terms of business strategy inclusion to ensure sustainability and guarantee livelihoods of the workforce and their respective families; to harness this and cement the thinking that require a more cohesive relationship between all involved parties and stakeholders.

Environmental resource economics to overcome the challenges associated with sustainable development and the prescription of an integrated policy and management strategy (Nahman et al., 2009), can therefore become key ingredients when determining the specific interventions and support required. These interventions comprise:

- Knowledge, education, skills training considerations
- Partnerships and network groups
- Technology and infrastructure considerations
- Incentives
- Awareness
- Funding considerations
- Scope for innovation
- Technical considerations

These specific recommendations to address the RECP challenges from this study and associated problems are all discussed in the sections below. These recommendations directly addresses the research questions in terms of (1) the lack of financial assistance, whereby incentive programmes and funding consideration are discussed, (2) how strategic partnerships can benefit the economy through the creation of sustainable jobs, (3) addressing the capacity constraints by effectively transferring knowledge, and (4) highlighting the potential that incentives could set as a foundation for industry growth.

The section below therefore provides detail on the mechanisms that could potentially be put in place to elevate industry and contribute to the shift of its becoming more sustainable.

### **Knowledge, Education, and Skills Training Considerations**

The lack of internal expertise within companies is identified as a key element in the results section of chapter 4. Based on the interview results, strong emphasis is placed on expert capacity lacking in this field, especially within businesses where implementation becomes crucial to enhancing individual operational performance. The connection between government and industry also requires strengthening to ensure that policy directives and legislation are communicated effectively, and environmental resource economics through RECP participation can provide guidance in this regard.

Most industries are still using very inefficient processes, and jobs can be created in doing assessments, retrofits and reengineering, as well as from the new technologies/products that would have to be manufactured (refer to Appendix C, 11, A).

Growing capacity within the technical field could therefore positively contribute to these challenges, and it is imperative that the NCPC–SA, as the sustainability vehicle of government, reviews its current mandate and considers diversifying its core focus to expand in this area.

More training mechanisms should be put in place to ensure that current service providers are well exposed to the methodologies of expert trainers in the more developed countries, and this is key to the paradigm shift that is so much needed in South Africa. Knowledge mining should be robustly exploited to the fullest, to ensure that experts transfer knowledge that is so lacking in South Africa.

Capacity has been increasingly acknowledged and addressed through the resource efficiency and cleaner production programmes of UNIDO over the past five years, but the shift would also be expected to include more hands-on site assessments than the normal classroom approach that has always been the case.

Addressing the capacity limitations will require developing and implementing a plan for building environmental resource economic research and development capabilities and capacity in developing countries. In South Africa, the Department of Science and Technology (DST) introduced a project through the Council for Scientific and Industrial Research (CSIR) that aims to develop a plan for building research capacity in the economics of global change and sustainability (Nahman et al., 2009).

Tertiary education institutions are also to be aligned with this move towards building local capacity within the country, and this could be done through innovative collaboration with government-funded programmes such as the NCPC–SA, which could support the objectives of the New Growth Plan in terms of creating one million jobs, as well as that of transitioning to a green economy by focusing on low-carbon and sustainable strategies.

Therefore educating the population from a very young age is critical, as it will in provide a means of understanding the need to use natural resources wisely, the importance of conserving water and ecosystems, and also the importance of recycling of waste and how this could positively contribute to social and community upliftment.

### **Partnerships and Network Groups**

Highlighted in chapter 4 as an element that could potentially drive triple bottom-line imperatives, industry priorities through partnerships with government should be encouraged as to ensure that they adapt to national legislation frameworks and invest in environmental initiatives. Sustainable initiative linkages through partnering with various networking groups could potentially harness this relationship with government, and result in job creation opportunities and knowledge exchange.

It is imperative that the efforts by various organisations towards sustainable management of natural resources should complement each other to minimize duplication; and that furthermore policy makers should play greater roles in developing and implementing policies and procedures to support such sustainable development oriented approaches simultaneously throughout the world in a coordinated and proactive manner for the short and long term future (Jegatheesan et al., 2009).

The Sustainable Intrapreneurship Programme of the NCPC–SA like some other government internships, is another platform for creating jobs within the green space of South Africa, as engineering postgraduates are recruited, adequately trained, and placed into participating companies for a period of 6 to 12 months. This programme is designed to address the resource constraints that exist and restrict implementation, especially within medium-sized businesses.

Retaining the services of these postgraduates has now been identified as crucial for companies, as these professionals have now been trained and identified to manage internal RECP assessments to optimise the resources of companies and realise associated savings potential based on their interventions.

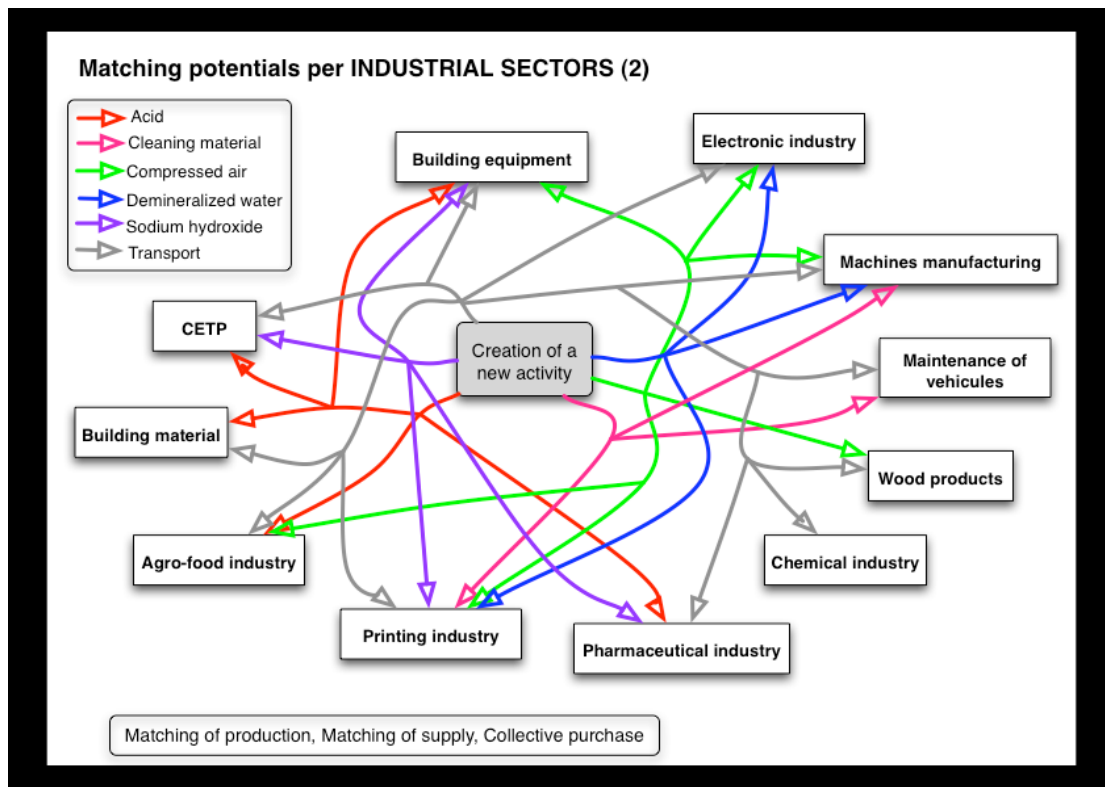
The New Growth Path calls on the state to provide bold, imaginative and effective strategies to create the millions of new jobs that South Africans need. This requires a combination of initiatives that require direct state involvement, private sector partnerships, as well as the mobilisation of civil society to take a proactive interest in addressing the problems presented by unemployment (National Treasury, 2011). Policy options to support youth employment will provide an additional lever for government to create jobs and will not be limited to any particular sector. In certain areas, such as tourism, the New Growth Path has already identified opportunities for youth. These include improving training, as well as identifying employment and entrepreneurial opportunities for youth.

In order to resolve persistent societal problems, structural transformations or transitions are necessary. This “transition” is imperative as change is constant, and adopting RECP methodologies to reduce the environmental impact of business processes, thereby enhancing productivity and increasing profits, requires internal transformation from a reactive to a more proactive approach to be communicated to all relevant team members within companies.

In the past few decades, there have been efforts to improve resource use efficiency through system-wide linkages in many industrial areas. These are referred to as “industrial symbiosis”, “by-product synergy”, “by-product exchange”, “eco-industrial park”, “eco-industrial network” or “industrial ecosystem” (Van Beers & Van Berkel, 2005). Eco-industrial parks provide a basis for the effective implementation of closed-loop manufacturing at a higher level (UNEP, 2011b).

Humankind is part of nature, "no waste can be wasted", and whatever is waste for one, is food for the other belonging to another kingdom (Pauli, 2011). Depending on the boundaries and specifics of any project, industrial symbiosis could potentially respond to local circumstances and needs, with these networks usually involving some material, by-product or waste exchange or other energy-sharing infrastructure. This also includes, as in Figure 7, information access; environmental monitoring or

employee training; shared supporting utilities (e.g. laboratories, storage); or even shared environmental staff (Van Beers & Van Berkel, 2005).



**Figure 7: National Industrial Symbiosis Programme**

(Source: NISP, 2015)

In terms of implementation of resource efficiency and cleaner production assessment recommendations, it is imperative to have baseline data when implementing measures, but could also serve as a hindrance to successful implementation (refer to Appendix B.13.E). This is extremely important as it will help create a platform where benchmarking will ensure that improvement takes place. Implementation can only be successful if dedicated individuals within companies are empowered to make strategic decisions based on the recommendations made following the conclusion of RECP assessments.

Portfolios of those involved or are responsible for the projects within companies must also be revisited, to redirect their energies on resource saving priorities and also at the same time to alleviate the burden on senior management with other priorities outside of environmental concerns.

“Industry clubs” such as waste minimisation clubs should also be considered, as this platform for information sharing is crucial in dealing with specific problems. Solutions for problems identified within one company can be shared with representatives of others who struggle to deal with similar related problems, and this will increase the confidence of individuals as they will grow comfortable with sharing ideas and finding innovative ways of improving the environmental performance of their respective companies.

### **Technology and Infrastructure Considerations**

Cleaner technology is identified as a crucial element in the results section that will help revitalise and shift industry to reduce cost and increase profitability. More efficient equipment could effectively optimise processes and at the same time reduce waste generation.

Waste-to energy-technologies has the ability to convert the energy content of different types of waste into various forms of valuable energy (World Energy Council, 2013).

The case study of the Laogang landfill gas project in China in Figure 8 overleaf, highlights how landfill gas extraction can provide electricity to nearly 100 000 residents, but requires considerable investment to implement.



## Laogang Landfill Gas Project

### Landfill Gas Extraction + Gas Generator Sets Plant

*One of more than 60 landfill gas extraction and generation projects currently underway in China, the Laogang Landfill Gas Project in Shanghai is China's largest such facility to date.*

*The proposed project scope for the Laogang facility is planned for expansion to 15 MW at which time it will save 37,800 tons of coal every year and use more than 8,100 cubic meters of flammable and explosive landfill gas emissions. At the same time, it will transmit about 110 GWh per year to the Shanghai Power Grid, will account for half of Shanghai's green power generation, and address daily electricity needs for about 100,000 residents.*

*Each GE Jenbacher J420 engine combusts 2.7 million cubic meters (m<sup>3</sup>) of methane each year, providing an overall yearly reduction of greenhouse gas of around 18.9 million m<sup>3</sup> for the seven gas engines. The renewable energy company will sell any excess electricity generated to the grid.*



**Location:** Shanghai, China

**Date Commissioned:** Planned for December 2012

**Rated Capacity:** 15 MW (Phase 1: 10 MW)

**Annual Production:** 110 GWh

**Capacity Factor:** 83.7%

**Carbon Offset:** 340,000 tons per year

**Owner:** Shanghai Laogang Renewable Energy Corporation (joint venture).

**Design/construction:** Veolia Environmental Services

**Generation Offtaker:** East PRC Power Grid

**Generation Technology:** (7) 1.4 MW GE Jenbacher J420 gas engines gensets

**Cost:** \$29.3 million

**Figure 8: Laogang Landfill Gas Project, China**

(Source: Clean Energy Action Project, 2012)

Renewable and cogenerated electricity can contribute to efforts to diversify South Africa's energy mix. The government is committed to promoting clean, renewable energy sources through implementing special tariffs (feed-in tariffs) for renewable electricity generation through a competitive bidding process. Under consideration is a funding mechanism to support the Renewable Energy Independent Power Producer (REIPP) programme, which can also be used as a vehicle to channel international climate funding for renewable energy projects (National Treasury, 2013b).

CDM initiatives should therefore be pursued as a means of support to reposition industry, and UNIDO (2003) states that for CDM projects, there are a number of opportunities identified by previous studies as having good potential for emissions reduction:

- Fuel switching for thermal energy supply
  - From coal and oil to natural gas
  - From electricity to natural gas
- Energy efficiency improvements in steam and thermal energy supply systems
  - Gas-fired boilers and steam systems coal-fired boilers and steam systems oil-fired boilers and steam systems
  - Electrode boilers and steam systems
- Energy management (energy efficiency) in the following areas:
  - Variable speed drives
  - Electrical motors
  - Lighting
  - Compressed air systems (Trikam, 2002).

### **Incentives**

Incentive programmes are crucial to sustain industry and provide some platform that will not only alleviate the “not being competitive enough to the Far East” mind set that exists within certain businesses, but also as a mechanism to enhance the performance of industry in a positive way. This will help reposition industry to ensure a much better contribution to GDP and the economy, and also at the same time indirectly feed the job creation challenge that South Africa is facing currently.

It is therefore of economic importance for government to ensure that incentive programmes are effectively communicated, and this should be dealt with in a much more hands-on manner as done currently. Industry workshops to promote these programmes should not be limited to certain provinces, but should become a driven

process within each region. For example, industry should be engaged with in key industrial hubs, as this will entice business owners and management to speak more freely and at the same time ask specific questions that are relevant to their businesses.

Investment interest in the water sector Investment interest in companies along the water value chain is steadily growing, driven by public sector challenges as well as increasing local and global water scarcity. Most of the green technology and investment business opportunities are currently in treatment technology, new resources, and certain water services, and not in municipal systems or infrastructure. Increasing water pricing will be the predominant driver for water tech innovation and investments in different solutions (GreenCape, 2017).

There are a wide variety of funding solutions, with some being indicative of the most green-focused funds or incentives available, and provide potential leads or starting points to explore various options. Further to those below, the full range of government investment incentives can be found at [www.investmentincentives.co.za](http://www.investmentincentives.co.za).

### **Funding Considerations**

Incentive programmes available and offered through various entities and government departments, include:

- The Productivity Incentive Programme (PIP): this is an incentive specifically for the clothing, textile, footwear and leather sector, and is managed through the Industrial Development Corporation on behalf of the Department of Trade and Industry.
- The Manufacturing Competitiveness Enhancement Programme (MCEP)
- The Green Technology Fund (GTF)
- The Cluster Incentive Programme (CIP)
- The Green Energy Efficiency Fund (GEEF)

Tackling the environmental and economic crises and to halt climate change, we need drastic cuts in the amount of carbon dioxide and other greenhouse gases we put into the air. That means leaving most of the existing reserves of high carbon fuels in the ground. We need workers to insulate and retrofit homes and buildings to conserve energy. We need workers to build enough renewable power to meet all our energy

needs. And we need workers to maintain the new systems the future of humanity depends on (Neale, 2014).

Funding, subsidies and insurance for solar PV are increasing. Although accessing funding can be a major challenge for service providers, an increasing number are beginning to unlock self-funding through innovative models being introduced by ESCos and engineering procurement contractors (GreenCape, 2017). Subsidies are available and funding can also be accessed from the private sector, quasi-governmental and government organisations. Additionally, most of the large banks are beginning to explore the option of funding PV as a fixed asset as it has very limited resale value if removed and resold. Other key levers are the active interest by the insurance industry to reclassify PV as a fixed asset. There is also an array of incentives for energy efficiency in the commercial and industrial sector, further improving the case for energy service interventions.

Trade policies should be reconsidered with the growth of the manufacturing sector, and not only the supply of raw materials (refer to Appendix B, A.15). Transitioning to a green economy in Africa may require national commitments to promote science, technology and innovation. This brings to the fore the necessity to bring on board not only the formal epistemic community but also actors with indigenous knowledge in, for example, traditional low-carbon technologies. The need for low-carbon and resource efficient production will require substantial investment and infrastructure, and this should make partnerships between national governments and the private sector imperative (Afful-Koomson, 2012).

### **Awareness**

One-on-one sessions should also be considered as some companies are more receptive when on their “own turf”, and this will also allow more interaction in terms of explaining specifics around the criteria and what companies are able to apply for.

It must be noted that many companies are not aware of these programmes, and only learn about them when engaging with the NCP–SA during the assessment phase. Incentive programmes play a pivotal role in the implementation phase of the assessment and intervention, and without financial support, businesses become reluctant to further the hard work that has already been done within companies in terms of improving their environmental performance.

## **Scope for Innovation**

Section 4 identifies international initiatives as key for industry in becoming competitive in the global market.

UNEP and UNIDO have over the past few years been the key drivers of many environmental initiatives in Africa and across the globe, and these are mainly driven and managed through national government departments that serve as the custodians of these programmes and ensure that local capacity and reach is achieved to enable a sustainable platform for future replication.

These include especially two programmes, the Industrial Energy Efficiency Programme (IEEP), which is funded through UNEP, the Swiss Government and South African government, and the eco-labelling project, which is funded through UNEP and has the NCPC-SA as the implementation arm for both programmes. These programmes have allowed for local capacity to be strengthened in specific areas where technical expertise needs further boosting, and models for replication have been prioritised by government departments such as Trade and Industry, Energy, and Environmental Affairs.

Life-cycle management has also strongly been coming through within a global context, as much more emphasis is placed on adding value within the value chain. The need is therefore to have more life-cycle interventions that will not only benefit the environment, but also contribute positively to industry sustainability. This in turn will result in financial rewards through recycling, resource efficiency and cleaner production assessments, and participation in eco-labelling programmes, as well as introducing management systems to align with business imperatives.

UNEP's life-cycle initiative as the key implementation driver provides strategic guidance and support to industries globally. The absorption rate within South Africa and other developing countries for these types of initiatives has seen huge growth potential that will enable industry to reposition itself and contribute to job retention, recycling market growth, business sustainability, and many others.

Environmental resource economics has the potential to contribute to natural resource management as well as both microeconomic and macroeconomic policy. It can also contribute to improved integration between natural and social sciences, and therefore has the potential to support decision makers in dealing with the complex trade-offs

with which they are often faced. If applied correctly, environmental resource economics can therefore contribute much to the advancement of sustainable development in developing countries (Nahman et al., 2009:354).

The economic model previously pursued by resource-rich economies such as South Africa has become a “model of the past”, as China has made a necessary economic policy shift from “quantity to quality”. China is taking active steps towards a less resource-intensive, more sustainable growth path (Creamer, 2014). In China alone, 10 million people are engaged in recycling jobs, with 700 000 people involved in recycling electronic products. Globally, more than 2.3 million jobs have been created in the renewable energies sector (Peter & Swilling, 2011).

We see current opportunities for businesses and investors in the waste sector in the Western Cape that are primarily focused on recyclables (plastics), organics, e-waste, and construction and demolition waste. Unlocking post-consumer waste and increase feedstock requirements for large-scale alternative waste treatment facilities (such as waste to energy) will require partnerships between private industry and municipalities. Western Cape municipalities are therefore gearing up to implement PPP that will potentially attract a further R1.3 billion and create approximately 1 600 jobs in the next five years (GreenCape, 2017). On a global scale, under the green investment scenario, the recycling rate in 2050 would be more than three times the level projected under business as usual, and the amount of waste destined for landfills would be reduced by more than 85% (UNEP, 2011b).

South Africa has enormous potential as an investment destination. There is a vast array of opportunities available to the foreign investor and healthy capital flows into South Africa reflect the increased interest and confidence in the country. Furthermore, South Africa’s positioning at the southernmost tip of the African continent is strategic for accessing world markets (UNIDO, 2003).

In 2003, South Africa introduced a plastic bag levy to reduce unwanted litter. By 2009, in his budget review, the finance minister announced an increase in the levy on plastic bags and the introduction of a levy on incandescent light bulbs at the manufacturing level and on imports. The plastic bag levy was expected to generate US\$ 2.2 million in budget revenue, while the incandescent light bulb levy was expected to generate an additional US\$ 3 million. The South African policy is seen to

have inspired other countries such as Botswana, to adopt similar regulations (UNEP, 2011b).

### **Summary**

It is important that businesses understand and internalise the associated consumption and production costs of their operations that negatively, through inefficient processes, impact the environment and indirectly affect the immediate social and eco-systems. The reduction of material, energy inputs, water inputs and waste requires improvement. Researchers could therefore use this study as a tool to connect the thread between industry and government, and identify the deterrents that prohibit the elevation of industry to a level of sustainability in terms of resource efficiency and cleaner production capabilities.

The recommendations cover certain aspects of RECP intervention and related outcomes and service extensions, and it is hoped that the content of this document will shed some light on the barriers as well as opportunities associated with implementation in the CTFL, chemical and agro-processing sectors, based on the approach used to address matters of sustainability through resource-efficient and cleaner production methodologies. It is intended that this document also fulfil its aims and objectives to create an understanding of how production processes in these three sectors impact the environment, and what programmes and initiatives are available to provide support and improve the performance of industry. It is also intended that the findings of this study serve as a basis for future studies that will explore other and more efficient methods of improving the environmental performance of industry within these sectors, and at the same time highlight the mechanisms that will assist with implementation and contribute positively to the South African economy through job creation potential and sustainable lifestyles.

RECP in South Africa has become a concept that is immensely important to both governments and industry. This is because of its contribution to improving the environmental performance of industry, and also to financially sustain businesses through innovative technical interventions. This study explores and recommends some of the RECP interventions required in a few of the priority sectors in South Africa, and this is based on the collective feedback and findings from respondents. Evaluating their importance and systematically engaging all resource-intensive sectors are therefore imperative for any future research conducted, and this should be done through focused benchmarking against industries within the developing

world. It is also recommended that further research be conducted to seek “closing the loop” solutions within industry, and this could positively contribute to business sustainability and improve the overall performance both environmentally and economically.



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## APPENDICES

### Appendix A: Industry Questionnaire Responses

QUESTION	YES	NO	COMMENT
<b>A. KNOWLEDGE &amp; UNDERSTANDING OF NCPC-SA AND RECP</b>			
1. How did you become aware of the NCPC-SA and its programmes?			<ul style="list-style-type: none"> <li>a) Owing to previous work / feedback our company information was placed on a database. The NCPC-SA contacted me as a result.</li> <li>b) We had a consultant that did our ECO footprint, called Living Wealth, and they put us in contact with André Page (NCPC).</li> <li>c) GBCSA, Cape Town 2012 conference. Introduced to the programme through an architect.</li> <li>d) I haven't been able to establish this; however most likely through our local KZN cluster group.</li> <li>e) Through contact with Andre Page.</li> <li>f) We were advised by Christopher Fennemore, the Director   Water Institute of Southern Africa, Manager   Pollution &amp; Environment Branch, eThekweni Water &amp; Sanitation.</li> <li>g) I attended an energy-efficiency presentation put together through the KZN clothing and textile cluster. The NCPC had a part on the programme. I then made contact and plans were made to do an assessment.</li> <li>h) Through the Cape Clothing and Textile Cluster.</li> <li>i) I was contacted by Mr A Page.</li> <li>j) The programme was introduced to our company by Mr Andre Page of NCPC / CSIR.</li> <li>k) Was contacted by Andre Page.</li> <li>l) I was researching information for a consultant that could do an assessment of the efficiency of our refrigeration system, electricity usage, and overall production</li> </ul>

			<p>efficiency. During the time I then got information about the NCPC-SA. I browsed the website; at that stage the website was not offering any tangible information about the programme. I contacted the NCPC-SA, not knowing they were providing a service to the industry for no consideration. I made numerous phone calls to the listed number over a two-week period with no response, I then wrote an email, and received a response from a certain Ms Podesta Maepa (“Podesta”), and she informed me about the services offered by the NCPC-SA. The engagement process started from there.</p> <p>m) Their representatives visited our company.  n) Through email from Podesta.  o) When the representative came to our factory and explained to us about the National Cleaner Production Centre.</p>
2. Were you aware of the concept Resource Efficiency and Cleaner Production (RECP) at the time of engaging with the NCPC-SA?	5	9	
<ul style="list-style-type: none"> <li>If YES to Question 2, how did you become aware of RECP?</li> </ul>			<p>a) Previous work, research and a sense of caring for the environment.  b) Svenmill had an internal audit done by Jeffares and Green on their carbon footprint. From the audit an ECO Committee was established.  c) It is basic production information. You need to apply it to stay in business.</p>
3. Did you find the RECP assessment a useful and value-adding initiative for your business?	14		
4. Please substantiate your response above.			<p>a) Some interesting options were addressed, e.g. Anaerobic Digester.  b) RECP assessment added guidance and recommendation to existing initiatives.  c) Certainly was a value-adding initiative since it highlighted numerous areas within the operation where resource efficiency could be achieved. Furthermore, projects were</p>



			<p>identified with realistic and feasible payback periods. The assessment provided is an independently created document which can be utilised for potential capital financing through various initiatives available.</p> <ul style="list-style-type: none"> <li>d) The RECP assessment provided us with many useful energy conservation ideas. Some of these suggestions like repairing leaks, updating to more energy-efficient sewing machines and using more energy-efficient lighting, have either been implemented or are in the process of being implemented. All toilet taps have now been converted to push taps to save water.</li> <li>e) We were able to make decisions on upgrades and investments</li> <li>f) Yes, as an auditing process that had a secondary benefit of stimulating further energy-saving ideas and future projects.</li> <li>g) It has made us aware of the potential savings to be made and pointed out problem areas where we can minimise risk to the environment.</li> <li>h) A few points were raised where savings could be achieved.</li> <li>i) It motivated the need to improve on energy and resource savings.</li> <li>j) The assessment undertaken assisted the company in quantifying Water, Energy and Material consumption, and identified opportunities for the reduction of Energy, Water, Materials and Waste associated with our production process.</li> <li>k) Raised awareness of waste &amp; inefficiencies and provided suggestions for solutions.</li> <li>l) We needed an assessment of the efficiency of our overall production system, to ascertain which of our production centres were consuming most electricity, and the RECP has provided us with that report; we will now be in a position to make a decision on how do we</li> </ul>
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			<p>proceed to ensure we reduce our inefficiencies in the production process.</p> <p>m) We managed to change some systems as we were advised to.</p> <p>n) They add tools to help and be more effective.</p> <p>o) It helped us to identify areas in our business where there was a loss during the process of our production and the waste.</p>
<b>B. SERVICE PROVIDER EXPERTISE AND KNOWLEDGE</b>			
5. Was sufficient clarity provided on the processes and formalities by the RECP team throughout the assessment?	14		
6. Please substantiate your response above.			<p>a) We were well aware of what should happen next and when. The consultants appointed were professional. However, finer details of the Anaerobic Digester were not provided.</p> <p>b) Clear and concise information was given with helpful slides and graphs.</p> <p>c) Continuous feedback was provided on a number of occasions relating to formalities of RECP assessment and processes and protocol involved. As an organisation, we were informed in a professional manner at all times.</p> <p>d) The concepts were clearly explained and backed up with detailed workings on current costs, recommended alternatives, projected savings and the capital investment required to realise those savings. A detailed final presentation was given outlining the outcome of the assessment.</p> <p>e) Discussions and brainstorming sessions were interspersed formally and informally during the process.</p> <p>f) All procedures were explained in writing and telephonically and we were kept up to date with progress at all stages of the assessment.</p>

			<p>g) The introduction meeting provided clarity.</p> <p>h) Continuous discussions were held between us and the team.</p> <p>i) The service providers demonstrated a deep understanding of their subject matter, as well as a good knowledge of the tanning industry. They also explained their process and associated results in an 'easy to understand' way.</p> <p>j) Detailed report was prepared and submitted.</p> <p>k) Podesta kept us abreast of developments on the NCPC-SA's internal approval processes that had to be done, until the approvals were secured. Subsequent to that, we were constantly engaging throughout the process with Podesta, the lead consultant, and other consultants, to ensure that the assessment that was being conducted was going to cover the aspects that we required to be assessed by the NCPC-SA, and that the result was going to meet our expectations.</p> <p>l) During our workshop we were given time to ask questions and they were well clarified.</p> <p>m) The report was clear and easy to understand.</p> <p>n) They explain what can be improved and how we can improve on those areas.</p>
7. Was the service provider employed to conduct the assessment adequately equipped in terms of expertise and knowledge?	14		
<b>C. INDUSTRY CAPACITY BUILDING</b>			
8. Did you find that the employees within your business were aware of the cleaner production assessment and the concept of RECP?	7	7	a) Yes, at senior level.
<ul style="list-style-type: none"> <li>If YES to 8 above, then what kind of attitudes and mind-set did you encounter during the assessment?</li> </ul>			<p>a) Having an established Eco Committee helps with the communication of assessments and initiatives to all staff. The feedback from employees is positive and supportive.</p> <p>b) Positive, receptive and constructive.</p>

			<p>c) All employees were informed, but some were reluctant to give information and change behaviours.</p> <p>d) Openness to any suggestions and acceptance of criticism, albeit very little.</p> <p>e) The employees were aware because we continuously inform them in our weekly staff meetings of the necessity to control costs. We informed them of the cleaner production assessment, and its potential benefits to the business. All our employees are well aware that our business operates in a very tight margin industry, and cost control and minimisation are critical in all production centres to ensure survival of the business. All employees were positive as it is in every employee's interest to ensure that the company controls or reduces operational costs, so that the business does not resort to downscaling of operations resulting in retrenchment of employees.</p> <p>f) They had a positive mind set during the assessment because they managed to adapt to the changes that were made.</p> <p>g) Positive.</p>
<ul style="list-style-type: none"> <li>• If NO to 8 above, then how was the awareness aspect addressed internally with employees?</li> </ul>			<p>a) Employees were prepped beforehand and given more information as the process commenced. A training session was also given by the consultants.</p> <p>b) Key individuals were identified and formed part of an awareness and feedback meeting. Numerous people were identified from all areas of the organisation especially areas where the assessment had the greatest impact. The meeting involved employees who were in supervisor and management positions. Any awareness should not only be provided for management but for individuals at lower levels such as supervisors and key line operators.</p> <p>c) Employees were informed of the assessment and the need to reduce energy consumption via the normal line</p>

			<p>management channels as well as in Health and Safety forums.</p> <p>d) Through meetings and informal discussions.</p> <p>e) A meeting was called in which all staff were made aware of the assessment and were asked to assist with any needed information.</p> <p>f) The Operational, Production and Maintenance management structure was involved with the initial briefings from the Service Providers, as well as during the information gathering / assessment stage. Now that the final report has been received (10 April 2013) they will also be involved in the evaluation of the results and recommendations.</p> <p>g) Meetings were called and they were made aware of the study, its findings and possible solutions</p> <p>h) It was addressed internally through the workshop which was held on our premises and training.</p>
9. Do you think that sufficient training was provided to your internal champion?	8	5	
<ul style="list-style-type: none"> <li>If YES in 9 above, then was this knowledge transferred to any other individuals within the business?</li> </ul>			<p>a) Monthly meetings are held with our Champion and Eco Committee. Through the assessment by RECP. Regular updates were sent to the committee and managers.</p> <p>b) Knowledge was transferred to the Maintenance Manager.</p> <p>c) Yes.</p> <p>d) Yes.</p> <p>e) Now that we are in receipt of the final report, the champion will involve the necessary staff to implement the relevant recommendations.</p> <p>f) Yes, the report was circulated, subsequent meetings were held and programme of implementation was agreed to.</p> <p>g) Yes it was transferred to other employees within the company who attended the workshop.</p>

			<p>h) Yes.</p> <p>i) To all the staff members it was transferred to minimise the cost of production, as it was everybody's business to be involved.</p>
<ul style="list-style-type: none"> <li>If NO in 9 above, then what could have been done differently to ensure that sufficient knowledge was transferred?</li> </ul>			<p>a) It didn't matter. The champion did not need training. He was knowledgeable enough.</p> <p>b) The assessment and awareness have not required identification and training of a change agent at this particular stage.</p> <p>c) Specific training on utilities such as boiler efficiency and compressed air.</p> <p>d) The clean production assessment that was being done in our business evolved around assessment of high-voltage electricity usage, efficiency of the refrigeration system, efficiency of the high-voltage motors, efficiency of the condensers, efficiency of the evaporators, and assessment of waste and its suitability to generate biogas, which will in turn generate electricity and heat. All these aspects of assessment required use of specialised equipment to ascertain efficiency or lack thereof, and there was no person within our organisation who could be trained to do this assessment in future as it is highly specialised, and this skill is not required in our day-to-day business activities.</p>
<b>D. IMPLEMENTATION</b>			
10. Were the RECP recommendations identified during the assessment, feasible for implementation?	14	2	<p>a) Yes, but not all.</p> <p>b) Ease, time and cost of implementation are important.</p>
<ul style="list-style-type: none"> <li>If YES in 10 above, then mention some of the elements that were important for the business to pursue for implementation?</li> </ul>			<p>a) Yes, some electrical modifications, and also NO. Too many loose ends that needed more research in terms of the Anaerobic Digester; as it is a costly project, it had not been implemented, but it would have been a good project to implement.</p> <p>b) Installing Eskom IDM Lighting Standard Product.</p> <p>c) All the leaking equipment identified was addressed.</p>

			<p>Eight-foot tubing lights were replaced with five-foot daylight energy-saving lights. Both compressors were serviced and air leaks repaired. We are also in the process of replacing old sewing machines with more energy-efficient machines.</p> <ul style="list-style-type: none"> <li>d) Steam reticulation.</li> <li>e) We were already involved in investigating and implementing a number of projects; however it was useful to have independent input, analysis &amp; confirmation from an independent source.</li> <li>f) Not all improvements were made due to financial constraints but many items were rectified, for example leaks metering implemented, etc.</li> <li>g) Testing all steam traps, checking water leaks, and checking steam / compressed air leaks.</li> <li>h) Water and electricity saving.</li> <li>i) A number of errors were discovered in the municipal billing process, which we look to recover immediately. Introduction of a Cecanter centrifuge to reduce the volume of water in the effluent sludge disposed of at a cost per kg. Introduction of low-flow shower heads.</li> <li>j) Energy saving, wasteful expenditure and more accurate operations.</li> <li>k) The assessment revealed numerous inefficiencies in our processes, and we are already in the financial planning process to implement the recommendations. It was found that the refrigeration system is inefficient as there are leaks that result in loss of pressure and wastage of resources; the recommendation was to install an air purger, energy-efficient motors, evaporators, and condensers. It was also found that the waste being generated by the abattoir is suitable to generate biogas, which will generate renewable electricity and heat to completely cover the supply required by the abattoir, and to stop using fossil-generated electricity sourced from</li> </ul>
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			<p>the national grid, and also stop using bituminous coal to heat water required in the abattoir. All these mentioned recommendations are in the financial planning phase of implementation.</p> <p>l) We bought a low-kilowatt compressor that consumes little electricity.</p> <p>m) Water usage, flour, oil, divider machine, electricity, waste.</p>
11. Did the assessment meet the needs and expectations of management?	14		
12. Please substantiate your response above.			<p>a) A good report was given, but the implementation of high-cost projects was problematic.</p> <p>b) The production incentives and savings associated with recommended implementations exceeded managers' expectations.</p> <p>c) Team focusing on the assessment was professional and experienced in approach and proposals were clearly outlined</p> <p>d) The report detailed various recommendations which increased management awareness of the saving which could be generated by using more energy-efficient equipment. Many of the report recommendations have been implemented.</p> <p>e) It confirmed many the initiatives that we had already identified / undertaken.</p> <p>f) We were already involved in investigating and implementing a number of projects; however it was useful to have independent input, analysis &amp; confirmation from an independent source.</p> <p>g) Most of the managers were given feedback for their respective areas and were asked to implement recommendations; these were generally well accepted.</p> <p>h) Task team established to look at these points and savings possible.</p> <p>i) The report has provided our company with numerous</p>



			<p>pragmatic projects that can be implemented and lead to material cost savings.</p> <p>j) The immediate steps and awareness of savings were highlighted. Some steps have been introduced to implement; others will follow, as they need capital investment.</p> <p>k) We were aware that we have numerous inefficiencies in our production system, particularly in the cooling system, as we were not consistently getting the -25 °C that we require in all some of the chillers. We needed to get competent and skilled people to assess the entire production process, measure the power usage, and identify all weaknesses and suggest potential solutions.</p> <p>l) We managed to save costs from some of the changes that were implemented.</p> <p>m) It was clear, detailed and easy to understand.</p> <p>n) After implementation, we realised that there were a lot of changes in our systems, and measures were put in place to make sure that we do things accordingly.</p>
13. Were any of the recommendations implemented?	11	6	a) Not yet as the report was only received on 10 April 2013.
<ul style="list-style-type: none"> <li>If YES in 13 above, then how long did it take to implement the options identified for improvement?</li> </ul>			<p>a) Two years, as some are still being implemented, as budget constraints exist; however it is a pity that the project that could have made the biggest change was not implemented.</p> <p>b) Svenmill Limited meters at each department to monitor electricity usage. Implementation started in 2012 and completed this year in 2013.</p> <p>c) Water Leaks – approx. 6 months, Compressor Air Leaks – approx. 4 months, Eco Lights – on an on-going basis as the old tubes go, Sewing Machines – on an on-going basis, just recently received first consignment and still to be commissioned.</p> <p>d) Some were immediate, some are still in process.</p> <p>e) Some recommendations were implemented immediately, others within 2 months, and some still need to be done</p>

			<p>when finances are available.</p> <ul style="list-style-type: none"> <li>f) Compressed air audit done – in process of repairing leaks (2 – 3 weeks).</li> <li>g) Most of the recommendations were underway and part of the company's planning to improve on processes.</li> <li>h) Some smaller maintenance-based steps were implemented immediately; others such as off-peak electricity management followed after completion of capex.</li> <li>i) The timing varies depending on the cost of the recommendation. It took us a week to implement the water-saving recommendation; we installed water tanks and we now harvest 500,000 litres of rain water. As mentioned in 10 above, we are in the financial planning phase for the implementation of the biogas plant and the abattoir cooling system upgrade. On both, it took us two weeks to identify and select preferred contractors, and we are now in the financial deal-structuring phase.</li> <li>j) Less costly implementation was done immediately and high cost took some time due to finance.</li> <li>k) Implementation took between 3 months and a year. Many of the issues raised will be implanted going forward as capex becomes available.</li> <li>l) Short-term implementation was dealt with with immediate effect and long term took a bit of time due to budget matters.</li> </ul>
<ul style="list-style-type: none"> <li>• If NO in 13 above, then what was the reason for not implementing the options identified for improvement?</li> </ul>			<ul style="list-style-type: none"> <li>a) Anaerobic digester: Insufficient research / information. Proof that it would work.</li> <li>b) Due to low production the installation of Eskom IDM lighting programme has been put on hold.</li> <li>c) Awaiting final report to be forwarded to firm. In addition, awaiting meeting with respect to possible capital investment incentives.</li> <li>d) There needs to be an additional training programme for these individuals which needs to be done over and</li> </ul>

			above the assessment, using the information from the assessment as a working exercise. e) Capex and management's ability to effect the changes.
14. Did the company have internal resources / manpower to manage the implementation process?	9	4	a) However, we are confident that with a combination of our own staff and outside contractors we will be successful in implementing the relevant recommendations.
<b>E. CLEANER TECHNOLOGIES AND INCENTIVE PROGRAMMES</b>			
15. Were any recommendations specific to the need for cleaner technologies?	9	7	a) At this point we are unable to comment as we have not yet studied and digested the full detail of the report.
<ul style="list-style-type: none"> <li>If yes in 15 above, then were these options viable in terms of pursuing?</li> </ul>			a) Some of them. b) Yes, these would be worth pursuing; however raising finance in our industry is difficult, especially for cleaner technologies. c) Mostly. d) Some interventions will require capital investment which can only be addressed once funding is available. Others, such as changes in lighting, were applied for to Eskom and subsequently granted. e) The recommendation for the introduction of the biogas plant that will produce renewable electricity and heat is a cleaner technology initiative which we are in the process of implementing. f) Yes they were viable. g) All the identified aspects were taken into consideration and management took steps to purchase what was needed.
16. Are you aware of any government incentive programmes that exist to assist with implementation?	10	4	
<ul style="list-style-type: none"> <li>If YES to 16 above, then how did you come to know of the incentive programmes?</li> </ul>			a) Via Mr Page. Some were also mentioned in the reports (e.g. Eskom). These were, however, not straight forward. b) Through NCPC & Carbon & Energy Africa. c) We have been previously involved with IDM incentives through ESKOM. We have not yet pursued PI incentive through DTI for capital investment but are aware of the

			<p>programme.</p> <p>d) The IDC offers the clothing and textile sector a grant to improve competitiveness. This programme is widely promoted within our industry. Eskom offers subsidies with regard to the replacement of old lighting with new energy-efficient lights.</p> <p>e) We are involved and fully accessed in PI programmes at a group level.</p> <p>f) We were informed of the DTI programme by Mr Andre Page.</p> <p>g) Only superficially aware of some programmes, need to learn more about others.</p> <p>h) Our business operates in a very tight margin industry; therefore I always keep abreast of what incentives are available to potentially assist in subsidising our capital or operating expenditure.</p> <p>i) Through the NCPC.</p> <p>j) DTI incentives.</p> <p>k) Through the NCPC programme.</p>
17. Have you tried accessing these incentive programmes?	5	8	
<ul style="list-style-type: none"> <li>If YES in 17, then were you successful in your application?</li> </ul>			<p>a) Still need to follow up.</p> <p>b) Eskom incentive was successful and all lighting has been replaced in organisation with energy-saving systems.</p> <p>c) Yes, we have been successful in accessing IDC grants for new equipment. We are still in the process of accessing Eskom subsidies.</p> <p>d) Yes, very successful.</p> <p>e) No.</p>
<ul style="list-style-type: none"> <li>If NO in 17, then what are the reasons for not applying for these available incentives?</li> </ul>			<p>a) It's difficult dealing with government departments. Very time-consuming, very difficult to get the message across. Very difficult to meet eye to eye. Tannery staff do not have much spare time to go through these processes.</p> <p>b) Not aware of what is available.</p> <p>c) Not sure of what is available and how to access it.</p>

			<ul style="list-style-type: none"> <li>d) Not aware of incentives and criteria.</li> <li>e) Still to be evaluated once we have studied and digested the full detail of the report.</li> <li>f) Have only recently received the PIP and CIP revised guidelines. They appear to be complicated documents and processes to follow which required specialist advice to compile.</li> <li>g) We will apply for the incentives once we have finalised our financial planning process and received all the reports from NCPG-SA. We will be completing our financial planning process within a week, and we expect to receive all the reports from the NCPG-SA this week.</li> <li>h) Time constraints.</li> </ul>
<b>F. INDUSTRY GROWTH AND SUPPORT</b>			
18. What other support, be it financial or technical, do you think is required to induce a culture of RECP practices?			<ul style="list-style-type: none"> <li>a) Training of shop-floor personnel. Making personnel aware of the effects on the environment.</li> <li>b) On-going technical support - audits.</li> <li>c) Regular training sessions for workers.</li> <li>d) Greater awareness. I have the feeling that most firms wait for regulatory mandates before change occurs. Industries need to anticipate regulatory mandates prior to legislation in order to take advantage of the positive effects of change that can occur within an industry and also derive a sustainable competitive advantage.</li> <li>e) We have accessed IDC training grants to improve manufacturing efficiencies.</li> <li>f) We are satisfied with the current status at this stage.</li> <li>g) Financial as well as support in the implementation of technology, as industry does not have the knowledge to implement this technology.</li> <li>h) More awareness training, such as assistance in drafting an RECP policy, and recommendations of how the policy can be reflected in our QA programmes and job descriptions.</li> </ul>

			<p>i) Funding is a major concern as payback is sometimes long and not guaranteed</p> <p>j) There is an urgent need for national legislation similar to the German Renewable Energy Act (in German: Erneuerbare-Energien-Gesetz, EEG), which is designed to encourage cost reductions based on improved energy efficiency from economies of scale over time. There is also a necessity for a national awareness programme to make the business sector and the general public aware of the potential long-term environmental and financial savings that business and the country would accrue by adopting resource-efficient and cleaner production methods.</p> <p>k) If the government can subsidise small companies to purchase big machinery that is unaffordable in order to alleviate unemployment to a certain extent.</p> <p>l) Training of employees.</p> <p>m) There are expensive machines that can help in the growth of industry and are not affordable and our Government can help by subsidising small industry so that they can better their service and create job opportunities.</p>
19. Having participated in an RECP assessment, do you think that it has added value to your bottom line?	13	3	<p>a) But not much. The anaerobic digester should have made a big difference.</p> <p>b) Yes it will, once we have implemented [it].</p>
20. Do you think that RECP initiatives have the potential to create additional jobs within your business?	11	3	
<ul style="list-style-type: none"> <li>If YES to 20 above, why would you say this is possible?</li> </ul>			<p>a) An anaerobic digester would need new personnel to manage it, and with enough savings on costs, there could be more money available for expansion.</p> <p>b) A company might need one employee, i.e. waste collection and waste area.</p> <p>c) It also reduces operating costs and in turn creates the opportunity for additional jobs.</p> <p>d) If firms are able to increase their profit margin through</p>

			<p>higher efficiencies/greater resource utilisation, then surely they are able to derive competitive advantage within the industry, allowing for diversification and further investment.</p> <ul style="list-style-type: none"> <li>e) If these initiatives help us become a lower-cost producer, then there is the potential of increasing volume into our production facility and hence the possibility of creating more jobs.</li> <li>f) Normally green initiatives remove cost from production, therefore make us more competitive which in turn allows us to grow our business.</li> <li>g) By implementing energy savings that positively affect the bottom line, at the least, existing jobs are protected and at best, growth, which in turn stimulates employment.</li> <li>h) This is an area with many different aspects and would need the correctly trained person and I believe this would be a full-time job, especially within an organisation such as ours</li> <li>i) It could go either way. On the one hand the implementation will have its benefits for creating employment in maintaining the developments, and on the other hand improved production may lead to stabilising the need to employ additional staff.</li> <li>j) Our focus is on cost savings and improving the quality of our effluent discharge and waste reduction. To do so may require additional labour costs, i.e. more jobs.</li> <li>k) The RECP initiatives will create additional jobs because the company will require new people to work in the biogas plant, and the efficiency of the cooling system will result in more fresh meat being kept in the refrigerators, and this will create an additional throughput capacity on the plant, which will result in additional job opportunities being created for the processing of additional carcasses.</li> <li>l) It is possible because if companies can pursue the recommendations of the NCPD they will be able to save</li> </ul>
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			<p>money and be able to employ more people.</p> <p>m) Since we will be saving we can buy modernised machines to better [sic] our work and with higher productivity we will be able to employ more people.</p>
<ul style="list-style-type: none"> <li>If NO to 20 above, then why do you think this is not possible?</li> </ul>			<p>a) We need to be more efficient – as it is business is top heavy.</p> <p>b) Savings and increased efficiency do not necessarily translate into more demand or higher capacity. Currently we do not operate on maximum capacity so until demand is increased to full capacity, the need for more jobs are limited.</p> <p>c) We don't want to add cost to our structures.</p>
<p>21. Are you familiar with other environmental concepts such as Eco-labelling, Life Cycle Management, Environmental Management Systems, Life Cycle Assessments, Life Cycle Thinking, Carbon Foot-printing, etc.?</p>	9	5	
<ul style="list-style-type: none"> <li>If YES in 21 above, then would you participate in any of these types of initiatives should the opportunity arise?</li> </ul>			<p>a) If it's useful. For example, one could spend months in determining one's carbon footprint, but if no actions are taken, it just stays a number. Definitely, if it could help us to reduce the impact on the environment.</p> <p>b) Svenmill is already part of Living Wealth Eco Active Programme.</p> <p>c) Most certainly, carbon foot-printing and Eco-labelling would be of great interest.</p> <p>d) Yes, already having work done to establish the company's Carbon Footprint.</p> <p>e) Yes.</p> <p>f) We are, at group level, applying King III protocols that incorporate these concepts.</p> <p>g) We are following Oeko-tex® label requirements.</p> <p>h) I have superficially studied these concepts and they are of interest to us as they affect the sustainability of our business.</p> <p>i) Yes, we would undoubtedly participate. We are already</p>



			in the process of getting an environmental management system (ISO 14001).
			j) Yes.
22. Do you think that government understands the needs of industry?	5	8	a) Yes only to a certain extent. b) Yes partially.
<ul style="list-style-type: none"> <li>If YES to 22 above, then how would you support this statement?</li> </ul>			a) PI initiatives through DTI. b) Yes, in respect of the PIP process. c) We are working with the DTI to set up a cluster initiative. Once established, and the initiatives are funded by government, it could assist in developing the sector. d) Looking at government initiatives like the IDC's Green Energy Efficiency Fund, the DBSA's Green Fund, the DTI's MCEP, and the NCPG-SA, it is clear that the government understands the needs of the industry. There is, however, a need for a legislative framework and a concerted information campaign to persuade industry to adapt and make investment into RECP initiatives to ensure environmental sustainability. e) The government do have training but they lack financial assistance. f) Partially I would say 'yes', there is no subsidy for private companies and most of them are forced to close down because they were liquidated, as they did not have the right resources.
<ul style="list-style-type: none"> <li>If NO to 22 above, then what would you say is needed to support industry in becoming more compliant to RECP practices?</li> </ul>			a) Government needs to appoint competent workers (a large majority are incompetent and not efficient). Government needs to work with industry (not opposing it). Environmental legislation departments need to have personnel that assist industry with implementation and know-how. Currently they advise industry to obtain consultants (because they seem to be unsure) or just penalise industry. b) There is not enough ground-level participation to understand all the needs and constraints our industry has.

			<ul style="list-style-type: none"> <li>c) Greater awareness, demonstration of long-term strategic focus of Government with respect to future environmental legislation. There needs to be a catalyst for change, and industry needs to be aware of the pending/future environmental mandates that will eventually be implemented by Government. Electricity is only one facet of resource efficiency.</li> <li>d) Financial help and incentives that reward companies for initial investment and implementation.</li> <li>e) Specialised people to investigate savings of utilities.</li> <li>f) The industry competes heavily against imported products and the government should look at a means of either subsidising local manufacturers with local content or some sort of incentive to support producers of local material. One way would be to look at some way to formalise the emerging market in terms of laying down some guidance/ruling so that the hides in that sector do not become a total waste/loss to the industry.</li> <li>g) Municipal departments require greater skills and resources in order to assist Industry in monitoring progress and resolution of disputes.</li> <li>h) Government must create an environment where investors want to invest in SA. The competition in the market will force companies to be efficient.</li> </ul>
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## Appendix B: Civil Society Questionnaire Responses

QUESTION	YES	NO	OPTIONAL COMMENTS
A. RESOURCE EFFICIENCY AND CLEANER PRODUCTION			
1. Are you familiar with the NCPC-SA and its programmes?	7	0	
2. Are you familiar with the concept Resource Efficiency and Cleaner Production (RECP)?	7	0	
<ul style="list-style-type: none"> <li>If YES to Question 2, do you see RECP as a value-added support mechanism to industry?</li> </ul>	N/A	N/A	a) Yes. b) Yes, because it helps to question flow of materials and energy and minimise losses. c) RECP is not a support mechanism in itself. The NCPC provides support to industry in implementing RECP. d) Yes, it assists in providing an optimised process solution to companies within all sectors. e) Yes, mostly because companies are generally production focused and often do not have the time (and/or budget) to analyse innovative alternative RECP approaches and are not always exposed to the latest developments in technology. RECP is also about a culture and mind-set shift, and hence this programme also builds the necessary knowledge base and change in consciousness so that it can be effectively incorporated into the company's operation.
3. Have you ever participated in RECP projects of any nature?	6	0	a) Members of CAIA have but not the association. In addition the chemical industry's Responsible Care initiative entrenches RECP in its resource efficiency and pollution prevention management practice standard.
4. If YES, can you identify some of the projects you were involved with and what your particular role was?			a) Contracted by UNIDO, I have been part of the constitution and build up of the NCPC since 2002, including implementation of the business plan. My role was to support the respective NCPC directors in starting the business and building up the centre, moreover as a trainer and consultant to the NCPC for specific questions concerning energy matters. I carried out much training for NCPC staff as well as for external consultants, combined with company visits. The major results of the visits were reports on i)

			<p>status and ii) potential to improve production/resource efficiency in the respective companies.</p> <p>b) Training for NCPCs in Nicaragua, Colombia, Brazil, Ukraine, Serbia, Macedonia, Russia, Korea, and South Africa. Development of toolkits for UNIDO and UNEP. Individual consultancy projects for about 200 companies.</p> <p>c) Eco-labelling project which looked at providing capacity building and technical assistance to companies to meet the requirements of the eco-labels in export markets, thus enabling industries to introduce more environmentally friendly practices through the supply chains of their products.</p> <p>d) Very very many: 1989: PRISMA project in The Netherlands. First European Cleaner Production project to 2010: NCPC-SA project on cleaner production in textile, food, and chemical industries.</p> <p>e) CAIA runs the Responsible Care initiative in South Africa, which includes promotion of resource efficiency. I have overall oversight of this programme.</p> <p>f) I have conducted 82 RECP assessments within varying sectors in which I have been the consultant providing advice to the companies.</p> <p>g) Assessments of African Hide Trading, Coats, EAC Tannery, Feltex, Frame Knitting Mills, Fibertex, Freudenberg Non-Wovens, Gubb and Inggs, Herdman's, High Tech Weaving, International Trimmings and Labels, Impregnated Web Technology, JMV Textiles, Klein Karoo International, Svenmill, Van Dyck Carpets.</p>
5. Do you think that within the global RECP environment there are adequate technical support structures in place?	4	3	
6. Please substantiate your response above.			<p>a) The United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP) launched a joint programme to establish National Cleaner Production Centres/Programmes (NCPCs/NCPPs) in 1994. UNIDO drives the establishment of NCPCs/NCPPs in countries around the world and provides the technological and institutional support to these locally established bodies. UNEP established the International Panel for</p>

		<p>Sustainable Resource Management, or Resource Panel for short, in November 2007, and it has the mandate of decoupling resource use and environmental impacts from economic growth. I hence believe that the institutional frameworks exist globally to support RECP (think global act, local approach).</p> <ul style="list-style-type: none"> <li>b) I think globally there are many funding schemes. It is a matter of companies' lack of awareness of how to access these schemes and compile applications for funds.</li> <li>c) Globally RECP is enjoying increased attention and a number of multilateral agencies provide support for it.</li> <li>d) More technically able consultants and other experts (e.g. universities or research/knowledge institutions, e.g. CSIR) are necessary in many developing countries in Africa.</li> <li>e) RECP is well supported by international organisations such as UNEP and UNIDO and network of 44 NCPCs around the world.</li> <li>f) On a technical level there is no common structure that acts as a technical radar to describe new hot clean technologies; every consultant has to work and collect on their own little exchange of experiences.</li> <li>g) The structures mostly comprise technical training, sometimes concrete analysis in the respective companies. What lacks is: Proper implementation of some key RECP projects and comprehensive compilation of case studies. The cases should be the basis of campaigns, how to convince company leaders to join RECP and to profit from the advantages – although costs are implied. The cases should comprise and clearly demonstrate all necessary steps from first contact, convincing arguments for managers to act, to implementation (incl. what barriers had to be overcome, incl. psychological barriers), to evaluation of the project (display costs, earnings, profitability, statement of the respective manager to motivate further managers to join). At the end of the case the quantified results should be shortly (quantitatively!) summarised: energy savings, material savings (incl. water savings), cost savings, improvement of processes, reduction of waste, better-performing staff, reduction of environmental pollution.</li> </ul>
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			<p>Finally, a clear statement from the director of the respective company must be included, explaining why he implemented the measure(s), what he profited from it and a recommendation to fellow directors. Based on the quantification of pollution reduction, governments should be convinced to think about a joint elaboration of laws and regulations in the environmental pollution field (joint means: governments, NCPC-SA, company representatives or sector association representatives – as long as there is consensus and they are future/sustainability oriented) establishing respective laws and regulations (“to force companies to earn more money”) and/or possible subsidising schemes on reduction of environmental pollution in specific sectors. Lack of management training. This expertise is weak or absent in many companies. Thus a follow up of recommendations is not (or only partially) done and many RECP projects are not implemented. The technical structures (teaching capacities, etc.) seem to be OK. But is there enough orientation to implementation?</p>
7. Do we have adequate technical support structures in place within South Africa?	5	2	
8. If YES, then please elaborate.			<ul style="list-style-type: none"> <li>a) You have a fully competent NCPC.</li> <li>b) NCPC has trained very many consultants in general principles and understanding of Cleaner Production, as well as specific technical expertise (e.g. steam, compressed air, etc.).</li> <li>c) There are numerous private sector consultancies that offer this service. The NCPC also plays an integral support role.</li> <li>d) Companies need to commit to the programme, and the ones that are keen to reinvest in their companies and ensure they are on the forefront of technology are able to survive. A company requires a balance between social, environment as well as the business environments. The myth of environment’s costing money is still prevalent in industry. The recent MCEP and other programmes from IDC and DTI provide grants, soft loans for companies to take advantage of this. Companies require knowledge and guidance on where to go and how to apply for these funds. They also require a strategic business overall where all aspects of CSR are ensured. A</li> </ul>

			<p>new technology database should also be considered and awareness in sectors raised as to which technologies are suitable for them.</p> <p>e) The NCPC-SA is very active in arranging audits, especially in specific sectors. The Industrial Energy Efficiency (IEE) specialist training programme has been very helpful in educating industry to be more receptive to RECP as well as providing capacity building of both industrial company staff and RECP consulting firms. In terms of project implementation and support in this regard, further work needs to be done. Factories often have the impression that they need to fund their own implementation projects (although this is changing with education on the Productivity Incentive Programme and the Manufacturing Competiveness Enhancement Programme) and there is no IEE training on implementation. This is, however, a more costly exercise to fulfil owing to the detailed level of design and liability issues that arise from this level of professional advice.</p>
9. If NO, then please indicate why you say so.			<p>a) Because I feel that within the South African companies I worked, the concept was not known, the uptake of the concept was not so ready [<i>sic</i>] and implementation was there in a few innovative ones but not at large [<i>sic</i>].</p> <p>b) This is specifically true for SA (need for more project management capacities, more consequent orientation to implementation plans).</p>
10. Please identify any further technical support needs you foresee that could strengthen the local base of service providers.			<p>a) As mentioned in the last bullet point in Question 6, the weak point of the RECP programme(s) is not so much of a technical nature. The support on this side seems to be more or less adequate (one possible question would be, if training is sufficiently oriented to practice reality, to systematic follow up of implementation schemes (project management capacities), to the implementation of projects in companies). Strengthening the base of service providers would encompass:</p> <ul style="list-style-type: none"> <li>• Maximum professional competence (supposed to be given).</li> <li>• Maximum knowledge of how companies work on a decision taking level (given?).</li> <li>• Maximum knowledge of economic challenges (given?).</li> </ul>

		<ul style="list-style-type: none"> <li>• Maximum competence to convince company representatives to follow up proposals and accompany / support the implementation (assumption: not given).</li> <li>b) More cooperation, more experience exchange, more focus on in-house training, more documentation of results and publication, more detailed work on technical solutions.</li> <li>c) Better and expanded portfolio of services focusing on the introduction of innovative practices, and dissemination to lead businesses and other business intermediaries for the take up by the market.</li> <li>d) Consultancy skills that make the consultant do more than just execute an RECP project, but where the consultant learns to look at everything through the eyes of the client.</li> <li>e) We need to focus on action, not always seeking things we need to do before we can act.</li> <li>f) Cleaner Technology database of what is feasible and how it is applied. Some technology matching exercises with overseas sectors and how they survived.</li> <li>g) Something like an NCP-CA Implementation Office would be useful. Such an office could follow up on recommendations made by consultants. If factories are not planning to implement, the office could find out why, and try to overcome the barriers. If the factory lacks the capacity to implement, the NCP-CA Implementation Office could help with sourcing funding and/or appointing engineering consultants to arrange implementation.</li> </ul>
<p>11. Is there any particular industry / sector that you think needs more focus on and further intervention in terms of future RECP projects?</p>		<ul style="list-style-type: none"> <li>a) All resource-intensive industries that are located in South Africa, including mines and in some cases their smelters, agriculture and forestry. Even more important are industries that provide input materials to labour-intensive downstream producers, e.g. textiles and leather, because they supply the clothing and footwear manufacturers.</li> <li>b) Smaller companies need to be engaged in business greening but more along networking and guidance.</li> <li>c) Paint formulating industry, and the cold storage industry.</li> <li>d) I worked with [the] textile industry in South Africa and it will benefit</li> </ul>



		<p>from further interventions not only on RECP and but more advanced sustainability approaches: foot-printing, LCM, eco-innovation.</p> <p>e) Maybe food, metalworking and mining.</p> <p>f) The focus has to be laid on those industrial sectors that are important for a region or SA as a country. Reasons for focus can be economic importance, employing importance, environmental pollution, etc., and I think, yes, more focus is necessary, but not so much in the sector of SME, but more in medium and big companies. But that would need even more competence in the consulting sector than with SME</p>
<p>12. Do you think that RECP projects have been effective overall within the local industry?</p>		<p>a) That question is difficult to be answered, for I do not know evaluation results concerning effects of implemented RECP projects. From my point of view, two answers are to be given, (1) The effectiveness of RECP projects – if implemented – is good, and (2) The effectiveness of RECP programmes is not satisfactory, if we compare input from the NCPC-SA side (incl. input from/to external consultants and their work) with the number of implemented projects and thus the quantified output.</p> <p>b) Not sure, feel that the outreach was limited although the effort taken was significant.</p> <p>c) Yes (as far as I can see).</p> <p>d) Yes. In the chemical sector both energy and water use efficiency has improved significantly over the last five years.</p> <p>e) Yes, it has been effective. Proven case studies indicate that. However the evaluation of which companies should be chosen should be more carefully considered based on financial need and commitment. Also complete integration of the RECP concept should be identified through existing management systems to ensure that companies continue with the programme outside of the project.</p> <p>f) Generally very effective in putting out the message and engaging the wider industry as well as carrying out a number of assessments; however there has been limited implementation of proposed RECP measures due to a number of barriers.</p>

<p>13. What would you consider to be the constraints within industry in terms of RECP implementation?</p>			<p>a) Most important constraint is that companies do not know about their potential to improve and they are not sure of the profitability of the projects to be implemented. Very often industries simply do not know what is possible within their companies/processes. Moreover old thinking (e.g. short-term thinking) and old information hinder the perception of new opportunities.</p> <p>b) Low awareness and demand from the market.</p> <p>c) Lack of knowledge and understanding of RECP.</p> <p>d) Funding is often cited as a constraint but the new enhanced competitiveness programme of the DTI should address this.</p> <p>e) Companies claim lack of financial resources. I believe it is a lack of commitment, which can be identified from the beginning of the programme. Companies are keen to implement improved housekeeping measures but baseline data is very important so they know they have saved money. So a lack of measurement is also partly a hindrance to implementation.</p> <p>f) These barriers include, amongst others:</p> <ul style="list-style-type: none"> <li>- Financial constraints, i.e. funding of capital expenditure (slowly being addressed and communication of funding mechanisms being rolled out).</li> <li>- Concerns of changes impacting on product quality (case studies and track record in implemented similar projects as well as inculcating the need for assessment to analyse the product quality constraints). As an example, a textile stenter (dryer) may function to remove a certain amount of moisture and this needs to be defined to provide the parameters for a stenter optimisation project.</li> <li>- Lack of willingness to be innovative and apathy regarding implementing changes (need senior management in a company to make this an operational requirement to constantly look to try and improve efficiency).</li> <li>- Lack of in-house engineering capacity (consulting firms could make up for this if appropriate).</li> <li>- Industry's short-term focus (continuing dissemination of information of the impact of lifecycle costs and awareness</li> </ul>
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<p>14. What other interventions and support would you recommend could be of value-add to industry to improve their environmental performance?</p>			<p>creation around rising resource prices).</p> <ul style="list-style-type: none"> <li>a) Voluntary agreements between companies / industrial sectors and governments on the increase of resource/environmental performance, and to integrate management processes into reflection.</li> <li>b) Conferences, seminars, more projects with industries, maybe adapting the idea of waste minimisation tables to involve several companies in common projects.</li> <li>c) Link the RECP intervention with other benefits that would allow companies to position their products and brand better in the market, e.g. labelling, CSR, reporting. Use techniques such as foot-printing to show in concrete numbers the opportunities for actions that can be used also as a basis for monitoring. Monitor the international market and its demand, e.g. EU introduced a single market for greener products initiative based on harmonised product and company foot-printing methodology.</li> <li>d) More self-help, industry-specific guides and handbooks on RECP.</li> <li>e) A rational approach to environmental legislation which mutually reinforces different aspects.</li> <li>f) Companies need to be exposed to what's happening in similar sectors in other developing countries. Knowledge exchange such as study tours could assist in this regard. New technology updates should also be provided to companies. Networking with other companies is also invaluable within similar sectors.</li> <li>g) Guidance in terms of environmental legislation and imminent legislative changes (for example, Air Quality Act emissions licence requirements); however this needs to be done to alert companies (due diligence) and not to prescribe things (as this is the responsibility of government enforcement agencies). Development of integrated waste management plans (IWMPs). Carbon footprint assessments as South Africa gears towards the development of the carbon tax in 2015.</li> </ul>
<p>15. Do you think that government understands the needs of industry?</p>			<ul style="list-style-type: none"> <li>a) No, at least not satisfactorily.</li> <li>b) Cannot assess as a European.</li> <li>c) In South Africa, not sure whether it does.</li> </ul>

		<ul style="list-style-type: none"> <li>d) No. 95% of government employees (manager level) in SA are not geared towards and do not understand entrepreneurship or industrial management.</li> <li>e) To a limited extent.</li> <li>f) Partly. However the area of alternative technologies should be expanded. Some trade policies should also be reconsidered with the growth of the manufacturing sector and not only supply of raw materials.</li> <li>g) There are mixed feelings in this regard. Partly government does tend to create challenging environments for businesses in prescribing specific codes for payment grades, and unnecessary bureaucracy (which in themselves bring best practice but possibly not always well thought out in terms of their impact and not allowing sufficient phase-in for change). Also government does not always provide sufficient facilitation of using local expertise rather than importing from elsewhere. On the positive side, there is a large amount of funding and institutional support being provided to industry especially focusing on those most vulnerable sectors, and the fact that this exists shows that government is receptive to the needs of industry.</li> </ul>
<p>16. What specific government support do you think is required to assist industry with RECP implementation?</p>		<ul style="list-style-type: none"> <li>a) There must be more cooperation between governments and industries – a major duty for the NCPC-SA: joint formulation of goals and measures to be taken to achieve the goals.</li> <li>b) Conferences, seminars, more projects with industries, maybe adapting the idea of waste minimisation tables to involve several companies in common projects.</li> <li>c) Providing an enabling framework, a threat of imminent regulation, sustainable public procurement, coordination of regulatory and voluntary approach for better cohesion in requirements and reducing the need for multiple and sometimes not coherent compliance, special support to SMEs.</li> <li>d) Provide self-help tools so plants/factories can do RECP themselves, with minimal support from consultants/experts required.</li> <li>e) Industry requires government to create an enabling environment</li> </ul>

			<p>for business to do the best it can. RECP is a commercial imperative today.</p> <p>f) More knowledge tools on alternative technologies and management systems.</p> <p>g) Funding for implementation, research into local benchmarks, e.g. energy required per unit of production, capital invested per unit of production so that factories can compare their performance with the best and be motivated to improve.</p>
17. Do you think that RECP initiatives have the potential to create additional jobs within industry?	5	2	
<ul style="list-style-type: none"> <li>If YES to 17 above, why would you say this is possible?</li> </ul>			<p>a) REPC means to continuously improve processes and includes maintenance. If processes are optimised (energy and resource-wise), productivity is increased, leading to a market advantage. This would lead to an increase in production, combined with employing more people. As a side effect, the industries that offer services and goods to increase resource efficiency will increase their business – combined with the respective increase of jobs.</p> <p>b) Consultancy market, new technologies.</p> <p>c) RECP leads to increased demand for recycling and for cleaner technologies. This creates new jobs.</p> <p>d) More jobs created in industries such as alternative technology for RECP solutions, e.g. in energy-efficient equipment. The demand for sustainability and/or energy managers has also increased over time.</p> <p>e) Implemented RECP projects will reduce costs and therefore allow factories to survive competition and provide scope for growth. Often RECP initiatives lead to a closed-loop approach where companies take stock of their impacts and minimise these by doing things in-house (for example developing a wastewater treatment plant on site which does not reduce the requirement to have municipal treatment plants but acts to remove unnecessary additional load to these plants). These initiatives mean creating more jobs on site.</p>
<ul style="list-style-type: none"> <li>If NO to 17 above, then why do you think this</li> </ul>			<p>a) Not sure, but have not seen much job creation during my career,</p>

is not possible?			<p>because by and large the focus is on streamlining processes and reducing also human resources.</p> <p>b) Pursuit of more than one goal with a specific intervention often leads to non-achievement of both. Jobs will be created in the economy if businesses are sustainable.</p>
18. Are you familiar with other environmental concepts such as Eco-labelling, Life-Cycle Management, Environmental Management Systems, Life-Cycle Assessments, Life-Cycle Thinking, Carbon Foot-printing, etc.?	7		
<ul style="list-style-type: none"> <li>If YES in 18 above, then which ones do you think will improve the environmental performance of industry?</li> </ul>			<p>a) All above concepts assume, that the respective companies are sensitised to the issues of resources efficiency, sustainability, etc. Otherwise they do not make sense. The life cycle issue is the utmost important topic to improve environmental performance of industries. It is maybe the only really important issue to bring industries onto the path of sustainability. If companies think in life cycles, they recognise the overall importance of resource efficiency (and life cycle costing, which is one of the most important keys to implementation of improvement measures)</p> <p>b) ISO 14001 and 50001 are working, but they lack good input for the definition of actual technical improvement measures. Eco-labelling apparently reaches about 10 to 15% of buyers.</p> <p>c) A combination of all.</p> <p>d) EMS, LCM, Foot-printing.</p> <p>e) Depending on the type of industry, many of these instruments are already used. The priority of industry is to comply with the ever-increasing stringency of regulatory requirements, and introduction of more instruments just adds to cost and not necessarily to improved performance.</p> <p>f) It depends on the industry sector, for example supply chain solutions can be addressed within LCA methodologies. Carbon foot-printing can be used to raise awareness on consumption levels. EMS assists the overall operational management of a company, identifying how to reduce impacts. Eco-labelling can assist in marketing companies' products or services to a niche</p>

			<p>market of engaged green consumers.</p> <p>g) All of these have their place in industry; however companies will be at different levels of receptiveness to using such techniques/tools. The way to promote these to industry is through highlighting their benefits. Eco-labelling has benefits in marketing, and brings about a need for benchmarking; however it does require transparent and open disclosure by all players in a particular sector (e.g. the carbon disclosure project). Life Cycle Assessment looks at the full value chain and indicates the full impact of a product from raw material extraction right through to disposal and allows one to design products that work within the system of natural cycles (can be recycled and are not harmful to the environment, etc.). Life Cycle Costing also allows one to highlight the cost of operating inefficiently (buying cheap inefficient equipment means higher operating costs). Environmental Management Systems formalise the management of impacts on a day-to-day basis and provide the platform to continuously control, militate against impacts, and progressively improve environmental performance.</p>
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### Appendix C: Government Questionnaire Responses

QUESTION	YES	NO	COMMENT
A. KNOWLEDGE & UNDERSTANDING OF NCPC-SA AND RECP			
1. How did you become aware of the NCPC-SA and its programmes?			<p>a) Know the Director of NCPC as he is my predecessor from my previous job.</p> <p>b) The NCPC is the DTI programme; all its business plans and programmes are approved by the DTI.</p> <p>c) I was involved in the establishment of the programme when I was still working for CSIR MSM Division. The initial programme was funded by the Danish Government for the textiles sector.</p> <p>d) Motivated establishment of NCPC-SA, and co-governing</p>

			<p>and advisory role as deputy director at the South African Department of Trade and Industry (the DTI) since NCP-C-SA's inception in 2002.</p> <p>e) Through some of the eco-labelling work and discussions that took place in about 2008. Through sustainable production and consumption workshops and work. Through engaging on sustainable public procurement for a study undertaken for the International Institute of Sustainable Development (when working as a consultant). Through discussions on the setting up of the IEE programme. Through discussions re. how to get more Western Cape industries to work with the NCP-C (and thus to help the WC achieve its targets of reduced water, energy and waste consumption).</p>
2. Were you aware of the concept Resource Efficiency and Cleaner Production (RECP) at the time of engaging with the NCP-C-SA?	4	1	
<ul style="list-style-type: none"> <li>If YES to Question 2, how did you become aware of RECP?</li> </ul>			<p>a) Through quarterly engagement with the NCP-C.</p> <p>b) By getting involved with the work of NCP-C.</p> <p>c) As a participant in UN Commission for Sustainable Development events, I became aware of UNEP/UNIDO NCP-Cs in other countries. On occasion of the DTI's applying for UNIDO membership in 1998 I prepared a request that an NCP-C be established for South Africa with UNIDO facilitation. The request was approved by UNIDO and the DTI. UNIDO secured funding and the DTI committed matching funding. The NCP-C-SA was announced as a partnership project at the Johannesburg World Summit for Sustainable Development in 2002.</p> <p>d) I was the co-ordinator of the West Sussex Sustainable Business Partnership in the UK from 2003 to end 2005. This partnership focused on RECP in businesses across all sectors in the county. We also worked with other counties in the South-East England region and with UK national programmes such as the Carbon Trust,</p>



			Envirowise and NISP, to jointly provide the best advice and support to businesses to improve their energy efficiency and use less polluting methods of production.
3. Are you actively involved with projects relating to the NCPC-SA and other RECP initiatives?	5		
<ul style="list-style-type: none"> <li>If YES, then please identify the projects you are involved with and what your role is.</li> </ul>			<p>a) As currently an employee of the DEA, I participate on the DTI–NCPC Executive Management Committee (EMCO). I am also responsible for the development of the national SCP policy framework and the national strategy for sustainable development.</p> <p>b) All RECP projects and IEE projects. I am the chairperson of the Project Steering Committee of the EMCO and sometimes attend NCPC MANCO meetings.</p> <p>c) Technical support in the textiles and clothing industry to Mortex in Durban.</p> <p>d) Administration of the DTI’s funding and overseeing responsibilities; in this role assisted NCPC-SA with preparing strategic planning and reports. Also facilitated a meeting with sector desk managers at the DTI to secure co-operation between DTI sector desk and RECP project managers.</p> <p>e) As a province, we are trying to encourage improved energy and water efficiency and reduced waste production/more responsible waste management (incl. pollution to air, water and soil). We have just completed the development of an energy consumption and CO<sub>2</sub> emissions database for the Western Cape. The database has been developed to support the strategy to meet the following objectives: To build on data collated for 2004 and facilitate the tracking of energy and related emissions over time. It deepens the Western Cape Government’s (WCG) understanding of key energy and emission issues and management priorities both in terms of sector consumption and geographic distribution of that consumption. To provide a disaggregation of province</p>

			<p>energy and emissions profiles to district and sector levels. The database will be used to engage with municipalities at first for them to engage with other sectors (with our support) around energy consumption issues. We are about to start the development of a long-term mitigation scenario exercise for the WC. This will outline what initiatives we should focus on to reduce our impact on climate change through decreasing energy usage/increasing efficiencies. We are driving a strategic assessment for the placement of large-scale wind farms in the WC and linking to the same being done at a national level. Other areas that I am not driving but am also involved in are our waste section, which has been driving the development of a green procurement policy for the WCG. This has, however, taken some time to implement; our water and air quality section has a focus on RECP through programmes such as Too Precious To Pollute, their air quality management forums and licensing, etc., and GreenCape is a special purpose vehicle under the WC Department of Economic Development &amp; Tourism. They are tasked with supporting the growth of the green economy in the WC, with an initial focus on energy. A large number of initiatives are under way, including the promotion of renewable energy (large and small scale), feasibility studies, the promotion of local content, supporting SMMEs, etc.</p>
4. Do you consider industry's environmental performance as important as economical performance in terms of sustaining industry?	5		
<ul style="list-style-type: none"> <li>If YES to 4 above, then what are your reasons?</li> </ul>			<p>a) Natural resources are core to economic output and their unsustainable use could result in the collapse or [we] need to find more innovative ways to improve products.</p> <p>b) The triple bottom line makes all the three sustainability pillars equal, as a results environment forms part of the</p>

			<p>bottom-line elements of economic and social requirements for sustainability.</p> <p>c) The environment performance really helps companies to benefit financially as they become aware of savings which can be derived from saving things like water, electricity, and even effluent.</p> <p>d) Industry greening is seen as a major component of the green economy, which has been adopted by most economies of the world to counter the 2008–2009 economic meltdown. Green jobs are seen to be the solution to high unemployment rates. Industry’s environmental performance is key to energy and resource efficiency, which generate resource security. Industrial sustainability is dependent on resource security – without resource security there will be no investor certainty and no investment in industry. Lots of industries will fail because of poor access to quality resources.</p> <p>e) The utilities in SA have been falsely cheap for some time. The cost of electricity has already rocketed in the recent past and is set to continue. The cost of water should soon follow a substantial increase pathway. These are things that are considered environmental resources, but will have a direct impact on the financial sustainability of industry. There is an increasing awareness of the effect of poor air, water and soil quality on communities and the effective functioning of ecosystems. As legislative and other mechanisms are used to reduce these polluting impacts, stricter requirements will be placed on industries, which will lead to increased economic impacts. By not solving their issues of poor environmental performance, this will increasingly hit their bottom line. Industry relies heavily on the services that ecosystems provide. By ignoring their impact on these ecosystems, they are eroding their</p>
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			asset base. This may be fine for short-term profit gain, but will not sustain industry in the long term. With the increasing focus internationally on carbon foot-printing, industries in SA that export their goods will already be hard hit due to the distance to market (i.e. heavy carbon footprint). Industries that export, therefore, have to find ways of reducing their carbon footprints in order to still be able to compete in international markets.
<ul style="list-style-type: none"> <li>If NO to 4 above, then what are your reasons?</li> </ul>			
5. Do you think that the projects and initiatives undertaken by the NCP-PC-SA are effective and of value to support industry?	5	1	
<ul style="list-style-type: none"> <li>If YES to question 5, then please support why you say so.</li> </ul>			<p>a) The cost of doing business has escalated (e.g. including levies, taxes, abatement, fines) and the end-of-pipe solution has proved not to be the best option. Thus industry needs support on identification and prioritisation of improving business competitiveness while minimising environmental impacts.</p> <p>b) The assessment and sector guideline documents add value to the industry competitiveness development, thus have a contribution to the overall industry support including financial savings.</p> <p>c) Those companies that have been involved with the projects are aware of the need to measure their consumption and how to maximise the usage of the resources available to them.</p> <p>d) NCP-PC-SA initiatives are partially effective but performance can improve. RECP needs to re-strategise to better align with green economy features, such as job creation and job retention reported in quarterly and annual reports. RECP should also recognise that training and education is an important component of capacity building, therefore bringing educational aspects into RECP approaches. RECP work should be meaningful to workers as well as investors, with measurable and</p>

			<p>reportable benefits to both, for example, certificated short courses in contrast with advocacy and implementation that are currently not evaluated.</p> <p>e) Yes, from what I know of the programmes, but I have not been up to date with the NCPC's programme for some time now. I think that there certainly needs to be support to industry to help them along this seemingly daunting journey, which is the role that NCPC plays. Then providing hands-on support to the extent that industries can prioritise and get ready to roll out projects is also valuable.</p>
<ul style="list-style-type: none"> <li>If NO in Question 5 above, then what is your supporting reason.</li> </ul>			<p>I am not sure of the extent to which the NCPC is able to help with actual implementation or whether after their advice and support has been provided, businesses are not able/do not take up the implementation of recommendations. The NCPC support needs to be coupled with programmes and mechanisms that provide tax breaks or financial loans/support for businesses to implement the actions required.</p>
<b>B. FINANCIAL SUPPORT</b>			
<p>6. How would your department be able to assist and strengthen the activities of the NCPC-SA and RECP within a South African perspective?</p>			<p>a) By providing the policy framework for projects, and by providing financial support where possible for the RECP messaging and industry support to be scaled up as these ultimately build evidence that industry can do something about sustainable consumption production and ultimately sustainable development.</p> <p>b) To ensure that funding is available for NCPC activities' continuation.</p> <p>c) The Department of Trade and Industry is responsible for the funding of the NCPC.</p> <p>d) Incentive schemes such as the 12I tax incentive reward energy efficiency. Unfortunately DTI incentives used to support new investments and not refurbishment to make existing plant and equipment more efficient.</p> <p>e) Market the NCPC programme through all our</p>

			engagements with industry and with municipalities (who then engage with industry). Work with the GreenCape and the NCPC to see how synergies could be developed so that the different programmes strengthen each other. Engage, together with the NCPC, with the Technical Assistance Unit at National Treasury to explore what tax incentives/financial mechanisms could be put in place to support implementation.
7. Is any financial support available from your department to assist industry with implementation of RECP assessment recommendations?	4	1	
<ul style="list-style-type: none"> <li>If YES in 7 above, then please list these financial support programmes in place.</li> </ul>			<ul style="list-style-type: none"> <li>a) Indirectly available if industry applies for funding streams such as the green fund or also where there is donor funding that the department could assist in unlocking for industry</li> <li>b) MCEP, Manufacturing Incentive Programme (MIP), Cluster Improvement Programme (CIP) and Section 12I of Taxation Act.</li> <li>c) A new incentive scheme announced in 2012 is supportive to investment in replacing inefficient plant and equipment with cleaner, more efficient technologies. NCPC-SA should encourage enterprises to utilise this cleaner technology incentive scheme to the maximum. Maximum utilisation might motivate National Treasury to increase the total amount available to industries.</li> </ul>
<ul style="list-style-type: none"> <li>If NO in 7 above, then what financial support mechanisms do you envisage will be crucial to adopt to assist industry with implementation?</li> </ul>			<ul style="list-style-type: none"> <li>a) Tax incentives/financial mechanisms could be put in place to support implementation – see models from UK programmes such as The Carbon Trust, Envirowise, NISP.</li> </ul>
8. Are you aware of any other government incentive programmes that exist to assist with implementation of RECP?	1	3	<ul style="list-style-type: none"> <li>a) DTI is the core one but there are other indirect and direct ones such as DST R&amp;D tax incentive.</li> <li>b) Green economy and industry greening policies. Most importantly – efficiency skills development is required. All education and training courses, from schools to higher education, must teach the importance of using</li> </ul>

			energy, water and materials responsibly, along with re-use and recycling as an everyday responsibility. All technical training courses must include efficiency components, including skills to calculate the long-term costs and benefits of efficiency. Efficiency must become a way of working and a way of life.
<ul style="list-style-type: none"> <li>If YES to 8 above, then can you list these incentive programmes?</li> </ul>			<p>a) The demand side management programmes through Eskom (although I understand that their funding has been heavily cut with their not receiving the percentage increase on electricity prices that they had requested). Solar water heating rebate system of Eskom. Eskom programmes re installation of localised small-scale renewable energy technologies by business.</p>
<b>C. INDUSTRY GROWTH AND SUPPORT</b>			
9. What other support, be it financial or technical, do you think is required to induce a culture of RECP practices within the South African industry?			<p>a) Sharing of lessons among industry/government/funders and such could be profiled in policy documents.</p> <p>b) Awareness and training programme.</p> <p>c) More funding can be motivated to increase budget from the DTI.</p> <p>d) Case studies and capacity building – possibly done through industry associations/bodies. Eco-labelling (to reduce confusion in the market). Perhaps streamlined Environmental Impact Assessment (EIA) processes for industrial developments following an RECP path. Really would look at models in the UK (am sure there are others around that work, but the NCPD-SA one is the one I worked with from 2003 – 2005) – combination of national programmes that provided hands-on support and technical assistance, linked with advice on what technologies to be used in implementation, comparative costs and benefits, etc., linked with tax incentives for those technologies, and regional/county programmes that supported businesses to broadly identify areas for improvement, legislative compliance and cost savings</p>

			and signposted them on to the national programmes. The regional/county level then also showcased good practice from business in their area, prepared businesses for entry into sustainable business award programmes (that cascaded from local, to county to regional level).
10. Do you think that RECP has added value to industry over the past few years?	5	1	
<ul style="list-style-type: none"> <li>If YES to 10 above, then what are your reasons?</li> </ul>			<ul style="list-style-type: none"> <li>a) Mostly they saved money from paying for electricity, water, waste non-compliance fines, etc.</li> <li>b) The number of projects and enrolments for assessment programmes has increased.</li> <li>c) Reports from industry support the above.</li> <li>d) RECP succeeded in raising awareness of RECP. Most participating industries implemented the low-hanging fruit, and many have partially implemented the efficiency options recommended by RECP consultants. RECP prepared the way for the green economy in the sense that RECP showed policy makers that efficiency is cost effective and will over the long run deliver a sustainable industrial sector, whereas 'business as usual' is not sustainable.</li> <li>e) Certain large industries have reduced their energy and water consumption and waste production substantially – this would have saved them costs, reassessed their process flows and also reduced resource waste such as employee time, and capacitated employees to look for further areas of improvement.</li> </ul>
<ul style="list-style-type: none"> <li>If NO to 10 above, then what are suggestions to improve this service by the NCPC-SA?</li> </ul>			<ul style="list-style-type: none"> <li>a) Have to get to a point where industries are implementing the changes required. Guess this study is part of that – identifying what's needed to make implementation happen.</li> </ul>
11. Do you think that RECP initiatives have the potential to create additional jobs within the South African industry?	5		
<ul style="list-style-type: none"> <li>If YES to 11 above, why would you say this is</li> </ul>			<ul style="list-style-type: none"> <li>a) Most industries could still be using inefficient processes;</li> </ul>



possible?			<p>therefore jobs could be created in doing assessment, retrofits, and reengineering. And indirectly from the new technologies/products that would have to be manufactured.</p> <p>b) They have added to the retention, not to the new job creation.</p> <p>c) As companies become more competitive, they grow and increase their employment.</p> <p>d) New green jobs will include energy, water, materials and waste managers, ensuring that these resources are utilised responsibly throughout the enterprise – not only in the production process. In-house trainers in industries or industry sectors, teaching and training the workforce in efficiency. Private consultants offering teaching and advocacy in sustainability capacity building. Measuring and verification practitioners to certify efficiency improvements if required to access incentives. Soil, air and water quality practitioners. Business advisors facilitating access to government incentives.</p> <p>e) If businesses save by reducing their energy, water and raw material consumption and by reducing their waste production, they have more money available to employ more people to expand their production.</p> <p>Also creation of jobs as advisors to industry, companies to manufacture and provide the more resource-efficient technologies to industry.</p>
<ul style="list-style-type: none"> <li>If NO to 11 above, then why do you think this is not possible?</li> </ul>			
12. Are you familiar with other environmental concepts such as Eco-labelling, Life-Cycle Management, Environmental Management Systems, Life-Cycle Assessments, Life-Cycle Thinking, Carbon Footprinting, etc.?	5		
<ul style="list-style-type: none"> <li>If YES in 12 above, then which of these initiatives do you think can benefit the growth of South African</li> </ul>			<p>a) A combination of all these in one form or the other.</p> <p>b) Proudly South African and appliances labelling initiatives</p>

industry?			<p>plays a key role in the project life-cycle management.</p> <p>c) All of them as you cannot say one fits all different industries, but apply the ones most suitable for them.</p> <p>d) The following concepts result in access to environmentally sensitive markets that will promote trade, and this means growth: Eco-labelling. Life-Cycle Management and Life-Cycle Assessments = Part of eco-labelling. Environmental Management Systems, if certificated e.g. ISO 14001 certification. Carbon Footprinting, if ISO 50001 certificated, promotes trade.</p> <p>e) All.</p>
13. Do you think that government understands the needs of industry?	4	1	
<ul style="list-style-type: none"> <li>If YES to 13 above, then how would you support this statement?</li> </ul>			<p>a) Government understands that they need to provide necessary policy signals and support towards resource efficiency at lowest possible financial implications; however as there is an existing, mature economic regime, the challenge is more on how to bring change without job losses and decline in economic growth.</p> <p>b) The government is responsible for the creation of the enabling environment for industrial and competitiveness development. It is the government's prerogative to support industrialisation for green and greening industries.</p> <p>c) I know, I work for the Government, hence funding NCPC.</p> <p>d) Government support is not only a question of understanding industry's needs. There are many demands for government support; therefore government must make choices how to spend its limited resources. The need to control effective utilisation of incentives, and to get value for money is also a factor in government's decisions to support a specific activity.</p>
<ul style="list-style-type: none"> <li>If NO to 13 above, then what would you say is needed to support industry in becoming more compliant with RECP practices?</li> </ul>			<p>a) Big industry might understand, but not sure of extent to which the multitude of smaller businesses understand. Government (provincial) may think they understand</p>

			industry, but we might find that engagement is not frequent enough, and the space for dialogue not open enough for this to be possible.
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