Investigating the Current Supply Chain Sustainability Reporting Practices of South African Organisations

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Declaration

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Abstract

The need for sustainable supply chain management has become a necessity given the growing impact of climate change and global warming. Given the limited literature on supply chain sustainability in South Africa, the main objective of this study is to investigate the current sustainability reporting practices in supply chains of South African organisations. The focus is on the supply chain sustainability practices of organisations listed in selected sectors on the Johannesburg Stock Exchange (JSE). Data collected from sustainability and integrated annual reports of organisations in the sample are analysed using non-parametric statistical tests to compare sectors on the JSE and companies listed on the Socially Responsible Investment (SRI) Index with those that are not. The results show that there are differences in the supply chain and sustainability practices for the selected sectors and between SRI and non-SRI companies. South African organisations need to increase their focus on supply chain sustainability and further research is necessary to support and expand on the findings of this study.

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List of Acronyms

• BSI	British Standards Institution	pg 17
• CACG	Commonwealth Association for Corporate Governance	pg 21
• CDLI	Carbon Disclosure Leadership Index	pg 16
• CDP	Carbon Disclosure Project	pg 02
• CO_2	Carbon dioxide	pg 03
• CO_2e	Carbon dioxide equivalent	pg 55
• COP	Conference of the Parties	pg 16
• CPLI	Carbon Performance Leadership Index	pg 17
• CSMS	Corporate Sustainability Management System	pg 14
• GRI	Global Reporting Initiative	pg 03
• ISO	International Organisation for Standardisation	pg 03
• JSE	Johannesburg Stock Exchange	pg 01
• KPIs	Key Performance Indicators	pg 89
• LCA	Life Cycle Analysis	pg 45
• NBI	National Business Initiative	pg 16
• NGO	Non-Governmental Organisation	pg 09
• OECD	Organisation for Economic Cooperation and Development	pg 21
• PAS	Publically Available Specification	pg 17
• SCOR	Supply Chain Operations Reference	pg 42
• SME	Small and medium sized enterprises	pg 05
• SRI	Socially Responsible Investment	pg 04
• SWOT	Strengths, Weaknesses, Opportunities and Threats	pg 14
• tCO_2e	tonnes of carbon dioxide equivalent	pg 02
• UNFCCC	United Nations Framework Convention on Climate Change	pg 15
• USA	United States of America	pg 36
• WCED	World Commission on Environment and Development	pg 08

Chapter 1: Introduction

1.1 Background

Sustainability is a topic of increasing importance due to the impact of climate change and global warming that is being felt worldwide. Organisations are facing a number of factors. Firstly, extreme climatic events; secondly rising energy prices in general; thirdly pressure from consumers and employees and finally, changing legislation that places harsh penalties on those who do not reduce their emissions and ensure their operations are sustainable (World Economic Forum, 2009). In 2013, global carbon emissions rose to a record high of 36 billion metric tons primarily due to increased coal consumption outweighing the growth of alternative renewable energy sources (Garside, 2013). This illustrates the importance of developing and implementing sustainable practices throughout the supply chain.

The trend towards sustainable practices is on the rise globally as governments, organisations and the public realise the increasingly negative environmental impact anthropogenic activities have on the environment (Heal, 2012). It is imperative that organisations consider climate change in their strategies and operations due to the fact that it is such an important social and environmental issue (Busch, Hoffmann & Ziegler, 2011). Furthermore, individuals, organisations and governments must adapt proactively rather than reactively to combat the effects of climate change. This will facilitate vulnerable communities that are less adaptable to extreme climatic changes and events, mitigating the negative impacts these changes and events will have on global business operations and profits (Pilifosova & Smit, 2003). Many African countries are less resilient to climate change due to extensive poverty, frequent droughts, inequality in land and natural resource distribution and heavy reliance on rainfall for agricultural purposes (Pilifosova & Smit, 2003). It is clear that countries such as South Africa need to focus on sustainable development and sustainability to reduce the devastating effects of climate change on the environment, economy and society in general.

This study provides an assessment of the current supply chain environmental sustainability practices of South African organisations. This study facilitates academics, organisations, investors and governments in assessing the sustainable performance of organisations listed on the Johannesburg Stock Exchange (JSE) based on financial, social and environmental perspectives. Environmentally sustainable supply chain practices are investigated through the use of qualitative software analyses on integrated annual reports and sustainability reports to obtain a view of the current level of commitment to sustainability. This is particularly relevant due to the impending carbon tax, the

implementation of which has been delayed until 2016, to allow for further planning, contributions and feedback (Greve, 2014). Organisations should view this as an opportunity to develop, implement and make corrective adjustments to their emissions reductions programmes to minimise the financial implications of the tax in the future.

As South Africa's total emissions for 2012 were well over 500 million tonnes of carbon dioxide equivalent (tCO_2e), and with emissions continuing to increase, it is imperative that all spheres of society work together to facilitate the decarbonisation transformation (CDP, 2013). South Africa has been plagued by labour unrest, volatile financial markets and a supply-demand imbalance due to the higher value of goods imported than the value of the raw materials that are exported. In addition, demand centres such as Gauteng and many natural resources are located far from the Port of Durban, Port Elizabeth and the Port of Cape Town necessitating increased transportation and distribution. Due to the unmaintained rail network, transport providers are faced with the challenge of transporting large quantities over long distances on the national road networks. This in turn has led to further damage to road surfaces, increased congestion and lead time delays, which have driven up logistics costs. Further challenges facing the logistics industry in South Africa include a skills shortage, resistance to change and insufficient supply chain strategies and tactical plans (CSIR, 2013). It is clear that there are many obstacles to overcome to develop fully integrated supply chains that minimise environmental degradation and maximise financial success.

To achieve sustainable business operations, organisations must utilise the tools and resources available to them. These tools include corporate governance frameworks and integrating corporate social responsibility and corporate sustainability practices. Corporate sustainability and corporate social responsibility are interlinked themes facilitating management in ensuring their organisation's triple bottom line performance is in line with international standards. The triple bottom line of an organisation consists of three pillars, namely; social, environmental and financial, which should be managed simultaneously to achieve holistic success. Corporate sustainability is a relatively broad and abstract concept that relates to an organisations' ability to perform current operations without negatively impacting the ability of future generations to do the same (Van Marrewijk, 2003). Corporate social responsibility is a key management tool that facilitates the achievement of corporate sustainability, and relates to the inclusion of social and environmental aspects in addition to the conventional financial aspects included in financial reports (Maines & Sprinkle, 2010).

Environmental management is another critical tool developed to guide companies in their efforts to reduce their emissions, decrease their waste throughout the supply chain and minimise any other negative environmental impacts (Calantone, Melnyk & Sroufe, 2003). To assist organisational

environmental management, the International Organisation for Standardisation (ISO) developed a family of standards relating to environmental management systems (ISO, 2014). These standards, in conjunction with the Global Reporting Initiative (GRI) guidelines for sustainability reporting, provide organisations around the world with a framework for developing, implementing and assessing environmental sustainability practices. The GRI sustainability reporting guidelines are the most widely recognised and used sustainability reporting guidelines in the world (KPMG, 2013), and the reporting requirements for organisations listed on the JSE are based on the GRI guidelines.

The JSE is the largest stock exchange on the African continent and is renowned for maintaining excellent corporate governance standards. Organisations listed on the JSE are required to provide an annual integrated report that includes disclosures on financial, social and environmental performance (SAICA, 2011). The supply chain activities of organisations listed on the JSE are assessed in this study to determine what environmentally sustainable best practices are being used and to determine areas in need of improvement. This will help ensure that South African organisations maintain international standards and remain competitive in global trade.

Given the importance of sustainable development and the many challenges faced by the South African logistics industry, it is necessary to study current supply chain decarbonisation efforts. Although the exact nature of supply chains may differ depending on the industry and type of organisation, ideally, supply chain members should have similar objectives with regards to environmental and financial success. In reality, the goals of private and public companies differ in that public companies face greater levels of scrutiny and are required to be more transparent with regards to their operations. When companies have similar environmental and financial objectives, increased supply chain integration is possible, enhancing organisational effectiveness and efficiency. Many opportunities exist for organisations wanting to decarbonise their practices, from packaging initiatives to waste management to developing green facilities (World Economic Forum, 2009). These opportunities allow firms to reduce their carbon dioxide (CO_2) equivalent emissions and also lower costs due to reductions in waste, increased productivity and more efficient utilisation of resources.

1.2 Problem Formulation

1.2.1 Problem Statement

Due to the importance of sustainable development and mitigating the effects of anthropogenic activities on the environment, it is imperative to study organisational best practices that facilitate excellent environmental performance. Effective and efficient supply chain management may have a significant impact on both financial and environmental performance thus, necessitating the need to identify areas of strong performance and areas in need of improvement. The aim of this study is to investigate the current supply chain sustainability reporting practices of organisations listed on the Main Board of the JSE.

1.2.2 Research Objectives

The research objectives of the study were used to formulate research questions that are answered through qualitative and quantitative data analysis techniques. The first objective for this study is to investigate and compare the current supply chain sustainability reporting practices of organisations listed in the Basic Materials, Industrials, Retail and Manufacturing sectors of the JSE and to compare practices between SRI and non-SRI indexed companies. The second objective is to investigate preparation efforts for the carbon tax that is due for implementation in 2016. The final objective for this study is to determine the "readiness" for the 2016 carbon tax of JSE-listed organisations based on the findings of the first two objectives and information gathered in the literature review.

1.3 Audience

The intended audience for this study includes individuals, organisations, academic institutions and government officials who are interested in the supply chain environmental sustainability practices of South African organisations. Investors may use the findings to facilitate their understanding of current and future environmental performance, which will become increasingly relevant as stricter regulations are applied locally and internationally and as pressure from consumers and markets rises.

Organisations across South Africa may use the study as a guideline to the level of commitment to sustainable development that is currently expected. This will be particularly important for organisations and competitors in similar industries so that benchmark comparisons can be made to monitor progress and development. Supply chain members, both downstream and upstream, may find the study useful to help understand what best practices have been implemented and what best practices may be implemented in the future to improve financial and environmental performance. This study is of

particular relevance for organisations that will be impacted by the carbon tax due for implementation in 2016, as it may facilitate the implementation of their decarbonisation efforts.

Government officials can use the results of the study to determine the current level of commitment to sustainable development by large South African organisations and use this as a proxy for the level of commitment from small and medium-sized enterprises (SME's). The results of the study may also provide an indication of investments made in sustainable initiatives that will benefit the environment and society as a whole.

Academic institutions will benefit from understanding what organisations are doing to aid in the country's transition to a low carbon economy and may use the results of the study to develop future research and further studies. Academic institutions from other countries may use the information gathered in this study to compare the practices of a developing African nation with those of other developing nations and with developed nations to determine where discrepancies exist and identify reasons behind those discrepancies. Together, government officials, academic institutions and industry members can use studies such as this one to observe progress and develop corrective actions that can be used to combat environmental degradation and preserve societal well-being for the current and future generations.

1.4 Motivation of the Study

This study is beneficial to a number of South African stakeholders as climate change and global warming are placing new pressures on many industries. With the introduction of the carbon tax in 2016, many organisations will face financial pressure from their emissions and it is imperative that they begin adapting their operations to more sustainable methods. Supply chain activities offer enormous potential to reduce emissions and, therefore reduce social, environmental and financial costs. Consumers are also becoming increasingly aware of the negative effects of organisations on their environmental and social wellbeing and are placing additional pressure on industry and the government to adopt sustainable practices.

This study provides some insight into what South African organisations are currently doing to become more sustainable and enhances the understanding of the supply chain activities that large organisations are focusing on improving. Sustainable supply chain best practices in the South African context are identified to facilitate organisations and other interested parties in developing and improving benchmark standards.

Previous studies have limited data on supply chain sustainability in South African organisations and the goal of this study is to contribute to existing literature so that relevant stakeholders may better understand this topic. Going forward, the information can be used to complement related findings in sustainable supply chain literature in South Africa and around the world, and to identify future research topics that require further investigation.

1.5 Layout of Contents

The remainder of this document is divided into five chapters. Chapter 2 provides a literature review of the relevant concepts relating to sustainability in organisations and supply chain sustainability. Chapter 3 discusses the South African context of the study including the JSE, its sectors and relevant indices. Chapter 4 outlines the research methodology used in this study and includes any limitations and all assumptions that were made. Chapter 5 presents the results of the study, providing a discussion of the data analysis and findings. Chapter 6 provides the conclusions relating to the research objectives and recommendations for future research relating to this topic.

Chapter 2: Literature Review

2.1 Introduction

Sustainable development has become a necessity given the impact of climate change and global warming on organisations around the world. Although the traditional focus in business has been on financial performance, there has been a shift towards focusing on environmental performance and sustainability of the triple bottom line. It is important for organisations to realise the negative impact their operations have on the environment and the potential of supply chains to contribute to reducing costs and harmful emissions.

Section 2.2 of this chapter presents a background of sustainability detailing the driving forces behind sustainable practices, organisational approaches to implementing sustainability and a discussion on relevant international agreements and standards relating to sustainable development. Section 2.3 provides a review of the interconnectedness of sustainable development, corporate governance, corporate sustainability and corporate social responsibility. Important sustainability practices such as environmental management and sustainability reporting are discussed in addition to the costs and benefits associated with corporate sustainability and corporate social responsibility. Section 2.4 addresses sustainability in supply chains to substantiate the business case for maintaining effective and efficient supply chains that are environmentally responsible. An overview of generic supply chain models is presented in conjunction with sustainability-related best practices, and decarbonisation opportunities that have the potential to improve efficiency and supply chain sustainability.

2.2 Sustainability: its relevance and development

As organisations face escalating environmental risks, it is essential that practical solutions are developed to mitigate these risks. The long term sustainability of organisations and society as a whole is under threat as natural resources are depleted and harmful emissions continue to degrade the natural environment. Organisations have the responsibility of ensuring that their activities promote sustainable development, given the global scale of business operations, and can begin with understanding the underlying forces driving the need for sustainable practices. This understanding, in addition to the guidance provided by international agreements and standards, will facilitate the implementation of sustainable practices in organisations.

2.2.1 Defining Sustainability

Sustainability is often implicitly defined with little international agreement on one concrete definition. Although definitions for sustainability can be relatively vague, a number of themes emerge that relate to maintaining the existence of human beings and balanced population growth, in addition to preserving natural resources and minimising negative environmental impacts (Brown, Hanson, Liverman & Merideth, 1987). According to Brown et al. (1987), sustainability from a social perspective would encompass the needs laid out by Abraham Maslow in the hierarchy of needs. Sustainability from an environmental perspective places emphasis on natural balance and the health and productivity of ecosystems, whereas sustainability from an economic perspective places emphasis on maintaining economic prosperity and controlling steady population growth. From this, it can be deduced that sustainability relates to social well-being, financial success in meeting desired living standards and a healthy, balanced natural environment. Perhaps the most widely used definition for sustainability comes from the World Commission on Environment and Development (WCED) report titled "Our Common Future". Sustainability is defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987).

According to Heal (2012), there are two types of sustainability; weak sustainability (the narrow definition) and strong sustainability (the broad definition). Weak sustainability places emphasis on meeting social and economic needs for both current and future generations, whereas strong sustainability encompasses the moral obligation of the current generation to ensure that all living organisms (not only humans) are sustained. In other words, society has an obligation to ensure that the natural environment is protected and maintained for the future, placing greater emphasis on the environmental perspective. It is relevant to note that sustainability can be viewed from a capital perspective based on natural, physical and intellectual capital. Environmental damage and degradation result in the depletion of precious natural capital such as reduced species and water supply, and unstable climates. The reduced natural capital places the sustained survival of current and future generations at risk even though physical and intellectual capitals have been built up. This trade-off of natural capital for physical and intellectual capital relates to the weak definition of sustainability. It is clear that in the future, physical and intellectual capital will not be suitable replacements for natural capital as the species and ecosystems that are necessary for fuel, tourism and agriculture are placed under greater threat from climate change and anthropogenic activities (Heal, 2012). For the purposes of this study, the term sustainability can be understood from the strong (broad) perspective encompassing social, environmental and financial aspects. Therefore, sustainability can be broadly defined as the

ability to meet current social, environmental and economic needs without negatively impacting the ability of future generations to meet their social, environmental and economic needs.

2.2.2 Implementing sustainable practices in organisations

As stated by Van Marrewijk and Werre (2003), driving forces behind sustainable practices in organisations can either be because of individuals, groups or events outside of the organisation; external driving forces, or they can be due to individuals, groups or events inside of the organisation; internal driving forces. A summary of some of the internal and external driving forces is presented in Table 2-1.

Table 2-1: Internal and External Driving Forces for Organisational Sustainability

Internal Driving Forces	External Driving Forces
Moral obligation	Compelled by consumers & employees
Enhancing corporate reputation	Legislation
Alignment with strategic objectives	Global warming & climate change
Enhance competitive advantage	Rising fuel prices
Improve efficiency & reduce costs	New growth opportunities
Desires of company leadership	Pressure from non-governmental organisations
Facilitate supply chain sustainability	Negative media attention

Source: Bonini, Görner & Jones, 2010; Van Marrewijk, 2003; Van Marrewijk & Werre, 2003; World Economic Forum, 2009

With regards to external driving forces, organisations apply sustainable practices because they feel compelled by consumers, employees or non-governmental organisations (NGO's), it is required by legislature, or because they genuinely would like to be sustainable (Van Marrewijk, 2003; Bonini, Görner and Jones, 2010). As climate change and global warming have increasing impacts on the world, countries are implementing legislation regarding the preservation of the natural environment particularly with regards to controlling greenhouse gas emissions (World Economic Forum, 2009). South Africa is planning to implement a carbon tax system from 2016 (delayed from 2015), which will cost organisations R120 per ton of carbon dioxide (CO_2) equivalent (Gordhan, 2014: 25). This will force many organisations to adopt sustainable practices that reduce their supply chain emissions and limit negative social and environmental impacts. According to the World Economic Forum (2009), rising fuel prices are also driving sustainable practices in organisations as they find ways to reduce transport and utilise renewable energy in place of fossil fuels such as oil and coal.

With regards to internal driving forces, Bonini *et al.* (2010), state that there are a number of strategic drivers for sustainability including enhancing the reputation of the brand/ organisation, new market and product opportunities, sustainable practices aligning with overall strategic objectives and enhancing competitive advantages. The supply chain itself also drives sustainable practices by developing efficiency; reducing supply chain costs and supporting the sustainability objectives of other supply chain members such as suppliers, distributors and retailers. Sustainability is also driven by the desires of individuals in leadership positions (Bonini *et al.,* 2010). It is clear from the literature that organisations adopt sustainable practices for a number of reasons, considering social aspects such as the opinions of consumers and employees, environmental aspects such as climate change and global warming and financial aspects such as improving efficiency and reducing costs, when making decisions regarding implementing sustainable practices.

The driving forces for implementing sustainability differ subject to the commitment level of the organisation towards sustainable practices. Currently, there is no standard format for adopting and implementing sustainability strategies, however, a number of authors have presented frameworks that can be used to develop sustainability within an organisation. According to Gupta (2012), there are two broad categories of implementation; namely, opportunistic implementation and stable implementation. Opportunistic implementation occurs when organisations implement sustainability and social responsibility practices with a short term view. Characteristics of opportunistic implementation include minimal activities being undertaken, limited if any plans for future development and no aim of continuation. Stable implementation occurs when organisations implement sustainability and social responsibility practices with a long term view. Characteristics of stable implementation include the formation of a team responsible for sustainability in the organisation, a solid development plan of action and the consideration of appropriate actions given the organisation's size and industry.

According to Van Marrewijk (2003), organisational approaches towards sustainable practices are dependent on the level of ambition the organisation has towards implementing sustainability. There are five levels of ambition for corporate sustainability in addition to pre-corporate sustainability (Van Marrewijk & Werre, 2003). The five ambition levels are as follows; compliance-driven corporate sustainability, profit-driven corporate sustainability, caring corporate sustainability, synergistic corporate sustainability and holistic corporate sustainability. Figure 2-1 illustrates the levels of corporate sustainability.

Figure 2-1: Levels of Corporate Sustainability

Source: Van Marrewijk, 2003; Van Marrewijk & Werre, 2003

When an organisation is in a state of pre-corporate sustainability, it does not yet have any ambition to implement sustainable practices of its own accord (Van Marreiwjk & Werre, 2003). Compliance-driven corporate sustainability refers to organisations that implement sustainable practices due to external pressure such as national or international legislation or internal pressure such as feeling a moral obligation. Profit-driven corporate sustainability entails organisations that incorporate social and environmental aspects that contribute directly to the organisation's profitability. Organisations that reach the level of caring corporate sustainability do so due to the belief that social, environmental and financial considerations are all equally important. Synergistic and holistic corporate sustainability are similar. However, holistic corporate sustainability entails greater integration of social, environmental and financial aspects into the strategy, operations and outcomes of the organisation. In other words, synergistic corporate sustainability is attained when the organisation includes all sustainability aspects in the majority of decision-making areas, whereas holistic corporate sustainability is attained when all of the aspects are considered in every decision that is made (Van Marrewijk, 2003).

Esty and Lubin (2010: 4) argue that although organisations may initially adopt sustainable practices to mitigate risk and minimise costs, they begin to formulate strategies to enhance value creation as time goes on, thus supporting the implementation types suggested by Gupta (2012) and the levels of ambition described by Van Merrewijk (2003) and Van Marrewijk and Were (2003). From this perspective, the stages in creating value could be considered proxies for the phases in achieving sustainability. The four phases required to create value in an organisation are presented in Figure 2-2.

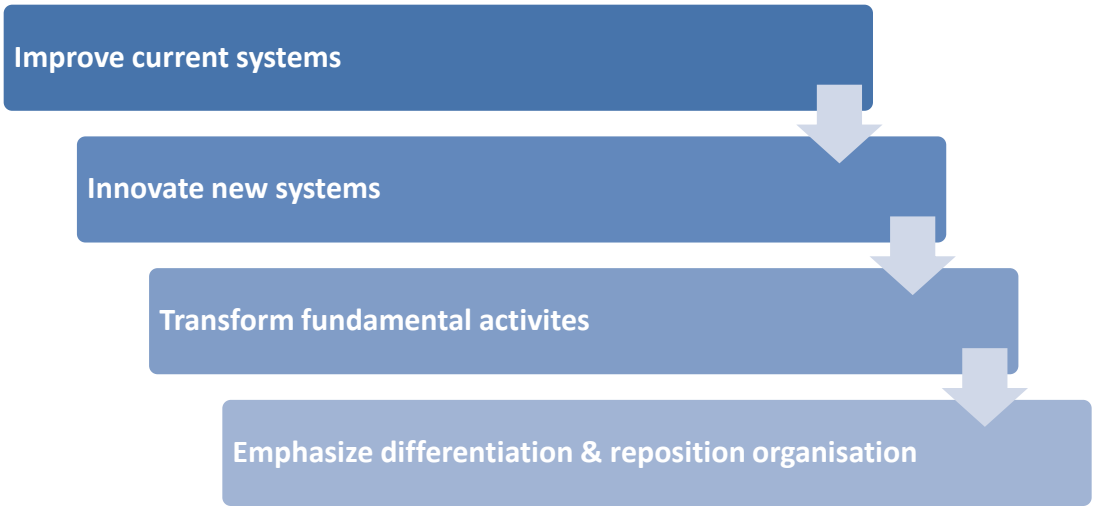

Figure 2-2: Phases of Value Creation

Source: Esty & Lubin, 2010: 4

The first phase relates to improving current systems to remain competitive when legislation changes and to improve efficiency and reduce costs associated with the environment. The second phase relates to innovating new systems to facilitate sustainable practices across the entire supply chain. This could affect the current products of the organisation, current procedures and activities in addition to logistics processes occurring across the supply chain. The third phase entails the transformation of fundamental business activities to provide new growth opportunities resulting in increased sales and ultimately profits. The fourth and final stage relates to the differentiating advantages provided by sustainable practices and the repositioning of the organisation as new strategies are developed (Esty & Lubin, 2010: 4). This indicates that those in leadership positions responsible for making strategic decisions have realised the increased importance of sustainability and that to remain successful in the future, sustainable practices must be maintained (Van Marrewijk, 2003; Van Marrewijk & Werre, 2003).

Epstein and Roy (2001), propose a generic five step implementation framework that can be customised by any organisation to suit its specific context and resulting requirements as shown in Figure 2-3.

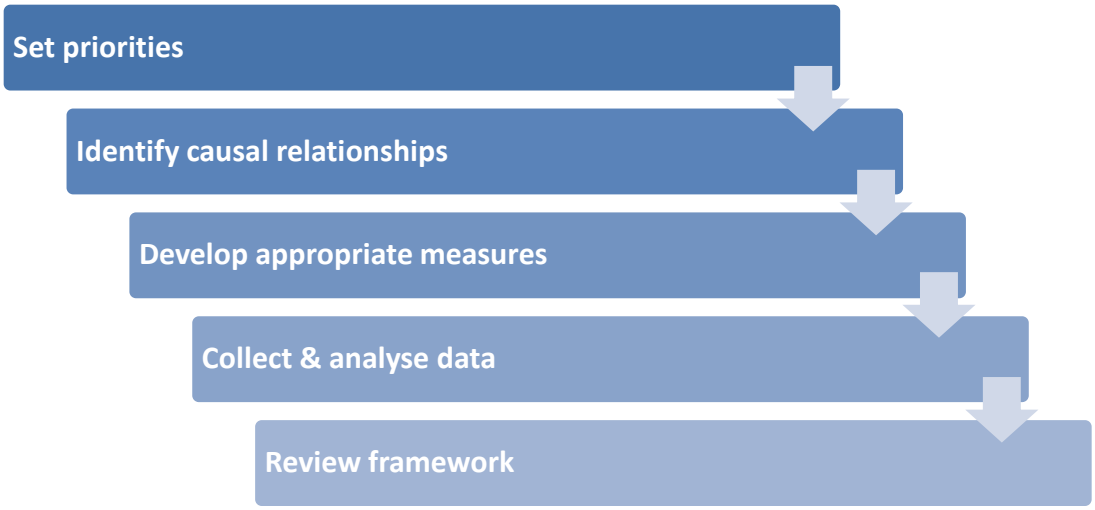

Figure 2-3: Generic Framework for Implementing Sustainability

Source: Epstein & Roy, 2001

As illustrated in Figure 2-3, it is important for management to begin by setting relevant priorities relating to their strategic sustainability objectives. Once priorities have been set, the relationships between sustainability practices and social, environmental and financial performance can be identified. This process is facilitated by the development of relevant metrics and key performance indicators that will enable the thorough collection of all necessary data. Once the data has been collected, it can be analysed to determine the strength of the previously identified causal relationships. Weak relationships are likely to be removed from the analysis and other links may be added so that continuous improvement processes are maintained after the framework has been reviewed.

A similar framework is suggested by Azapagic (2003); the Corporate Sustainability Management System. This framework consists of a five stage cycle shown in Figure 2-4, and each stage must align with the organisations' overall strategies and visions.

Figure 2-4: Corporate Sustainability Management System

Source: Azapagic, 2003

Figure 2-4 shows the five stages of the Corporate Sustainability Management System (CSMS). During the first stage, development of the organisations' sustainability policy occurs and a number of considerations must be taken into account. These include leadership and organisational commitment to sustainability, the identification of key stakeholders and sustainability issues and the definition of the policy and its alignment with the overall strategy of the organisation. The second stage involves planning the corporate sustainability management strategy and the following aspects should be considered: the establishment of the baseline, performing a SWOT analysis, the setting of objectives and targets for performance, the development of plans of action and the identification of responsibilities, and crucial employees and resources. During the implementation stage, it is important for the organisation to identify highest priority actions and align sustainability and business priorities. Other relevant implementation aspects include the identification of specific projects and appropriate tools, measuring and monitoring performance, overcoming barriers and resistance, and training, raising awareness and motivating employees. Communication is a vital part of getting internal and external support and management should always communicate with both employees and external stakeholders via sustainability reporting. The final stage of the cycle is to review performance and progress and take the necessary corrective action. It is imperative that companies aim to improve their efforts continuously to remain profitable and retain competitive advantages (Azapagic, 2003). The Corporate Sustainability

Management System suggested by Azapagic (2003) and the implementation framework suggested by Epstein and Roy (2001) are similar in that both begin with defining objectives and policies, formulating a plan of action, measuring and monitoring performance in order to collect and analyse relevant data, reviewing progress and taking the necessary corrective action.

From the literature it appears that although organisations may initially implement sustainable practices primarily due to regulatory compliance and financial pressure, the focus changes due to increased care and greater awareness of the importance and necessity of sustainability at present and in the future. Organisations are shifting towards fundamental organisational change and in so doing differentiate themselves and create strategic competitive advantages.

2.2.3 International Agreements and Standards

Currently, South African organisations have different levels of ambition with regards to corporate sustainability. Some organisations have not yet implemented sustainable practices, some have implemented basic sustainable practices and others have implemented extensive sustainable practices. South African organisations face increasing external pressure from international legislation regarding the sustainability of the world and ensuring a clean environment, in addition to pressure from national legislation regarding the carbon tax due for implementation in 2016 (Gordhan, 2014: 25). This means an increase in corporate sustainability is to be expected and should be encouraged with immediate effect.

External driving forces in the form of international agreements such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol place pressure on nations to transform to low carbon economies. The UNFCCC is an international treaty that many countries signed in 1992 to constrain rising global temperatures and limit the effects of global warming (UNFCCC, 2014). By 1995, the fact that emissions reduction stipulations were insufficient was realised and the Kyoto Protocol was developed. The Kyoto Protocol was implemented in 1997, and developed country members are legally bound to emissions reduction targets in an attempt to limit the global temperature increase to two degrees Celsius above the pre-industrial temperature average (UNFCCC, 2014). South Africa signed the Kyoto Protocol in 2002; however, due to its status as a developing country, it is not legally bound to meet its emissions reduction targets (European Commission, 2014). In addition to the UNFCCC and the Kyoto Protocol, the United Nations Global Compact is another voluntary agreement between organisations from multiple countries (including South Africa) who are committed to a number of principles within the categories of the environment, human rights, labour and anti-corruption (Henriques, Miller, Perez-Batres, Pisani and Renau-Sepulveda, 2012; United Nations Global Compact,

2013). This signifies that the South African government is committed to reducing greenhouse emissions and transforming to a low-carbon economy (Gordhan, 2014).

To assess progress made by members of the UNFCCC and discuss necessary changes to facilitate future efforts at transforming to decarbonised economies, Conference of the Parties (COP) meetings are held annually (UNFCCC, 2014). The first COP meeting took place in 1995 in Berlin, Germany (UNFCCC, 2014) and the 20th COP meeting took place at the end of 2014 in Peru (Climate Change Policy & Practice, 2014). In 2011, South Africa hosted the 17th Annual COP meeting in Durban (COP17/CMP7, 2011); a further indication of the commitment of the South African government to reducing greenhouse gas emissions. Currently, although 192 countries have signed the Kyoto Protocol (UNFCCC, 2014), global emissions reduction targets are not being met. This could be due to the fact that many countries are not bound to meet their emissions reduction targets due to the volunteering nature of the agreement. It could also be due to issues regarding the implementation of sustainable systems or problems relating to the standardisation of sustainability measurement and sustainability reporting guidelines. The most prominent voluntary sustainability reporting guidelines at present are the Global Reporting Initiative (GRI) Sustainability Reporting Guidelines (KPMG, 2013). Alternatives to the GRI guidelines are internal frameworks and country-specific reporting rules. However, reporting in South Africa, in addition to Brazil, Finland, Spain and Sweden, is based on the GRI framework. This is explicitly clear due to the fact that more than 90% of the organisations that apply sustainability reporting practices in South Africa use the GRI framework (KPMG, 2013).

In support of the global increase in sustainability reporting, non-profit organisations such as the Carbon Disclosure Project provide an international platform for organisations and even cities to report and communicate the environmental information relevant to their operations (Carbon Disclosure Project, 2014). The Carbon Disclosure Project (CDP) recognises the importance of supply chain sustainability through its Supply Chain Program. The CDP Supply Chain Program facilitates transnational organisations in developing and maintaining sustainability throughout their supply chains (Carbon Disclosure Project, 2014). The National Business Initiative (NBI) is the South African cohort to the CDP and organisations listed on the JSE Top 100 constitute the South African participants in the project (National Business Initiative, 2011). The CDP has developed the Carbon Disclosure Leadership Index (CDLI) which provides an indication of the thoroughness of an organisation's response to the risks and opportunities presented by climate change. CDLI scores range from low (below 50) to high (above 70) and represent the extent of dedication to and practical experience of disclosure on climate-related information (Carbon Disclosure

Project, 2014). The Carbon Performance Leadership Index (CPLI), also developed by the CDP, provides an indication of the current level of performance with regards to actions taken to reduce climate change and harmful environmental impacts of business operations. The CPLI ranks organisations based on performance bands ranging from 'A' (more than 85%) to 'E' (more than 0%), however, only organisations scoring an 'A' qualify for inclusion in the CPLI (Carbon Disclosure Project, 2014). According to the CDP (2014), if organisations receive a disclosure score of less than 50 they do not receive a performance score due to insufficient data. It is encouraging to note that although South African organisations respond to the CDP on a voluntary basis, the response rate for the 2013 South African CDP Climate Change Report was 83%; the second highest response rate in the world (CDP, 2013).

Many South African organisations have recognised the importance of environmental sustainability and are utilising the GRI sustainability reporting guidelines. While it appears that many organisations are using the same reporting framework, there are some discrepancies in how the framework is being utilised resulting in quality variation. The use of a consistent set of standards could facilitate improvements in reporting quality and enable organisations to benchmark their performance relative to their competitors and their industry in general. A number of institutes including the British Standards Institution and International Organisation for Standardisation, and non-profit organisations such as Social Accountability International have developed internationally applicable standards relating to sustainable development and management.

Social Accountability International has developed the SA8000 Standard for the social aspects of the organisation including child and forced labour, health and safety standards, discrimination in the workplace, working hours and compensation and management systems to name a few (Social Accountability International, 2012). The British Standards Institution (BSI) has developed a number of standards for environmental management aspects such as the carbon footprinting of products and sustainable development. The Publically Available Specification (PAS) 2050 provides a methodology for the assessment of greenhouse gas emissions of products from the point of origin to the point of consumption (British Standards Institution, 2014). The BS 8900-1: 2013 provides a framework for organisations to facilitate the management of their sustainable development (British Standards Institution, 2014).

The International Organisation for Standardisation (ISO), has developed over 19 500 standards (ISO, 2014), however, only standards relevant to the topic of sustainability are addressed in this study. The

ISO 14000 family of standards relates to environmental management, and presents instruments that allow organisations to mitigate their negative environmental impact and enhance their environmental performance (ISO, 2014). The ISO 26000 standard relates to social responsibility and offers direction with regards to maintaining socially responsible operations by improving the happiness and well-being of society (ISO, 2014). The ISO 50001 standard relates to energy management and provides organisations with a framework for building and expanding energy management systems within the organisation (ISO, 2014). The ISO 20121 standard relates specifically to ensuring sustainable event management with regards to potential social, financial and environmental impacts the event may have across the supply chain (ISO, 2012). For countries such as South Africa that have the opportunity to host an assortment of sporting, cultural and entertainment events every year, standards like ISO 20121 are incredibly beneficial in facilitating a reduction in emissions and shifting towards more environmentally friendly alternatives. The ISO 31000: 2009 standard relates to aspects of risk management including providing tools and techniques for assessing risk, determining threats and opportunities and finding sustainable solutions to mitigate and eliminate risk where possible (ISO, 2009). The increasing effects of climate change and global warming are forcing organisations, especially multinational corporations, to consider all risks facing the entire supply chain; from natural disasters to drought and starvation. Risk management has therefore become an integral part of ensuring sustainable supply chains and future operations. Standards developed by bodies such as ISO are incredibly important to developing countries as it provide best practice knowledge and facilitate the determination of strong and weak points with regards to technology, development and resource use. International standards also allow organisations to compare and benchmark against competitors and industry peers around the world (ISO, 2014).

It is clear that there are many forces driving organisations and governments around the world to increase their level of commitment to ensuring sustainable futures for all. Although some are driven by financial and legislative measures, others are driven by inherent care for the environment and the moral obligation to safeguard all of the resources that allow society to continue. International agreements such as the Kyoto Protocol facilitate the cooperation and communication necessary to ensure global efforts are being made to transform to low-carbon economies. International standards developed by organisations such as ISO allow companies, governments and other stakeholders to benchmark their performance with best practices and make improvements to current strategies and operations. The combination of international commitment, standards and recognition through awards will continue to

facilitate the global transition towards reducing greenhouse gas emissions and becoming fully sustainable in the future.

2.3 Sustainability in the Corporate Context

International commitments and standards provide a platform for small, medium and large organisations across the globe to transform their operations into sustainable endeavours. The driving forces or motivations for implementing sustainable practices differ depending on geographic location, the scope of operations and a number of other factors. Regardless of the driving force, whether legislative in nature or a simple case of achieving recognition and positive publicity through awards, it is imperative that organisations recognise the holistic implications of sustainability within their supply chains. When considering sustainability in the corporate environment it is necessary to take into account the relationships between corporate governance, corporate sustainability and corporate social responsibility within the overarching concept of sustainable development. These concepts and their relationships are discussed and a cost benefit analysis is presented to determine whether the benefits associated with greater sustainability and social responsibility practices outweigh the costs involved.

2.3.1 Sustainable Development in Organisations

To achieve sustainable development and apply international standards such as ISO, sound organisational structure and strategy must be in place. Businesses must remain in control of their operations to measure performance, determine weak areas in need of improvement, and develop an organisational framework that will facilitate sustainable growth and profitability. Corporate governance, corporate sustainability and corporate social responsibility provide tools for management to develop effective frameworks and efficient operational systems that allow the control of organisational performance facilitating the achievement of sustainable development. The relationship between these concepts is presented in Figure 2-5.

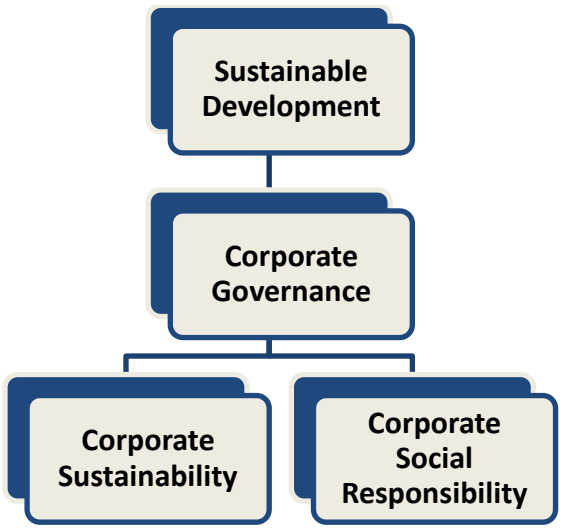

Figure 2-5: Relationship between Sustainable Development, Corporate Governance, Corporate Sustainability and Corporate Social Responsibility

Source: Van Marrewijk, 2003

It is clear that corporate governance (encompassing both corporate sustainability and corporate social responsibility) falls within the broad spectrum of sustainable development. According to Shrivastava (1995), sustainable development occurs when industrial growth is achieved without compromising the finite amount of natural resources that are currently available. According to the World Commission on Environment and Development (WCED) (1987), aspects of international environmental sustainability that must be addressed to achieve broad sustainable development include population control, food security, ecosystem resources, energy consumption and sustainable economies. Population control and food security directly affect the societies in which organisations operate and must therefore be managed to ensure social stability. Ecosystem resources and energy consumption must be managed to minimise the depletion of scarce natural resources and allow the redress of imbalances caused by anthropogenic activities. Finally, the policies and practices of sustainable economies must be developed in alignment with the objectives of broad sustainable development to facilitate the reduction of negative impacts on the surrounding social and natural environments (Shrivastava, 1995; Kleine & von Hauff, 2009). Organisations require a strategic framework that can be implemented and managed before being able to ensure their operations are socially responsible and sustainable in the long run. Corporate governance provides the tools and resources necessary to create the required strategic framework.

Corporate governance, corporate social responsibility and corporate sustainability are interrelated and overlapping ideas and there is much debate regarding consistent definitions of these concepts (Van Marrewijk, 2003). In practice, the definition understood in one organisational context may not necessarily be the same definition understood by other organisations in the economy or even in the same sector (Chipunza & Mariri, 2011: 2). A number of definitions of corporate governance are provided, followed by a brief overview of corporate governance within South Africa. Corporate governance refers to the strategies, processes and instruments that investors, top management and company directors utilise to manage the organisation and achieve pre-determined strategic objectives (Brewster, Carey, Grobler, Holland & Warnich, 2008). According to the Institute of Directors for Southern Africa (2009), corporate governance can be defined as organisational leadership that complies with the principles of responsibility, accountability, fairness and transparency in addition to the localised value of Ubuntu. The United Nations Global Compact and Global Corporate Governance Forum Publication (2009) states that good corporate governance should emphasize a strategic holistic view that includes financial, environmental and social obligations when determining opportunities, performing risk assessments and distributing resources for the sake of the organisation's stakeholders. While the definitions vary slightly, all contain central themes regarding best leadership practices and organisational responsibility to both the social and natural environment (Chipunza & Mariri, 2011).

Corporate governance on the African continent faces many challenges particularly with regards to ensuring that best practices are applied and appropriate standards are maintained. The implementation of good corporate governance practices should limit corruption and unethical business practices within organisations on the African continent (West, 2009). That being said, good corporate governance will facilitate organisations in achieving long term sustainable financial success (Rossouw, 2005), and will also provide opportunities for firms to obtain financial capital and encourage increased local and international investment (Ryan & Vaughn, 2006; Doidge, Karolyi & Stulz, 2007).

South Africa is often noted for the King Reports that were developed to facilitate good corporate governance in South Africa by the Institute of Directors of South Africa. Other notable codes that provide accepted standards based on best practices for corporate governance include the Organisation for Economic Cooperation and Development (OECD) Principles of Corporate Governance that were developed in 1999 and the Commonwealth Association for Corporate Governance (CACG) Principles for Corporate Governance also developed in 1999 (Rossouw, 2005). According to West (2009), South African corporate governance consists primarily of a stakeholder approach, most notably the King III

Reporting Code. The King Reports were developed by the King Committee, which was established under chairman Mervyn King in 1992 in order to provide a comprehensive set of corporate governance guidelines for organisations in South Africa (West, 2009). The King III Report on Corporate Governance for South Africa is the most recent report created in 2009 (KPMG, 2009), building upon the King I Report of 1994 and the King II Report of 2002 (Rossouw, 2005). The characteristics of good governance according to King III are "*discipline, transparency, independence, accountability, responsibility, fairness and social responsibility*" (West, 2009). It is interesting to note that the "apply or explain" approach is recommended by King III. This means that organisations must state what principles they have applied and then explain their current practices. Some of the key changes made in the King III Report include greater emphasis placed on integrated sustainability, more comprehensive stakeholder inclusion and a more thorough assimilation between organisational strategy, corporate governance and supply chain sustainability (KPMG, 2009). The King III Report moves away from separate financial and sustainability reports to integrated reporting, which allows organisations to achieve greater integration of their financial, social and environmental strategies and objectives. King III also encourages the use of external audits in addition to the current internal auditing processes to achieve greater validity and reliability of reporting results. This is likely to lead to improvements in the quality of the reported information, particularly with regards to social and environmental performance (KPMG, 2009).

Although stakeholder involvement is encouraged and emphasised in the King III Report, the significant integration of stakeholder interests into official governance systems is lacking (West, 2009). This presents a challenge due to the fact that the King III Report emphasizes stakeholders as the primary priority and shareholders as the secondary priority (KPMG, 2009). That being said, the JSE has a number of stringent listing requirements including the mandatory disclosure of the extent of an organisation's compliance with the King III Report, which allows potential investors and stakeholders alike to remain informed at all times. In addition, the JSE implemented the SRI Index in 2004 to recognise companies that maintain good corporate social responsibility practices and determine their share price performance. Due to the fact that South Africa is one of the largest economies on the African continent and its status as a developing country, it is imperative that organisations continue to implement and maintain sound corporate governance practices thus ensuring continued international investment and domestic growth and development (Ryan & Vaughn, 2006).

Closely related to corporate governance are the themes of corporate sustainability and corporate social responsibility. Although it is often unclear as to the exact nature of the relationship between the three

concepts, Chipunza and Mariri (2011) state that corporate governance can be viewed as the broad context within which corporate sustainability and corporate social responsibility fall. This is due to the fact that corporate governance relates to the way in which organisations deal with their legal obligations, thus setting the framework for corporate sustainability and corporate social responsibility (Gupta, 2012). The definitions of the terms "corporate sustainability" and "corporate social responsibility" also differ depending on who is providing them (whether organisation, individual or government) and the geographic location and resulting political, economic and social climates. In other words, there are a multitude of definitions that are based on the context of the situation. There is no singular standard definition for either term that can be applied to every individual, company or government around the world (Van Marrewijk & Were, 2003; Dahlsrud, 2006; Montiel, 2008). Figure 2-6 shows the relationship between sustainable development, corporate governance, corporate sustainability, corporate social responsibility and the triple bottom line.

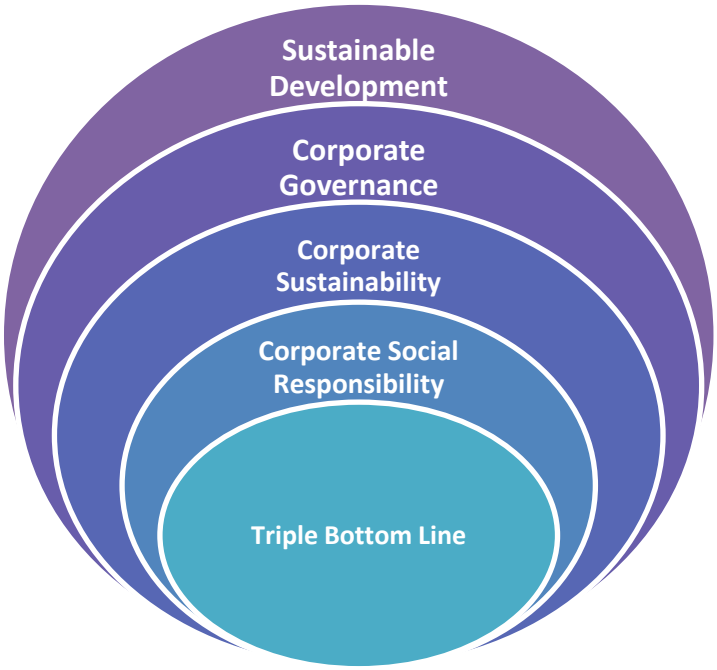

Figure 2-6: Hierarchy from Sustainable Development to the Triple Bottom Line

Source: Van Marrewijk, 2003

It is clear that corporate sustainability and corporate social responsibility are related within the spheres of sustainable development and corporate governance. Montiel (2008) states that corporate sustainability and corporate social responsibility had different primary focus areas in the past, however, the concepts have converged and now overlap. In the past, social issues were primarily discussed in the

field of corporate social responsibility and environmental issues were primarily discussed in the field of environmental management and corporate sustainability. Currently, the social dimension is recognised as an important part of the sustainability paradigm within corporate sustainability and the environmental dimension is included as a subset of comprehensive social performance dimensions within corporate social responsibility (Montiel, 2008). It appears that the boundaries between corporate social responsibility and corporate sustainability are blurring (Van Marrewijk, 2003; Montiel, 2008). Corporate sustainability and corporate social responsibility overlap due to the understanding that to balance the triple-bottom line, organisations need long-term sustainability and social responsibility. The triple-bottom line consists of the "3P's"; people, planet and profit representing the social, environmental and economic dimensions respectively. It is important for organisations to ensure that their supply chain partners understand the complex relationships amongst social, environmental and economic dimensions to regulate their social and environmental impacts and maintain long-term profitability (Akhtar & Faisal, 2011).

According to Van Marrewijk (2003), corporate sustainability should be viewed as the conclusive goal of the organisation. It relates to the strategy of ensuring the organisation is capable of operating in the future, whilst minimising negative impacts on the surrounding social and natural environments and maintaining profitability in the long run. There are four dimensions of sustainability according to a study undertaken by Christensen and Gallo (2011). The economic, environmental and social dimensions are the same as the dimensions in corporate social responsibility; however, the fourth dimension, intergenerational equity, is different. Intergenerational equity relates to the core concept underlying sustainable development; to meet the needs of the present generation without compromising the ability of future generations to do the same. When detailed definitions of sustainability are provided, the financial, environmental and social dimensions are mentioned more frequently than intergenerational equity. It is important that this view begins to change because the world is limited by a finite amount of resources, which must be managed through a sustainable triple bottom line approach if current living standards are to be maintained and improved.

Corporate social responsibility can be understood as the way in which organisations maintain ethical ideals and balance the triple bottom line in the best interests of their stakeholders (Gupta, 2012). According to Dahlsrud (2006), there are five dimensions of corporate social responsibility, namely; the environmental dimension, the social dimension, the economic (financial) dimension, the stakeholder dimension and the voluntariness dimension. The stakeholder dimension relates to the integration of

stakeholder concerns and meeting broad stakeholder requirements and the voluntariness dimension relates to committing to going beyond what legislation requires. The environmental dimension is mentioned least frequently, although this could be due to the fact that it was excluded from early definitions of the concept, which may have influenced current definitions. When detailed explanations are provided, the social and environmental dimensions are emphasized equally and appear to be equally important (Dahlsrud, 2006). This provides further evidence of the fact that corporate social responsibility originally focused more on social issues and corporate sustainability focused more on environmental issues. It is also clear that the two concepts are converging due to the similarity of the core aspects underlying the definitions.

Although corporate sustainability and corporate social responsibility have converged in some aspects, the concepts are distinct and have some differences. Corporate sustainability focuses on aspects such as value creation, environmental management and human capital management in an effort to contribute to sustainable development. Corporate social responsibility focuses on aspects such as stakeholder dialogue, transparency and sustainability reporting to communicate with and involve relevant internal and external stakeholders in their sustainable development efforts (Van Marrewijk, 2003). Figure 2-7 displays some of the focal points for corporate sustainability and corporate social responsibility.

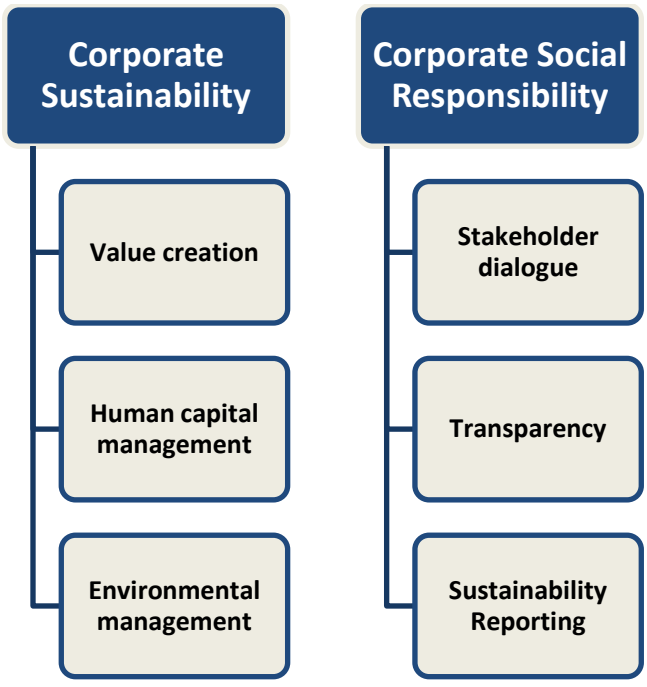

Figure 2-7: Key Practices in Corporate Sustainability and Corporate Social Responsibility

Source: Van Marrewijk, 2003

Value creation is important as it is often considered to be the primary objective of an organisation. Value creation is, therefore, related to the economic dimension of sustainability and is necessary for the continuation of any organisation (Perrini & Tencati, 2006). To create value, management needs to appreciate the significance of cost and revenue drivers. Once an organisation is able to effectively and efficiently control its value drivers, it can create and maintain profitability in the long run (Epstein & Roy, 2001). Creating value for the company can only occur if all of the firm's resources are utilised efficiently and effectively. This means that human capital and the firm's impact on the environment must be managed.

Corporate sustainability should aim to provide competitive advantages whilst preserving the natural and human resources that are required at present and in the future (Artiach, Lee, Nelson & Walker, 2010). According to Kleine and Von Hauff (2009), the three dimensions (pillars) of sustainability can be transformed into capital units, namely; economic capital, environmental capital and social capital. Economic capital has to do with financial capital such as monetary assets, tangible capital such as facilities and equipment and intangible capital such as knowledge and reputation, which is more difficult to value. Environmental capital relates to the availability of natural resources and other services that are provided by the surrounding natural environment. Social capital refers to the safety and relationship needs of people in addition to their development through education and training programs (Kleine & Von Hauff, 2009). It is clear that human capital must be managed to create value through relevant stakeholders and the surrounding community.

It is equally important to protect and maintain the natural capital of an organisation and this can be achieved through environmental management practices. Due to the impact of climate change and global warming, supply chains around the world are facing increased pressure to focus on environmental performance via environmental management systems. Improved environmental performance is likely to lead to improved financial performance and improved overall business performance (Montabon, Narasimhan & Sroufe, 2006). Environmental management systems allow organisations to improve environmental performance through the use of explicit environmental policies, environmental performance objectives, strategy alignment and managerial actions and agendas (Anton, Deltas & Khanna, 2004). Environmental management practices can be categorised into strategic practices, tactical practices and operational practices. Strategic practices indicate how an organisation will utilise environmental management practices to retain a competitive advantage and how these practices will be

implemented and maintained. Tactical practices relate to supply chain management, design and development and the recognition of improvements in environmental performance. Operational practices indicate how an organisation will utilise environmental management practices to reduce waste, reduce resource usage and improve resource allocation throughout the supply chain (Montabon, Narasimhan, Sroufe & Wang, 2002). Figure 2-8 presents an overview of strategic environmental management practices.

Figure 2-8: Strategic Environmental Management Practices

Source: Montabon *et al.*, 2002; Darnall, Henriques & Sadorsky, 2008

The strategic aspect of policies and programmes relates to the long term plan of the organisation with regards to its environmental performance. It is imperative that corporate environmental policies are linked to the overall organisational strategy. The mission statement of the organisation should include some aspect of the overall environmental performance objectives, and an environmental department or team should be appointed to manage and monitor all environmental activities, impacts and performance. It is also important to establish an organisational culture that supports the firms' environmental performance objectives. This can be done through the implementation of employee education and training programmes (Montabon *et al.*, 2002). To create and encourage environmental awareness with internal and external stakeholders, strategic environmental alliances should be developed across the supply chain and also with relevant research institutions, government and non-

profit/ non-government organisations. Staying up-to-date with environmental information can be undertaken through market surveillance, and environmental performance disclosure through sustainability and integrated annual reports will facilitate environmental awareness and promote the environmental reputation of the organisation (Montabon *et al.*, 2002; Darnall, Henriques & Sadorsky, 2008). Figure 2-9 presents an overview of tactical environmental management practices.

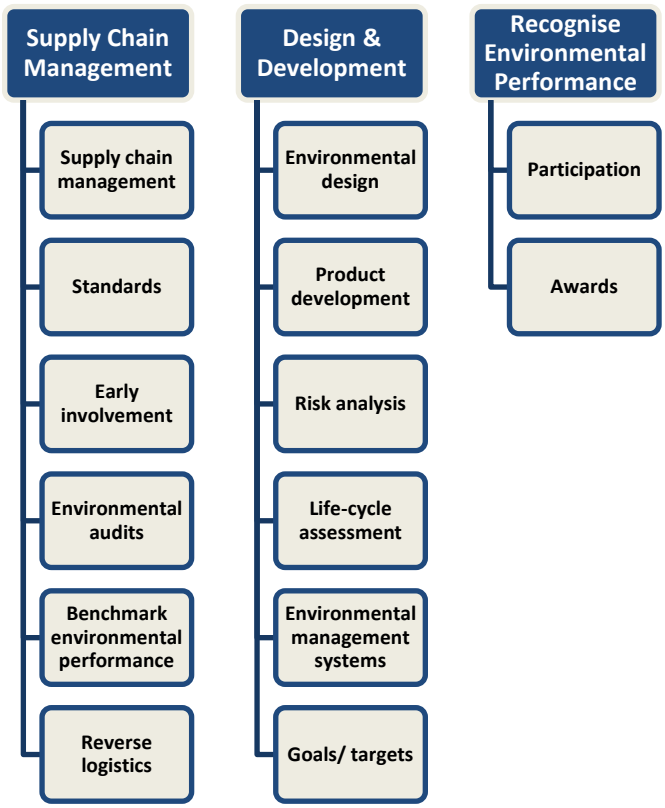

Figure 2-9: Tactical Environmental Management Practices

Source: Montabon *et al.*, 2002; Montabon *et al.*, 2006; Darnall, Henriques & Sadorsky, 2008; Bonney, El Saadany & Jaber, 2011

From a tactical perspective, supply chain management is a crucial aspect involved in organisational environmental performance. Supply chain management has the potential to reduce costs and environmental impacts whilst maintaining or improving long term profitability. It is essential that suppliers are involved at an early stage to facilitate the development of environmental management practices and to ensure that appropriate environmental standards are established. Internal and external environmental audits are essential when validating environmental performance of an organisation and members of its supply chain. Benchmarking environmental performance will allow the firm, other

industry members, government and research/ educational institutions to determine best practices and continuously improve environmental standards (Montabon *et al.*, 2002; Darnall, Henriques & Sadorsky, 2008). Reverse logistics is an important aspect in environmental management as the extent of the reverse logistics network will directly affect physical waste and resource use. A well-developed reverse logistics network can supply a strategic competitive advantage and will enable firms to reduce costs and negative environmental impacts (Bonney *et al.*, 2011).

With regards to design and development, there are a number of environmental management practices that will facilitate organisations in improving environmental performance throughout the supply chain. Environmental goals and targets, in addition to environmentally friendly design, can drastically improve the environmental performance of facilities and operations. The environmental design of facilities (green facilities) can significantly influence the potential of a supply chain or organisation to reduce waste and allocate resources more efficiently. Implementing relevant environmental management systems and performing a comprehensive risk analysis will allow organisations to mitigate environmental risks that could have a significant effect on business activities. On a product level, it is imperative that firms undertake product development in an environmentally sustainable manner and perform life-cycle assessments (carbon footprints) to determine environmental performance areas in need of improvement (Montabon *et al.*, 2002). To recognise environmental performance, participation in environment-related activities should be noted and awards should be given to those who demonstrate exceptional performance in alignment with the organisation's strategy. The basis for employee compensation should also include the evaluation of environmental criteria (Montabon *et al.*, 2002; Darnall, Henriques & Sadorsky, 2008). Figure 2-10 presents an overview of operational environmental management practices.

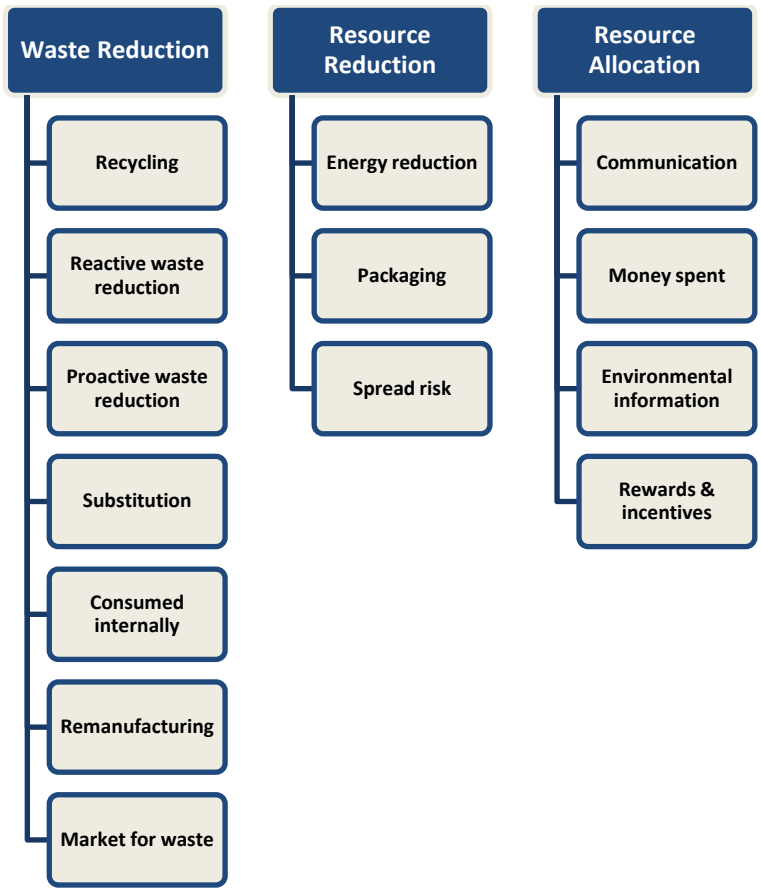

Figure 2-10: Operational Environmental Management Practices

Source: Montabon *et al.*, 2002; Montabon *et al.*, 2006

On an operational basis, it is imperative that organisations recognise the importance of waste and resource reduction as well as the efficient allocation of available resources. Waste reduction has to do with the reduction of physical waste, which can be accomplished through comprehensive proactive recycling and remanufacturing programs. Organisations should also strive to substitute hazardous substances with less hazardous replacements to limit potential environmental and health risks. It is also possible for many organisations to reuse their waste through internal consumption (recycling used water) or by finding a market for physical waste (reselling used plastic). Resource reduction has to do with minimising energy usage, especially the use of fossil fuels such as coal and oil, and minimising packaging materials quantities wherever possible. Organisations should aim to mitigate environmental risk by utilising appropriate third-party environmental service providers such as large scale recycling services (Montabon *et al.*, 2002; Montabon *et al.*, 2006). Efficient resource allocation can be achieved by communicating environmental objectives across the organisation and by determining an appropriate

budget to spend on different environmental initiatives. Finding relevant environmental information and publishing it for the use of employees and supply chain members will enable firms to facilitate the resource allocation process. Creating relevant incentives and rewards for good environmental performance will encourage the use of environmentally-friendly operations (Montabon *et al.*, 2002).

Referring back to Figure 2.7, organisational transparency has become increasingly important as organisations become more responsible to their surrounding environments. Investors and shareholders need to know what practices organisations are implementing to evaluate their performance. Other relevant internal and external stakeholders need to know at what level the organisation is currently performing in order to improve weaknesses and leverage strengths. Transparency is enforced for public organisations through the requirement of integrated annual reports containing information on social, environmental and economic performance. In addition to annual reports, companies can become transparent by disclosing their sustainability objectives and achievements online through their websites (Van Den Brink & Van Der Woerd, 2004; Henriques *et al.*, 2012).

Closely linked with the concept of transparency is stakeholder dialogue and engagement. Building and maintaining stakeholder relationships is crucial for the long term success of an organisation; these relationships are strategic assets that facilitate the creation of wealth (Perrini & Tencati, 2006). A firm can only maintain sustainable development if its stakeholder relationships are also sustainable. According to Azapagic (2003), there are ten categories of stakeholders, namely; competitors, creditors, customers, employees, local authorities, local communities, non-governmental organisations (NGO's), policy-makers, shareholders and suppliers. The various stakeholder groups have different levels of concern for the social, environmental and economic dimensions of corporate social responsibility. The majority of stakeholders have strong concerns for the economic dimension of sustainability and general awareness of negative environmental impacts is increasing. However, this awareness needs to translate into action with tangible results. As legislation and environmental regulations become stricter, supply chain members and other stakeholders need to place greater emphasis on integrated sustainability of the triple bottom line (Azapagic, 2003).

Referring back to Figure 2.7, sustainability reporting as a key aspect of corporate social responsibility is now discussed. Sustainability reporting is a prominent organisational tool that facilitates the achievement of strategic objectives and promotes stakeholder engagement via the publishing of corporate progress and sustainable performance (Huisingh & Lozano, 2011). Sustainability reporting pertains to the voluntary disclosure of sustainability practices within the organisation relating to social,

ethical, environmental, economic and managerial dimensions (Dumay, Farneti & Guthrie, 2010). There are two main reasons for sustainability reporting, namely; to assess the current state of these dimensions within the organisation and to communicate the effort that has been made and the progress that has been achieved in the last financial year (Huisingh & Lozano, 2011).

There are a number of tools that can be used for sustainability reporting, however, the GRI Sustainability Reporting Guidelines are considered to be the dominant standard for sustainability reporting across the globe (Boston College Centre for Corporate Citizenship & Ernest & Young, 2013). Advantages of these guidelines are that they encourage the participation of all stakeholder groups, they are recognised across the globe and they are one of the most comprehensive sets of guidelines currently available (Huisingh & Lozano, 2011). The GRI guidelines describe two sets of sustainability reporting principles; one set of principles for report content and another set of principles for report quality. The GRI principles for defining the content of sustainability reports are materiality; stakeholder inclusiveness; sustainability context and completeness. The principles for defining the quality of sustainability reports are balance; comparability; accuracy; timeliness; clarity and reliability (Global Reporting Initiative, 2011). It is incredibly important that the content included in sustainability reports follows guidelines such as the GRI Sustainability Reporting Guidelines, and that the quality of that content can be assured for stakeholder decision making. There is increased awareness and acceptance of the fact that sustainability should be based on a systems approach because organisations operate within a larger system be it a region, country, industry or the world (Dumay *et al.*, 2010). According to KPMG (2013), sustainability reporting can be assessed based on seven criteria; strategy, risk and opportunity; materiality; targets and indicators; suppliers and the value chain; stakeholder engagement; governance and transparency and balance.

It is clear that these criteria view sustainability holistically from an internal and external stakeholder perspective. Sustainability reports that address suppliers and the value chain are representative of the fact that sustainability must be viewed with a systems approach. Assessing organisational strategy, risk and opportunity as well as corporate governance will provide an outlook of what the organisation expects to achieve in the future and the actions it will take to achieve those objectives. It is also important for sustainability reports to address risks and opportunities so that stakeholders are aware of potential future problems and actions that can be taken to mitigate negative impacts and consequences. Reports that are transparent and balanced and represent material inclusions allow all relevant parties to review and assess economic, social and environmental performance. It is imperative that sustainability

reports disclose targets and indicators so that internal and external stakeholders are aware of the objectives of the organisation and know what measurements were utilised to represent organisational progress. This allows stakeholders to benchmark performance over time and against other organisations in the same industry or in the same country (KPMG, 2013).

Although sustainability reporting practices are advantageous, organisations face a number of challenges. The majority of the challenges are data-related; however, limited resources also featured as a difficulty in compiling sustainability reports. The lack of data availability, the accuracy and completeness of data and the external buy-in that is necessary to disclose data are some of the challenges faced by those who want to publish sustainability reports. These issues reinforce the fact that organisations will have to work with their supply chains and other stakeholder groups to ensure that they have accurate and relevant information that can be used in creating comprehensive sustainability reports that meet the requirements of tools such as the GRI Sustainability Reporting Guidelines (Boston College Centre for Corporate Citizenship & Ernest & Young, 2013).

A number of sustainability reporting trends have emerged in recent years. According to a study undertaken by KPMG (2013), sustainability reporting is increasing in emerging economies and the gap between the leading sectors and the lagging sectors is steadily decreasing. In addition, it is common practice for sustainability reports to be included in organisations' annual financial reports and the occurrence of integrated reports is increasing. The GRI Sustainability Reporting Guidelines are used by the majority of companies globally allowing for standardisation that promotes the development of frameworks, guidelines and standards. External auditing of sustainability reports and escalation with regards to increases in the quantity and quality of information are other noted trends which could be due to increased standardisation amongst organisations across the globe (Kolk, 2003; Kolk, 2010; Pounder, 2011). These trends can be used as a comparison to provide an indication of whether South African companies are performing relatively well or not when compared against international peers and competitors.

From the literature reviewed, it is apparent that sustainability reporting is ultimately on the rise and organisations would do well to develop strategic and mutually beneficial relationships with supply chain members and other stakeholder groups, to improve their economic, environmental and social performance. Sustainability reporting is a useful tool allowing organisations to remain transparent and develop healthy stakeholder relationships.

2.3.2 Costs and benefits associated with corporate social responsibility and corporate sustainability

There are many financial and non-financial benefits for organisations that implement corporate social responsibility and corporate sustainability practices. These benefits far outweigh the costs associated with the development, implementation and continuous improvement of these practices (Montabon *et al.*, 2006; Maines & Sprinkle, 2010). It is imperative for organisations to determine and compare all financial and non-financial costs as well as benefits to assess the potential risks and opportunities involved (Aras & Crowther, 2009). A basic comparison technique that could be used to assess consequences on social and natural environments is the cost benefit analysis (Prest & Turvey, 1965). A cost benefit analysis displaying the financial and non-financial benefits and costs associated with implementing corporate social responsibility and corporate sustainability is shown in Table 2-2.

Table 2-2: Benefits and Costs of Corporate Sustainability and Corporate Social Responsibility

BENEFITS	
Financial	**Non-financial**
Improved profitability	Improved reputation
Reduced risks	Positive word-of-mouth & publicity
Reduced costs	Increased consumer trust & goodwill
Carbon tax reduction (future)	Awards
Tax incentives	Brand differentiation
Improved product reliability	Competitive advantage
Improved access to capital	Increased innovation
Improved supply chain efficiency	Improved stakeholder relationships
Reduced waste	Employee recruitment & loyalty
New market opportunities	Improved health & safety
	Reduced damage to natural & social environments
COSTS	
Financial	**Non-financial**
Increased costs	Change management
Initial installation costs	Employee time & effort

Source: Epstein & Roy, 2001; Fox, Howard & Ward, 2002; Azapagic, 2003; Kolk, 2003; Srivastava, 2007; Aras & Crowther, 2009; Maines & Sprinkle, 2010; Boston College Center for Corporate Citizenship & Ernest Young, 2013

The financial costs incurred during the implementation of new systems are relatively high due to the fact that organisational change is required throughout the business. Physical facilities may need to replace current lighting systems with LED energy efficient lighting, develop and implement recycling systems and invest in new technologies. It may also be necessary to provide employee awareness programs and training to facilitate the necessary change management. Other costs that may be incurred include increased recycling costs, increased reverse logistics costs and increased labour costs. The non-financial costs relate to change management in addition to the time and effort employees will have to give to adapt to the new organisational objectives and structure (Maines and Sprinkle, 2010).

There are many financial benefits that can result from the implementation of corporate social responsibility and corporate sustainability practices. Organisations are always looking for ways to improve profitability. This can be achieved through rising consumer demand for socially responsible and sustainable organisations, thus, driving up price premiums and potentially increasing market share (Maines & Sprinkle, 2010). A number of cost reductions can also be expected, which would impact further improvements in overall profitability (Srivastava, 2007). Cost reductions throughout the supply chain include lower costs of materials due to material substitution and lower packaging costs due to reduced packaging materials usage and waste. Energy consumption will also be reduced due to more efficient utilisation of energy, and waste disposal costs will decline as recycling practices increase and fewer materials are wasted. Storage and handling costs may also be reduced as fewer products are returned, fewer materials are utilised and packaging is minimised (Epstein & Roy, 2001). Employee related costs will decrease due to lower health and safety costs and lower labour costs. If employees are surrounded by a healthy environment, they are more likely to have higher levels of productivity and motivation, which results in lower absenteeism and employee turnover. This ensures that the organisation can reduce costs associated with attracting and retaining employees (Azapagic, 2003; Maines & Sprinkle, 2010).

As regulations change and increased emphasis is placed on sustainable development, organisations that implement sustainable practices are more likely to have easier access to capital due to the fact that some investors are only willing to invest in socially responsible companies. Due to the lower level of risk, particularly regulatory risk and risks associated with climate change and global warming, investment in sustainable and socially responsible companies will cost less (Azapagic, 2003; Kolk, 2003; Aras & Crowther, 2009). New market opportunities can be created as innovation and systems improvement allow organisations to expand beyond their traditional scope of activity (Kolk, 2003). In some countries,

organisations are given tax incentives for utilising sustainable and socially responsible practices. For example, companies in the USA receive tax credits when they utilise environmentally-friendly materials and operating systems (Maines & Sprinkle, 2010). In countries where carbon tax programs have been planned and implemented, organisations could realise significant cost reductions when reductions in emissions are achieved. South Africa plans to implement a carbon tax of R120 per ton of carbon dioxide equivalent emissions in 2016 (Greve, 2014), which means organisations can achieve significant cost savings for each ton of emissions that is eliminated.

Financial benefits stemming from other areas of the supply chain include improved product reliability lowering the level of defective products resulting in decreased legal costs and post-sale costs. Fewer product returns and lower levels of customer dissatisfaction will result in reverse logistics cost savings, transportation cost savings due to load consolidation and route optimisation and further reductions in administration and labour costs (Maines & Sprinkle, 2010). Supply chain efficiency can be significantly improved resulting in upstream and downstream benefits, and waste reduction will facilitate the optimisation of all business activities. Although recycling costs may increase, overall waste costs will decrease resulting in a net positive financial impact (Boston College Center for Corporate Citizenship & Ernest Young, 2013).

There are many non-financial benefits stemming from socially responsible and sustainable business practices that facilitate firms in becoming market leaders. Higher levels of transparency combined with dedicated commitment of the organisation improves a variety of stakeholder relationships, namely; relationships with investors, relationships with regulators, relationships with customers, relationships with the surrounding community, and relationships with employees. Enhanced employee relationships and improved health and safety build loyalty and boost morale resulting in a happier, healthier workforce that is more productive (Epstein & Roy, 2001; Azapagic, 2003; Kolk, 2003; Aras & Crowther, 2009).

Sustainable and socially responsible organisations enhance their image and improve their reputation, which can lead to increased sales and profitability. It is also likely that these companies will encourage positive word-of-mouth from their stakeholders resulting in increased positive publicity. This equates to free advertising for the organisation that creates significant levels of positive brand reinforcement, increased consumer trust and goodwill (Azapagic, 2003; Aras & Crowther, 2009; Boston College Center for Corporate Citizenship & Ernest Young, 2013). By emphasising the commitment to sustainable and socially responsible development and encouraging innovation, organisations create brand

differentiation, which enables consumers to recognise the brand as unique and superior to competitor offerings. This provides the basis for a strategic competitive advantage, which can be used to enhance the organisation's position as a leader in their industry (Azapagic, 2003; Maines & Sprinkle, 2010; Boston College Center for Corporate Citizenship & Ernest Young, 2013.).

Other non-financial benefits include receiving prestigious domestic and international awards (Fox *et al.*, 2002). These awards illustrate to the public the level of commitment and dedication the company has to sustainable development. Perhaps the most important non-financial benefit to external stakeholders is the reduced damage to the surrounding natural and social environment which will become more apparent in the long term (Srivastava, 2007). It is clear that in the short term, the costs of implementing corporate social responsibility and corporate sustainability programs are high. It is important to note that in the long term, the financial and non-financial benefits of implementing these programs far outweigh the associated costs and organisations will be capable of maintaining strategic competitive advantages on both cost and quality. Ultimately, costs will decrease and sales and profitability will increase.

From the literature reviewed, it is clear that South Africa is noted for its excellent corporate governance standards providing the basis for sound corporate sustainability and corporate social responsibility practices that will ensure organisations achieve and maintain long term financial success whilst mitigating negative impacts on the social and natural environment. Aspects such as value creation, human capital management, environmental management, stakeholder dialogue, transparency and sustainability reporting facilitate organisations and their stakeholders in ensuring sustainable practices are developed and continuously improved. It is clear that although the costs of implementing sustainable and socially responsible business practices are high, the financial and non-financial benefits to all involved are far greater.

2.4 Supply Chain Sustainability and Best Practices

It is imperative that organisations consider supply chain related risks and opportunities given the current global social, economic and environmental climate. Strategic supply chain management is necessary to ensure that all activities from the point of origin to the point of consumption are managed in a sustainable manner. The structure of an organisation's supply chain depends on the nature of the product or service that is being provided in addition to the scope of activities that are outsourced. There

are many sustainability-related best practices associated with each stage of the supply chain, regardless of the structure that facilitates efficiency and the move towards low carbon operations.

2.4.1 Supply Chain Sustainability

Supply chain management encompasses the development and maintenance of upstream relationships with suppliers to downstream relationships with consumers to deliver high quality customer service at the lowest total cost to the supply chain. It relates to the management of the flows of goods, services and information between all members of the supply chain and includes functions such as planning, sourcing, manufacturing, distributing and returning products and services (Kumar, Teichman & Timpernagel, 2011). Strategic supply chain management has gained considerable recognition as a critical component of organisational strategy and planning. Companies achieve strategic competitive advantages by leveraging their core competencies whilst ensuring other members of the supply chain provide effective and efficient services for non-core competencies. Supply chains are facing increased pressure from internal and external stakeholders and increased environmental risk. This risk stems from the effects of global warming and climate change, which have received escalating recognition and attention in recent years (Handfield, Sroufe & Walton, 2005; Ho & Lin, 2008). Environmental issues have, therefore, become significant causes for concern around the world and the environmental dimension has become an integral aspect in strategy, planning and operations. Supply chains need to seek solutions that positively impact both economic and environmental performance (Handfield *et al.*, 2005), and should seek to develop, implement and improve operations to ensure that they mitigate their negative environmental impact and are socially responsible (Ho & Lin, 2008).

Green supply chain management and sustainable supply chain management are two important concepts that must be defined. Green supply chain management relates to the inclusion of the environmental dimension in the supply chain (Srivastava, 2007), and sustainable supply chain management relates to the inclusion of social, economic and environmental dimensions in the supply chain (Brown *et al.,* 1987). The terms ‘green’ and ‘sustainable’ are often used interchangeably, which is inaccurate. It is clear that green supply chain management places greater emphasis on environmental management practices whereas sustainable supply chain management places equal emphasis on the components of the triple bottom line. It appears that green supply chain management falls under the broad scope of sustainable supply chain management and focuses primarily on environmental sustainability initiatives. It is important to note that logistics management is crucial to the success of developing and implementing an efficient and effective green supply chain management strategy. This is because logistics services are

large contributors to negative environmental impacts such as greenhouse gas emissions, the disposal of hazardous and solid waste, fuel consumption and the use of scarce non-renewable natural resources (Ho & Lin, 2008).

There are a number of terms that are related to or included in definitions of green supply chain management, namely; sustainable supply chains, sustainable supply network management, green logistics, environmental logistics, supply chain environmental management, supply and demand sustainability, reverse logistics and green/ environmental purchasing and procurement (Lai, Sarkis & Zhu, 2011). According to Eltayeb and Zailani (2009), there are five stages organisations go through before reaching the ultimate goal of green supply chain management. The five stages are presented in Figure 2-11.

Figure 2-11: Five Stages in Green Supply Chain Management

Source: Eltayeb & Zailani, 2009

Defensive compliance occurs when firms implement environmental management practices as a reaction to legislation, because the financial cost of non-compliance would be too great. Minimal effort is dedicated to addressing environmental issues and any practice not required by regulations will not be developed or implemented. Waste minimisation goes one step further than defensive compliance and organisations can either reduce physical waste or make production processes cleaner. In other words, cleaner renewable fuel sources can be utilised, packaging materials can be reduced and product material inputs can be minimised to reduce the total waste that the system produces. Eco-efficiency occurs when firms meet the requirements of their customers with regards to quality and cost whilst minimising negative social and environmental impacts and managing the consumption of natural resources so that consumption does not exceed the current supply of these resources on earth. Design for environment encompasses eco-efficiency whilst taking into account long term environmental impacts, the energy required to produce and consume the product/ service and disposal related activities such as recyclability, reusability, disassembly and remanufacture. The final stage, green supply

chain, includes all of the previous stages; however, it also involves the consideration of the environmental impact of the product/ service's full life cycle from the point of origin to the point of consumption. This entails the consideration of the inputs required to produce the product/ service, the production process, the distribution or delivery process of getting the product/ service to the market and the reverse logistics activities related to disposal, returns, recycling and remanufacturing (Eltayeb & Zailani, 2009). It appears that there are similarities between the five stages of green supply chain management and the stages of corporate sustainability that were discussed in the first section of this review. One common theme is that many organisations begin by reacting to legislative and financial pressures and move towards a proactive holistic approach that appreciates the strategic organisational value that can be achieved from sustainable practices.

An alternative perspective is management approaches to greening the supply chain as presented by Van Hoek (1999). Table 2-3 presents the three management approaches and the characteristics that define them.

Table 2-3: Management Approaches for Green Supply Chains

Reactive Approach (comply with legislation)	Proactive Approach (pre-empt new legislation)	Value-seeking Approach
Minimal resources committed	Modest resources committed	Strategic integrative commitment
Informal organization	Top management commitment	Supply chain wide initiative
Initiator is responsible	Functional approach	Systematic & flexible
Filters, end-of-pipeline solutions	Environmental policy statement	Design for disassembly
Procure recycled materials	Perform environmental audit	Design for recycling & reuse
Product recycling labels	Recycling & reuse initiatives	Environmental life cycle analysis
	Design green parts & products	Review existing processes
		Suppliers commit to waste reduction

Source: Van Hoek, 1999

Although there are some differences between the two frameworks, there are many similarities. Once again it is clear that organisations begin with a legislative/ financial focus and move towards an environmentally sustainable perspective that encompasses greater commitment and comprehensive actions to mitigate negative environmental impacts. The value-seeking approach is identical to the green supply chain stage mentioned in the previous framework as it includes a system wide fundamental shift

towards holistic environmental management that requires the reassessment of strategies, plans and processes to develop and implement an efficient and effective environmental management program.

It is interesting to note that a number of drivers for green supply chain management are identical to the drivers for implementing corporate sustainability. Global warming and climate change are prominent external driving forces that make organisations address the negative impact their operations have on the natural environment. Rising fuel and raw materials prices are driving sustainable practices in organisations as they find ways to minimise transport and utilise renewable energy in place of fossil fuels such as coal and oil. International and domestic regulation and legislation, such as the Kyoto Protocol and carbon tax policies, force organisations to adopt sustainable practices to remain competitive. The increasing environmental awareness of all stakeholder groups, in addition to positive brand reputation and publicity, drive many organisations to adopt green supply chain practices. Forward thinking organisations see opportunities to create value and develop and maintain strategic competitive advantages. Higher levels of efficient and effective supply chain integration provide additional incentives for organisations to implement environmentally conscious practices (Kumar *et al.*, 2011).

Supply chain management and sustainability are inextricably linked due to the fact that supply chain management encompasses all activities related to the product/ service from the point of origin to the point of final consumption (Jayaraman, Klassen & Linton, 2007). Ensuring an environmentally friendly supply chain can result in decreased emissions and reductions in negative environmental impacts, whilst maintaining product or service quality, cost, consistency, function and resource use efficiency (Srivastava, 2007: 68). To reap the rewards of green and sustainable supply chains, they must be integrated into organisational structure.

To accomplish strategic sustainable supply chain integration a number of considerations must be taken into account. The expectations and requirements of multiple stakeholder groups are important, because they are likely to determine the ultimate success or failure of the business. These expectations must be integrated into strategic organisational objectives and plans to ensure that they are met. It is important to gain the commitment and support of top management as this will filter down through the organisation and encourage employees to emulate their leaders. Adequate investments in human resources will also be required to build up the relevant sustainability expertise. All business functions and employees should share the responsibility for sustainable practices, and incentives and rewards should be aligned with sustainable performance that meets strategic objectives. It is imperative that environmental management systems are implemented, certified according to relevant standards such as

ISO 14001 and that compliance is assured through internal and independent external auditing services (Murphy & Poist, 2000; Aronsson & Brodin, 2006; Srivastava, 2007; Lai, Sarkis & Zhu, 2008; Pagell & Wu, 2009; Best, Chadee, Poole & Wiesner, 2010).

A detailed summary of the best practices associated with supply chain strategy is shown in Table 8-1 in the Appendix. It is of the utmost importance for organisations to develop long term mutually beneficial strategic relationships with their suppliers to foster an environment of innovation that meets the requirements of all members of the supply chain. This will facilitate the mitigation of environmental risk and reduce overall negative environmental impacts (Wolf, 2011).

2.4.2 Supply Chain Models

Environmental impacts and risks occur at every stage of the supply chain from the planning phase to the returns phase. Two supply chain models are discussed to present the link between supply chain activities and the relevant environmental management considerations. The first model is the Supply Chain Operations Reference model, otherwise known as the SCOR model, which is shown in Figure 2-12.

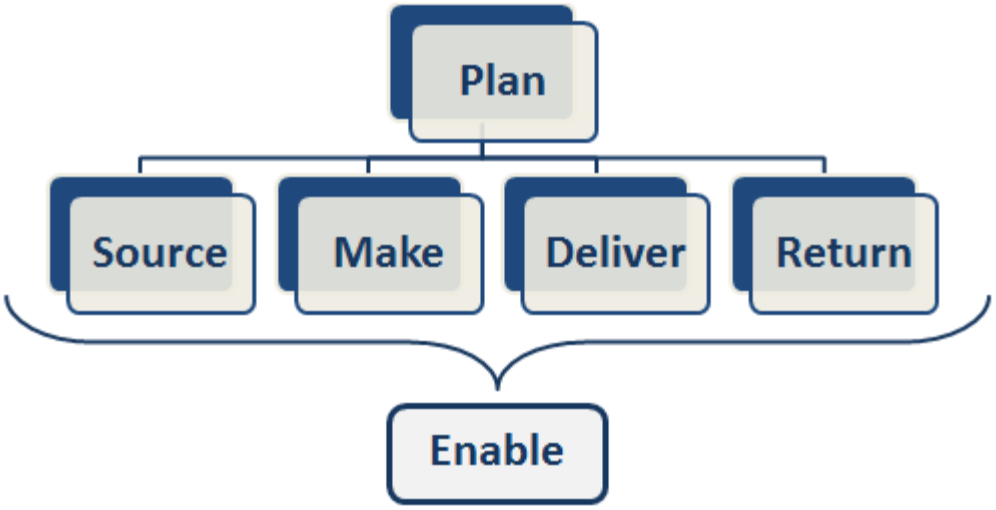

Figure 2-12: Supply Chain Operations Reference Model

Source: Supply Chain Council, 2012

The SCOR model represents generic processes that can be broadly applied to any organisation whether they provide products or services, whether they are publically or privately owned and whether they are situated in a developed or developing country (Supply Chain Council, 2012). The model in Figure 2-13 shows six processes that occur within the supply chain. The Plan process describes all of the planning

activities that must take place to perform supply chain operations (Supply Chain Council, 2012). These activities include determining stakeholder requirements, determining what resources are available and matching the relevant stakeholder requirements and available resources. The Source process describes all of the activities associated with sourcing raw materials, component parts and necessary support services (Supply Chain Council, 2012). These activities include ordering goods or services, receiving goods or services, checking that the quality and quantity of these goods and services are the same as what was expected and ordered and paying for all sourced goods and services. The Make process describes the activities associated with manufacturing or transforming raw materials and component parts into finished goods (Supply Chain Council, 2012). These activities include "assembly, chemical processing, maintenance, repair, overhaul, recycling, refurbishment and remanufacturing" (Supply Chain Council, 2012). Although these activities are generally associated with the returns process, many of the activities that are necessary require some form of transformation and are therefore included in the make process (Supply Chain Council, 2012).

The Deliver process describes all activities involved in the development and realisation of customer orders and includes activities such as arranging order shipments, picking orders, packing orders, verifying orders and transportation and shipping activities (Supply Chain Council, 2012). The Return process describes the activities associated with the return of goods; in other words reverse logistics activities (Supply Chain Council, 2012). Some of the activities that are undertaken include determining the reason behind the product return, arranging the return and receiving the returned goods. Traditional reverse logistics activities such as recycling, repair, refurbishment and remanufacturing are included in the Make process in the SCOR model (Supply Chain Council, 2012). The Enable process describes functions that support supply chain management (Supply Chain Council, 2012). Activities that are undertaken include "management of the business rules, performance management, data management, resource management, facilities management, contract management, supply chain network management, managing regulatory compliance and risk management" (Supply Chain Council, 2012). The SCOR model is applicable to any organisation regardless of the size, structure and nature of their activities. A more detailed supply chain model is presented in Figure 2-13 to illustrate the flow of logistics activities from the point of origin to the point of consumption.

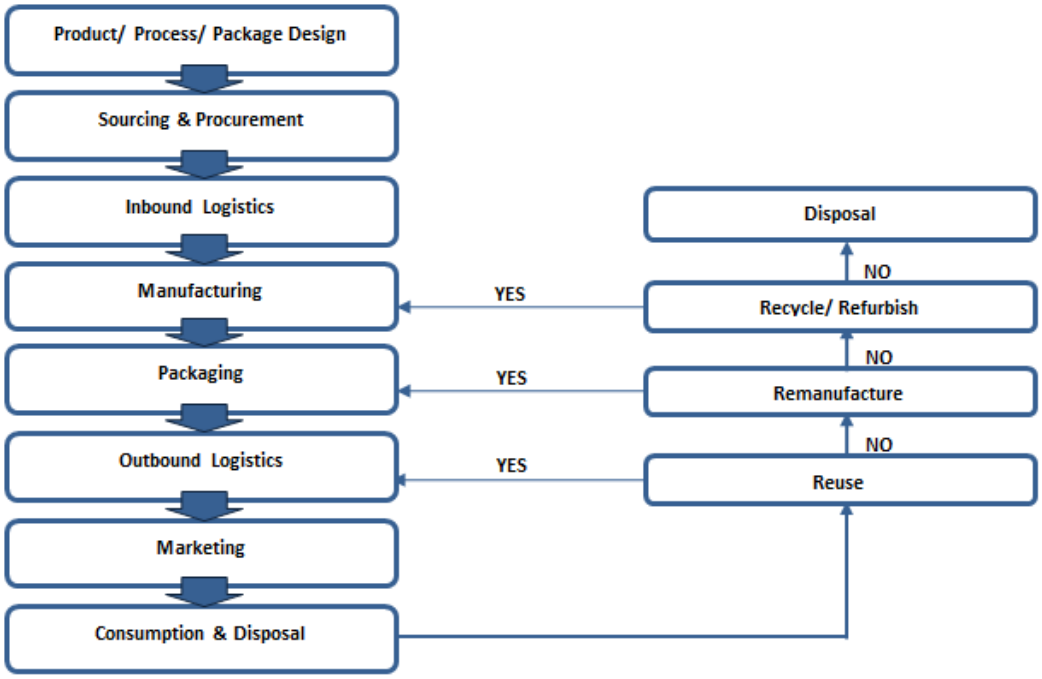

Figure 2-13: Supply Chain Model

Source: Dunn & Wu, 1990 and Eltayeb & Zailani, 2009

Although the model depicted in Figure 2-13 has different processes than the SCOR model, it is also generic and can be applied to any organisation producing goods or providing services. With regards to organisations providing services, a number of these processes are irrelevant. Service firms will not have to deal with all activities included in manufacturing, packaging and outbound logistics, nor will they deal with all activities associated with the disposal (returns) process. However, it is still important that these firms consider their strategy and environmental impact with regards to the manufacturing, packaging, outbound logistics and disposal of the office equipment and supplies that are necessary in providing their services.

With regards to product, process and package design it is imperative that organisations remain environmentally conscious. This is due to the fact that the environmental impacts of sourcing, production and distribution at later stages are a direct result of decisions that are made at the design stage (Eltayeb & Zailani, 2009). The opportunity to mitigate negative environmental impacts is greatest at the design stage (Kumar *et al.*, 2011). Because of the crucial significance of the design phase, it is important to include all supply chain members (both upstream and downstream members) in product, process and package design. This will help ensure that all environmental aspects relevant from the point

of origin to the point of consumption have been considered and included in the design (Kumar *et al.*, 2011).

Best practices to consider include designing for a reduction in hazardous materials; designing for the reuse of the product, part of the product or packaging without the need of transformation; designing for the recycling of the product and packaging; designing for product remanufacturing and refurbishment and designing for complete resource usage efficiency with regards to fuel consumption, energy consumption and materials usage in products and packaging. It is also necessary to perform a Life Cycle Analysis (LCA) to understand the environmental impact of the product from the point of origin to the point of consumption (Srivastava, 2007; Eltayeb & Zailani, 2009; Kumar *et al.*, 2011). A detailed summary of the best practices associated with product, process and package design is shown in Table 8-2 of the Appendix.

With regards to sourcing and procurement, the organisation must determine their environmental, social and economic objectives and requirements and select suppliers for raw materials, component parts and support services based on these objectives and requirements (Kumar *et al.*, 2011). Green purchasing (procurement) entails the consideration of sustainability issues in addition to conventional criteria such as cost, quality and terms of delivery (Eltayeb & Zailani, 2009). An assessment of all potential suppliers should be undertaken to evaluate which suppliers meet the requirements and objectives of the purchasing firm (Dunn & Wu, 1990; Kumar *et al.*, 2011). In this assessment, the supplier will be evaluated on aspects such as management, environmental performance and environmental auditing. The products or materials being sourced will be evaluated on aspects such as life cycle analysis, product labelling and product standards (Dunn & Wu, 1990).

Best practices related to green purchasing include product content requirements such as recycled materials or reusable materials; product content constraints such as the elimination of hazardous substances in raw materials or component parts; product content labelling of environmental characteristics such as emissions or recycled content; developing and administering supplier questionnaires to obtain information on their environmental activities and management; supplier environmental management systems; supplier environmental management system certification such as ISO 14000 and external auditing of supplier environmental performance (Murphy & Poist, 2000; Lai *et al.*, 2008; Eltayeb & Zailani, 2009; Pagell & Wu, 2009; Kumar *et al.*, 2011). Developing and maintaining a green procurement/ sourcing strategy will ensure greater supply chain integration through early supplier involvement and will result in reductions in water, energy and fuel consumption in addition to

decreased packaging (Kumar *et al.*, 2011). Table 8-3 in the Appendix provides a summary of the best practices associated with sustainable sourcing and procurement.

Inbound logistics activities and outbound logistics activities are similar except that inbound logistics deals with the flow of raw materials and component parts and outbound logistics deals with the flow of finished goods (Dunn & Wu, 1990). The primary considerations are the higher value associated with finished goods, the inherent increased risk of distribution of finished goods and the inflexible customer demands associated with finished goods (Dunn & Wu, 1990). All environmental considerations and activities relevant to the distribution of raw materials, component parts and finished goods are presented in the discussion on outbound logistics starting on page 47.

Manufacturing or transformation processes take the inputs such as raw materials, component parts and energy, and turn them into finished goods and waste. It is, therefore, imperative that organisations minimise the usage of raw materials, reduce energy and fuel consumption and eliminate as much waste as possible from the supply chain (Kumar *et al.*, 2011). There are seven main areas of waste in lean manufacturing, which were first identified by Taiichi Ohno of Toyota, namely; defects, overproduction, transportation, waiting time, inventory, motion and processing (iSixSigma, 2014). The most efficient supply chains around the world have implemented lean manufacturing principles creating value adding opportunities and positively affecting the organisations' bottom line (Kumar *et al.*, 2011). Lean manufacturing involves the trade-off between inventory costs and transport costs. The primary objective is to reduce inventory levels by ordering smaller, more frequent shipments; reducing inventory costs and increasing transport costs (Murphy & Wood, 2011: 165). Six Sigma is another manufacturing approach that can be used to make systems more efficient by focusing on quality; defects must be virtually eliminated from the system (iSixSigma, 2014). The traditional focus of lean manufacturing is on speed; getting all raw materials and finished products to the right place in the shortest time possible (Murphy & Wood, 2011: 165). The traditional focus of Six Sigma is on high quality of goods (iSixSigma, 2014); however, organisations have come to realise that both speed and quality are needed to maintain efficient operations. The combination of lean manufacturing and Six Sigma in Lean Six Sigma allows organisations to get the best of both (Murphy & Wood, 2011: 120). This should result in organisations reducing waste in the form of scrap materials and defect products in the manufacturing process resulting in positive effects on the organisations' bottom line. This will also reduce negative environmental impacts especially when production processes are designed during the initial design phase with the product and package also in mind. Employee training, regulated production processes,

continuous improvement (kaizen) practices and finding opportunities to create value out of waste will facilitate further efficiency and profitability improvements (Kumar *et al.*, 2011). Additional best practices to consider include producing during times of off-peak capacity, assessing current facility location, configuration and spatial layout, optimising space utilisation, reducing product handling, standardising equipment and reviewing current supply chain partnerships and technologies to minimise costs and improve environmental sustainability (Dunn & Wu, 1990; Murphy & Poist, 2000; Pagell & Wu, 2009; Kumar *et al.*, 2011). A summary of the best practices associated with manufacturing activities is presented in Table 8-4 of the Appendix.

The packaging process, usually performed at the manufacturer, can result in significant waste throughout the supply chain and must therefore, be considered during the initial design phase concurrently with process and product design (Kumar *et al.*, 2011). There are three types of packaging; primary, secondary and tertiary packaging. Primary packaging contains the physical product and performs functions related to protection, marketing and providing necessary product information (Kumar *et al.,* 2011). Primary packaging is usually disposed of by the consumer after consumption has occurred. Secondary packaging consists of the material that protects and contains primary packages and is usually either discarded by the retailer or the end user of the product (Kumar *et al.,* 2011). Tertiary packaging is used to contain and protect a number of secondary packages for example on a pallet, and is necessary to facilitate product identification, storage and transport activities (Dunn & Wu, 1990; Kumar *et al.*, 2011). Due to the significant role packaging plays throughout the supply chain, it is not possible to eliminate it completely. However, it is possible to reduce the quantity of packaging materials being utilised and to ensure that as much of the material as possible is either reused or recycled (Kumar *et al.*, 2011). Improved packaging as a result of concurrent product, process and package design and improved pallet configuration can facilitate the organisation in reducing materials utilised, increasing space utilisation in warehousing and distribution and reducing overall product handling. The results are lower levels of waste, lower levels of greenhouse gas emissions and lower levels of product damage due to improved handling (Dunn & Wu, 1990). Other packaging best practices include reducing the amount of air in the packaging system, using postponement principles, facilitating energy-efficient materials handling and using track and trace systems for packaging identification (Aronsson & Brodin, 2006; Pålsson, 2014: 24). Packaging best practices and improvement activities ultimately result in reduced negative environmental impacts and improved supply chain efficiency. A summary of the best practices associated with packaging activities is presented in Table 8-5 of the Appendix.

The considerations for inbound and outbound logistics are similar; the primary difference being the type of goods being distributed. Transportation processes require fuel and energy inputs, which result in pollution and product movement (Kumar *et al.*, 2011). There are a number of activities that must be considered with regards to minimising the environmental impact of the supply chain. By implementing improved materials and product handling activities, organisations can reduce materials and product waste and the amount of energy, labour and packaging required. This facilitates environmental efficiency in warehousing activities by reducing the amount of resources that are required to prepare products for shipment and distribution. The utilisation of standardised equipment, facility configuration and spatial layout, and cross-docking facilities all contribute to the minimisation of space utilisation and movement within the warehouse (Dunn & Wu, 1990). The design of the transport and distribution network plays a significant role in the potential to reduce negative environmental impacts throughout the supply chain. Increased emphasis should be placed on the ability of the transport network to reduce energy usage and lower total emissions (Kumar *et al.*, 2011).

Best practices to consider when designing the transport and distribution network include efficient vehicle routing and scheduling, minimising the number of shipments, shipping over shorter distances, improved space utilisation, lower levels of product handling and using routes with lower levels of congestion to reduce idle time (Dunn & Wu, 1990, World Economic Forum, 2009; Kumar *et al.,* 2011). Other important considerations include freight consolidation to improve vehicle efficiency, reducing air miles by ensuring full truckloads as often as possible, developing and implementing energy efficient technologies, using alternative fuels such as biofuel, implementing proper vehicle maintenance systems and redesigning vehicles for greater efficiency (Dunn & Wu, 1990; Aronsson & Brodin, 2006; World Economic Forum, 2009; Kumar *et al.*, 2011). A summary of the best practices associated with distribution activities is shown in Table 8-6 of the Appendix.

The modal selection can significantly influence both the environmental and economic performance of an organisation (Kumar *et al.*, 2011). Trade-offs will have to be made regarding cost, speed of delivery, risk of damage, carrier capacity and potential environmental damage (Murphy & Wood, 2011: 237). According to Pålsson (2014: 10), air transport requires almost six times more energy than road transport. Rail transport and shipping require significantly less energy than road or air transport; however, these modes are significantly influenced by available infrastructure (rail networks and access to waterways) and generally require longer transit times (Murphy & Wood, 2011: 237; Pålsson, 2014: 10). It is imperative that organisations consider their overall strategy and supply chain requirements

before making a modal selection. The lower economic and environmental cost of utilising rail or ship can be offset by long transit times, excess waste and customer dissatisfaction. It may ultimately prove to be more environmentally friendly for some organisations to utilise energy intensive modes such as air and road if excessive waste is minimised, thereby lowering total emissions and pollution (Dunn & Wu, 1990; Kumar *et al.*, 2011).

Marketing and logistics functions are inextricably linked due to their importance in fulfilling customer requirements and managing customer satisfaction (Dunn & Wu, 1990). A summary of the best practices associated with marketing and customer service is shown in Table 8-7 of the Appendix. Effective marketing activities result in improved information systems throughout the supply chain. When supply chain members integrate and develop an environment of sharing and collaboration, information can be passed on more efficiently and effectively. As a result, it is possible to replace inventory with information. It is, therefore, imperative for marketing decisions to incorporate supply chain environmental issues to facilitate the reduction of environmental degradation throughout the supply chain. Effective marketing and improved information systems increase the accuracy of demand forecasting and predicting sales resulting in reduced inventory waste and the elimination of inefficient distribution (Dunn & Wu, 1990; Lai *et al.,* 2008). Other best practices to consider include getting customers to cooperate for eco-design, cleaner production methods and green packaging (Dunn & Wu, 1990; Lai *et al.*, 2008).

Consumption and disposal processes relate to reverse logistics and waste management activities dealing with excess inventory, scrap materials, damaged products, raw material waste and packaging materials (Eltayeb & Zailani, 2009). Waste management and reverse logistics activities are interrelated as they have the ability to create value, reduce costs and mitigate negative environmental impacts stemming from consumption and disposal. Best practices associated with waste management include responsible disposal especially of hazardous materials, preventing pollution wherever possible and reducing emissions that harm the surrounding environment (Murphy & Poist, 2000; Rogers & Tibben-Lembke, 2001; Srivastava, 2007; Supply Chain Council, 2012). Reverse logistics consists of the flow of goods from the final consumer back into the forward supply chain to recycle, remanufacture and reuse (Eltayeb & Zailani, 2009). Best practices associated with reverse logistics activities start with determining how much waste can be diverted from landfills to create value through reuse, remanufacture and recycling (Eltayeb & Zailani, 2009). It is ideal to begin during the planning phase to ensure resource utilisation and resulting waste is minimised from the point of origin as this will reduce the total amount of waste generated

throughout the supply chain. Materials and parts that have been remanufactured or recycled have lower environmental impacts than new items and should therefore be considered, in addition to other more environmentally friendly materials, whenever possible by sustainable supply chain members (Srivastava, 2007). Recycling activities consist of the collection and disassembling of products and packaging to divide the materials into the correct categories for example, paper, plastic and different types of metals. These materials can then be processed and transformed into recycled products and packaging. Remanufacturing activities consist of the collection and assessment of consumed products to determine their condition (Pagell & Wu, 2009). New or recycled parts are used to replace damaged or defective parts and the product is then repackaged and redistributed (Pagell & Wu, 2009). Reusing activities consist of collecting used products and packaging materials and reselling or using them again as they are. No processing or transformation is necessary thus eliminating waste from the supply chain. Products and materials that cannot be recycled, remanufactured or reused are disposed of either by the relevant organisation or the end consumer. In addition to eliminating waste, reducing costs and minimising harmful emissions, organisations can create value through the sale of excess inventory, equipment and scrap and used materials (Dunn & Wu, 1990; Rogers & Tibben-Lembke, 2001; Aronsson & Brodin, 2006; Srivastava, 2007; Lai *et al.*, 2008; Eltayeb & Zailani, 2009; Pagell & Wu, 2009; Kumar *et al.*, 2011). A summary of the best practices associated with reverse logistics and waste management practices is presented in Table 8-8 and Table 8-9 in the Appendix.

It is clear that there are numerous best practices that can be applied at every stage of the supply chain to promote sustainable operations. The implementation of best practices to promote sustainable operations will make positive contributions to financial, social and environmental objectives. It is of the utmost importance for all supply chain members to collaborate in every phase beginning with product, process and package design and planning to ensure the minimisation of waste and the reduction of negative environmental impacts in each of the later stages. Certain practices such as relocating facilities require large investments and are not always feasible, particularly in the short run. Other practices such as recycling and reusing products, packaging and materials are relatively easily and inexpensively implemented. Ultimately, it remains up to the organisations to decide what best practices are feasible given their operations and the resources available to them. Since many organisations outsource activities such as manufacturing and distribution, it is important that they ascertain whether their service providers are also implementing sustainable best practices. There are opportunities for significant improvement in environmental performance and cost savings throughout the supply chain regardless of whether supply chain activities are outsourced or not (Srivastava, 2007; Kumar *et al.,*

2011). The primary focus through all supply chain activities should be on resource and emissions reduction to improve efficiency and effectiveness and drive sustainable development and profits (Kumar *et al.,* 2011).

2.4.3 Supply Chain Decarbonisation

The reduction of carbon emissions in the supply chain is known as supply chain decarbonisation; a topic of increasing importance in supply chain and corporate sustainability literature. The most significant contributor to lowering emissions is the reduction of non-renewable energy usage in the supply chain (World Economic Forum, 2009). The primary drivers for decarbonisation include more stringent regulation and legislation, rising and unstable fuel prices and increasing consumer pressure to become more environmentally friendly. The most feasible areas for supply chain decarbonisation are energy efficient physical facilities, energy efficient vehicle technologies, slowing the speed of transport through the supply chain, ensuring all networks are optimised, and training and education of supply chain members and stakeholders (World Economic Forum, 2009). However, the areas offering the highest abatement potential include low carbon sourcing in agriculture, energy efficient vehicle technologies, slowing the speed of transport through the supply chain, low carbon sourcing in manufacturing and packaging design initiatives (World Economic Forum, 2009). A summary of the decarbonisation opportunities identified by the World Economic Forum (2009) is presented in Table 2-4.

Table 2-4: Supply Chain Decarbonisation Opportunities

Decarbonisation Opportunity	Description	Feasibility Index (0 – 1)	Abatement Potential ($mtCO_2e$)
Energy Efficient Buildings	Minimise emissions from operating activities	0.9	93
Clean Vehicle Technologies	Introduce clean & environmentally efficient technologies	0.8	175
Despeeding the Supply Chain	Decrease transport speed & increase load fill	0.8	171
Optimised Networks	Improve network planning through transformation	0.8	124
Training & Communication	Provide training to transport contractors & building operators	0.8	117
Packaging Design Initiatives	Reduce weight & volume of packaging	0.7	132
Modal Switches	Switch from air & road long-haul to ocean, road & rail freight	0.7	115
Nearshoring	Switch ocean & air long-haul to road & rail freight	0.7	5

Decarbonisation Opportunity	Description	Feasibility Index (0 – 1)	Abatement Potential ($mtCO_2e$)
Low Carbon Sourcing (Agric.)	Optimise location of agricultural activities	0.6	178
Low carbon Sourcing (Manuf.)	Optimise location of manufacturing activities	0.6	152
Reverse Logistics/ Recycling	Improve % of recycled supply chain waste	0.6	84
Increased Home Delivery	Use alternative transport to deliver goods to consumer homes	0.5	17
Reduced Congestion	Develop traffic management systems	0.3	26

Source: World Economic Forum, 2009

It is clear that the supply chain decarbonisation opportunities presented by the World Economic Forum differ in their level of feasibility and the potential to reduce carbon emissions. To determine which of these opportunities is likely to contribute most significantly to the environmental performance of organisations, it is necessary to evaluate the feasibility index and abatement potential together (World Economic Forum, 2009). Figure 2-14 presents the scorecard for each of the opportunities as a product of the feasibility index (scale of 0 to 1) and the potential for abatement of emissions in metric tons of carbon dioxide equivalent.

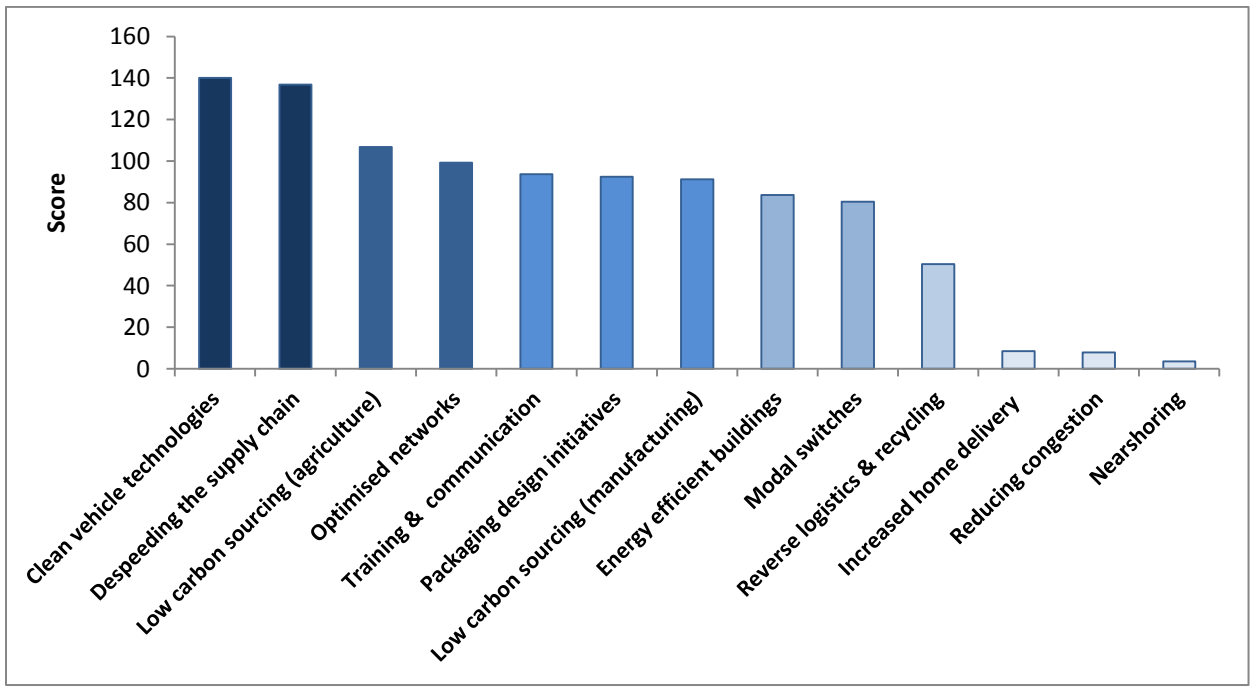

Figure 2-14: Decarbonisation Opportunity Scorecard

Source: World Economic Forum, 2009

From the scorecard shown in Figure 2-14 it appears that energy efficient vehicle technology and slowing down the speed of transport in the supply chain can contribute the most to organisational environmental performance. Low carbon sourcing in agricultural activities, optimising the management of networks, training and communication, packaging design initiatives and low carbon sourcing in manufacturing activities can enhance environmental performance further and create value in the supply chain. These opportunities are more achievable in the short term when compared with opportunities such as reducing congestion and redesigning and constructing energy efficient buildings, which are more achievable in the medium to long term. It is clear that no matter what type of industry an organisation is in, a number of supply chain decarbonisation opportunities are available.

Although much has been said on the need for the mitigation of negative supply chain environmental impacts, relatively little has been said on the emergence of adaptive logistics. According to Kreie and McKinnon (2010), mitigation has the primary goal of reducing negative environmental impacts (such as emissions) to ultimately attenuate the global warming process. However, the extent of damage to the natural environment will take decades to repair even if global decarbonisation and green transformation could be achieved tomorrow. It is clear that society as whole must adapt to a new environment with a changed climate. Adaptive logistics refers to the adjustments that will be necessary to align supply chains with the changing environment to adapt to the effects of global warming and climate change (Kreie & McKinnon, 2010). It is unclear what the exact nature of climate change will be in the future and the scope of this change is equally unclear. The effects of global warming will differ depending on geographic area and the resilience of the local population. Although no one can say with certainty what will happen and when it will happen, it is imperative that supply chains prepare for any eventuality and develop and implement systems that are robust and sustainable. Supply chains will need to develop direct responses to climate change, such as implementing green logistics systems to minimise negative environmental impacts, and will also need to develop indirect responses to climate change, such as redesigning and modifying logistics networks to meet the new demands that have arisen (Kreie & McKinnon, 2010).

2.5 Conclusion

The implementation of green and sustainable supply chain management has become increasingly important as organisations realise the significant impact their operations have on the surrounding environment. The importance of sustainable development is apparent as companies actively manage their triple bottom line performance through corporate sustainability and corporate social responsibility

practices. International agreements such as the Kyoto Protocol and standards developed by bodies like ISO provide support for organisations implementing sustainable practices whether they are driven by legislation, financial concerns or a moral obligation to protect the surrounding social and natural environments.

There is great potential for supply chain management to contribute to environmental management practices particularly with regards to reducing greenhouse gas emissions. Supply chain models such as the SCOR framework can facilitate organisations in determining the scope of their activities and the resources required to ensure sustainable operations. It is clear from the literature that many best practices have been developed to ensure the long term sustainability of supply chain operations and that there are a number of feasible decarbonisation opportunities with significant abatement potential. Chapter 3 describes the South African context of this study, outlining the country's efforts to transition to a low-carbon economy.

Chapter 3: South African Context

3.1 Introduction

South Africa, as a leading economy on the African continent, is a member of the Kyoto Protocol and is committed towards ensuring a sustainable future for the country. This is essential given the fact that total emissions for 2012 were over half a billion tonnes of carbon dioxide equivalent (CO_2e) (CDP, 2013). The government planned to implement a carbon tax in 2015 costing organisations R120 per ton of carbon emissions; however, it has been delayed until 2016. It is imperative that organisations focus their efforts on achieving long term sustainable operations given the financial impact of escalating environmental issues such as climate change and global warming (World Economic Forum, 2009).

This chapter describes the South African context of this study. The South African economy and its transition to a low-carbon economy are discussed in addition to the implications of the impending carbon tax on South African supply chain activities. The development of the JSE is outlined in addition to explanations of the sectors contributing to the JSE and the indices relevant to corporate sustainability.

3.2 South Africa's Transition to a Low-Carbon Economy

South Africa is a member of the Kyoto Protocol, which is an indication that the government is committed to making the transition from an energy-intensive economy to a low-carbon economy (Gordhan, 2013). Traditionally, the South African economy was driven by energy intensive sectors such as agriculture and mining; however, the economy has shifted towards knowledge and service in recent years (Media Club South Africa, 2015). The literature has shown that sustainability-related organisational practices are becoming increasingly important from both a voluntary and mandatory perspective due to businesses facing increased pressure from consumers, and changing legislation requiring greater commitment to reducing emissions and incorporating sustainability into organisational strategy (KPMG, 2013). It is particularly important for organisations in energy intensive industries to embrace sustainable change given the significant impact of their operations on the environment (CDP, 2013).

The previous South African Minister of Finance, Pravin Gordhan, announced the delay of the impending carbon tax from 2015 until 2016 in the 2014 Budget Speech (Greve, 2014). Organisations should view this delay as an opportunity to develop and improve environmentally sustainable practices and begin emissions reduction programmes to make corrective adjustments before the tax is implemented. The financial implications of the tax could place certain organisations in financial distress as the tax rate will

be R120 per ton of carbon dioxide equivalent emissions (Gordhan, 2013). It is, therefore, imperative that companies focus immediately on making operations as efficient and effective as possible to minimise the future cost implications of the tax. Tools such as carbon footprints can be used to determine the total amount of direct and indirect carbon dioxide (CO_2) and other greenhouse gas emissions expressed in carbon dioxide equivalent (CO_2e) of a product, process, organisation or region (Minx & Wiedmann, 2007). Given the significant impact of supply chains on financial performance and greenhouse gas emissions, it is important to determine sustainable supply chain best practices to determine where improvements can be made (Kumar *et al.,* 2011).

3.3 Johannesburg Stock Exchange

The JSE was established in 1887, and is the largest stock exchange on the African continent. It is included in the top 20 largest exchanges globally based on market capitalisation (JSE, 2014). Listing requirements for the JSE stipulate that companies must follow the King III corporate governance code and should publish an annual integrated report. The integrated report represents a transformation of the separate annual financial and sustainability reports to provide a holistic overview of the companies' financial, social and environmental performance (SAICA, 2011). As mentioned previously, the GRI Sustainability Reporting Guidelines are the most used reporting guidelines in South Africa. The guidelines consist of 70 assessment criteria including general indicators and sector specific indicators. The reason for the popularity of the GRI guidelines is because they can be used for any company, regardless of industry and size, and the assessment is comprehensive providing a standardised framework for companies to report their sustainability efforts and accomplishments to date (Kinderytė, 2008).

The Main Board is responsible for most of the JSE's market capitalisation and consists of over 300 listed companies. The sectors on the Main Board include Basic Materials, Consumer Goods, Consumer Services, Financials, Healthcare, Industrials, Oil & Gas, Technology and Telecommunications (JSE, 2014). Table 3-1 presents the JSE Main Board sectors and sub-sectors.

Table 3-1: JSE Main Board Sectors and Sub-sectors

Sector	Sub-sector
Basic Materials	Basic Resources
	Chemicals
Consumer Goods	Automobiles & Parts
	Food & Beverages
	Personal & Household Goods
Consumer Services	Media
	Retail
	Travel & Leisure
Financials	Banks
	Financial Services
	Insurance
	Investment Instruments
	Real Estate
Industrials	Construction & Materials
	Industrial Goods & Services
Healthcare	Healthcare
Oil & Gas	Oil & Gas
Technology	Technology
Telecommunications	Fixed Line Telecommunications
	Mobile Telecommunications

Source: McGregor BFA, 2014

It is clear that the JSE encompasses a range of industries from primary, secondary and tertiary sectors. The performance of the tertiary sector, in particular financial services, often provides a stabilising force when political and social unrest threaten the stability of the primary and secondary sectors, in particular mining and manufacturing (Media Club South Africa, 2015). The sector contribution (based on total number of companies) to the Main Board of the JSE expressed as a percentage is presented in Figure 3-1.

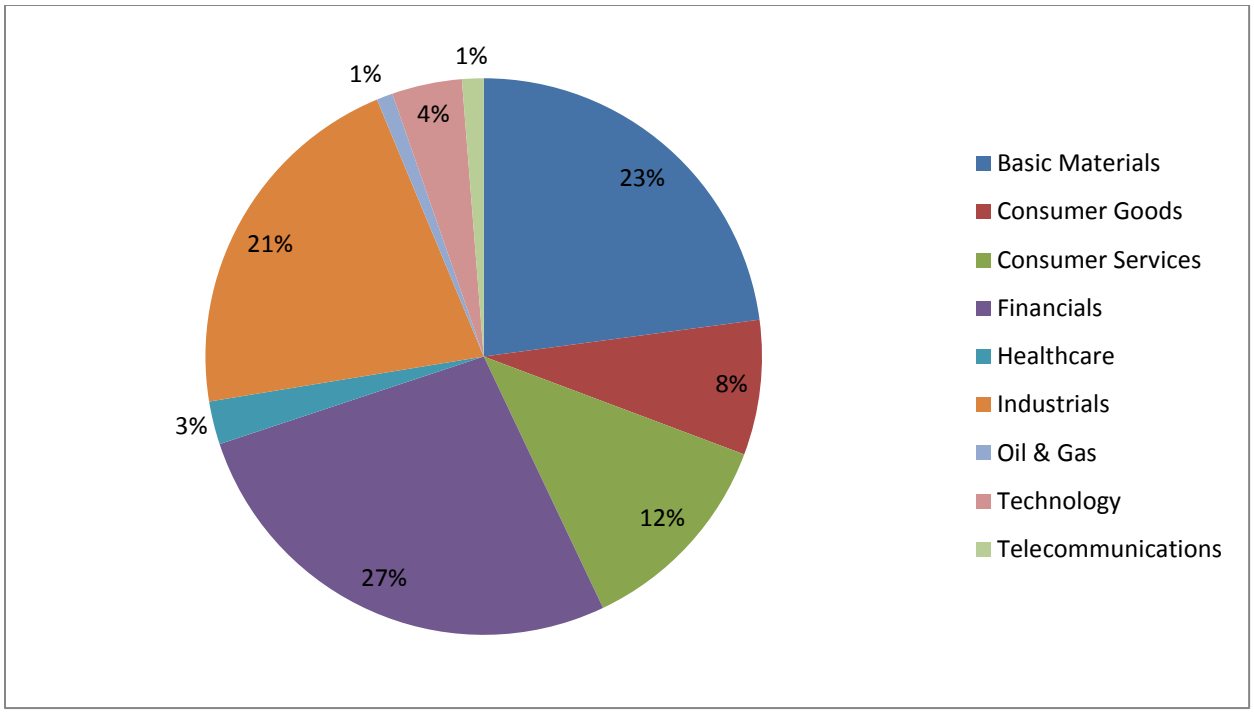

Figure 3-1: Sector Contribution to JSE in Number of Companies

Source: McGregor BFA, 2014

It is clear that Financials (27%), Basic Materials (23%) and Industrials (21%) make up the majority of the Main Board with regards to total number of companies, with a combined total of 71%. Consumer Goods and Consumer Services contribute a further 20% with the remaining 9% split between Technology, Healthcare, Oil and Gas and Telecommunications. The sector contribution (based on market capitalisation) expressed as a percentage is presented in Figure 3-2.

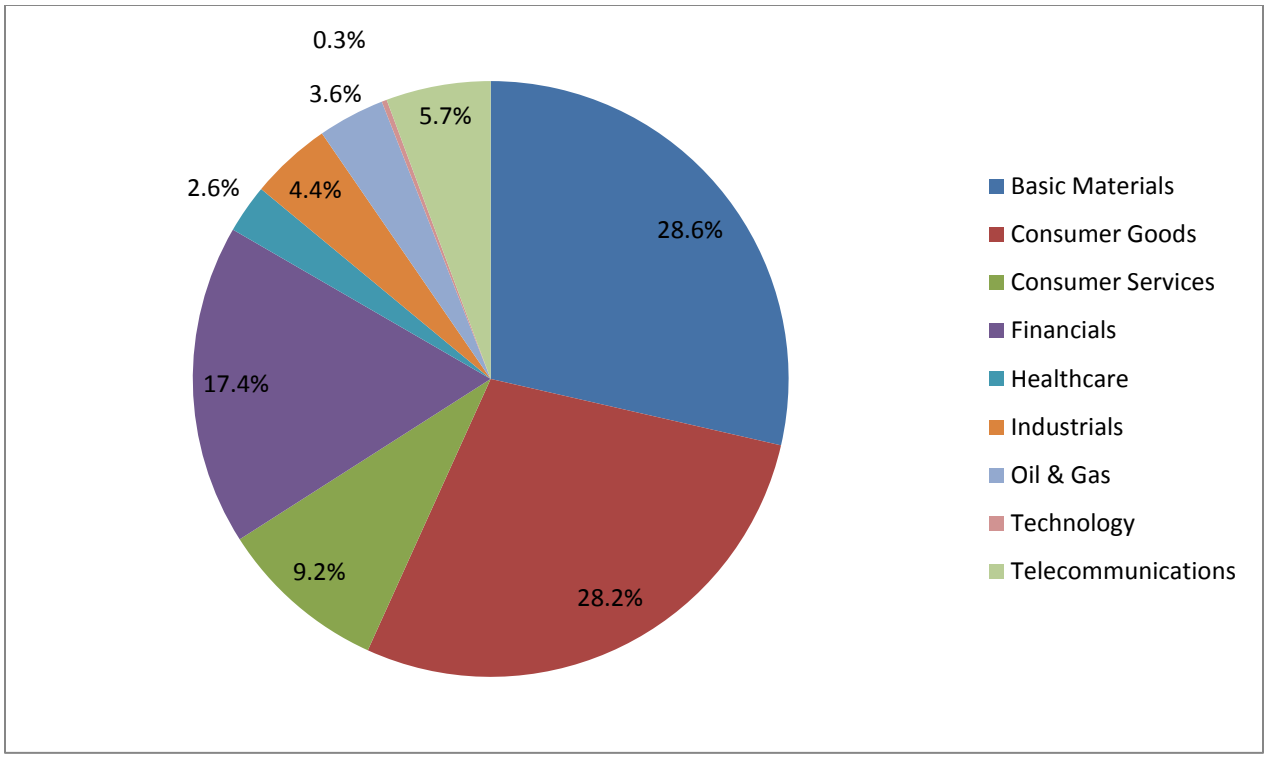

Figure 3-2: Sector Contribution to JSE in Market Capitalisation

Source: McGregor BFA, 2014

The sectors with the greatest contribution to market capitalisation are Basic Materials (28.6%), Consumer Goods (28.2%) and Financials (17.4%), with a combined total of 74%. The remaining 26% is divided between Consumer Services, Telecommunications, Industrials, Oil and Gas, Healthcare and Technology. It is important to observe the sectors' contribution to the JSE based on the combination of the number of companies in addition to market capitalisation. This can be seen in Figure 3-3.

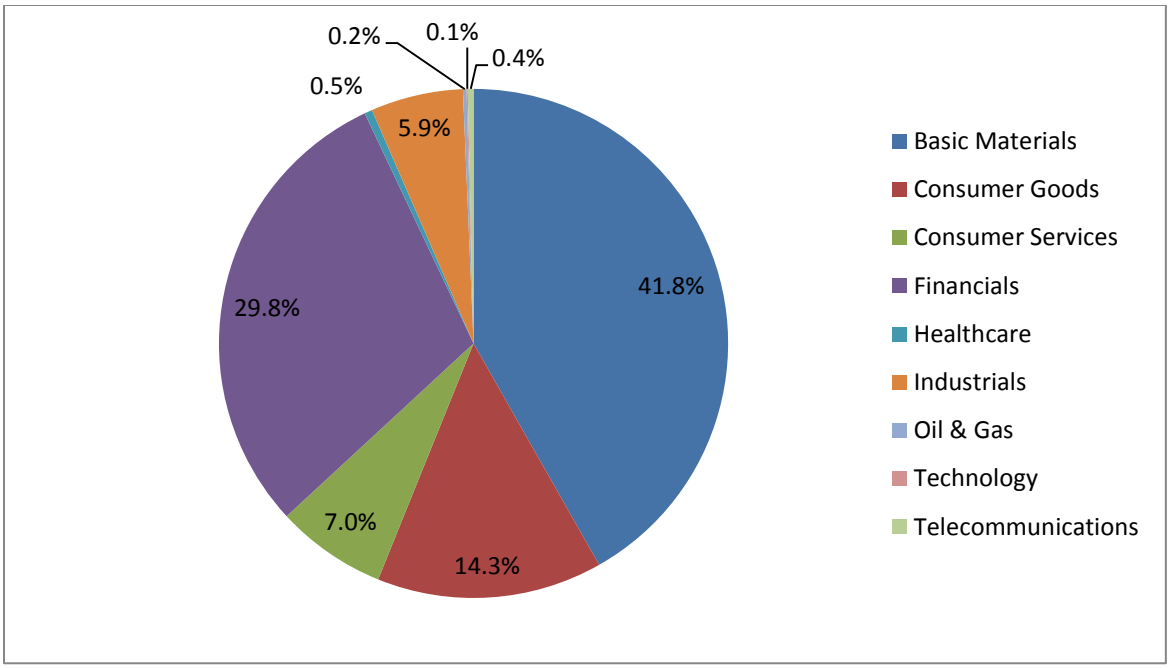

Figure 3-3: Sector Contribution to JSE as the Product of Number of Companies and Market Capitalisation

Source: McGregor BFA, 2014

From this it is clear that Basic Materials constitutes almost 42% of the JSE, which is most likely due to the large scale mining operations run by numerous South African organisations. The Financials sector contributes 29.8%, followed by Consumer Goods with 14.3%. Together, the three largest contributors make up more than 85% of the JSE. The remaining 15% is divided amongst Consumer Services (7%), Industrials (5.9%), Healthcare (0.5%), Telecommunications (0.4%), Oil & Gas (0.2%) and Technology (0.1%).

It is important to note that there are a number of indices on the JSE. The most notable index is the All Share Index. This index represents 99% of the full market capitalisation of the companies listed on the Main Board of the JSE. It is divided into three more indices based on the size of an organisation's market capitalisation, namely; the Top 40 Index, the Mid Cap Index and the Small Cap Index. The Top 40 Index consists of the 40 biggest companies based on market capitalisation on the All Share Index (JSE, 2014). Other prominent indices include the Satrix INDI Index representing the Top 25 Industrial companies, the Satrix FINI Index representing the Top 15 Financial companies, the Satrix RESI Index representing the Top ten Resources companies and the SRI Index (JSE, 2014). For the purposes of this study, the SRI Index is discussed in more detail.

The JSE SRI Index, currently consisting of 82 constituents, was launched in 2004 to facilitate the management of listed companies' triple bottom line performance. The index provides a benchmark for organisations to compare and improve their current sustainability performance, and allows investors to base their analyses on a broader set of criteria (JSE, 2015). The sector contribution to the SRI Index (based on the total number of companies) expressed as a percentage is presented in Figure 3-4.

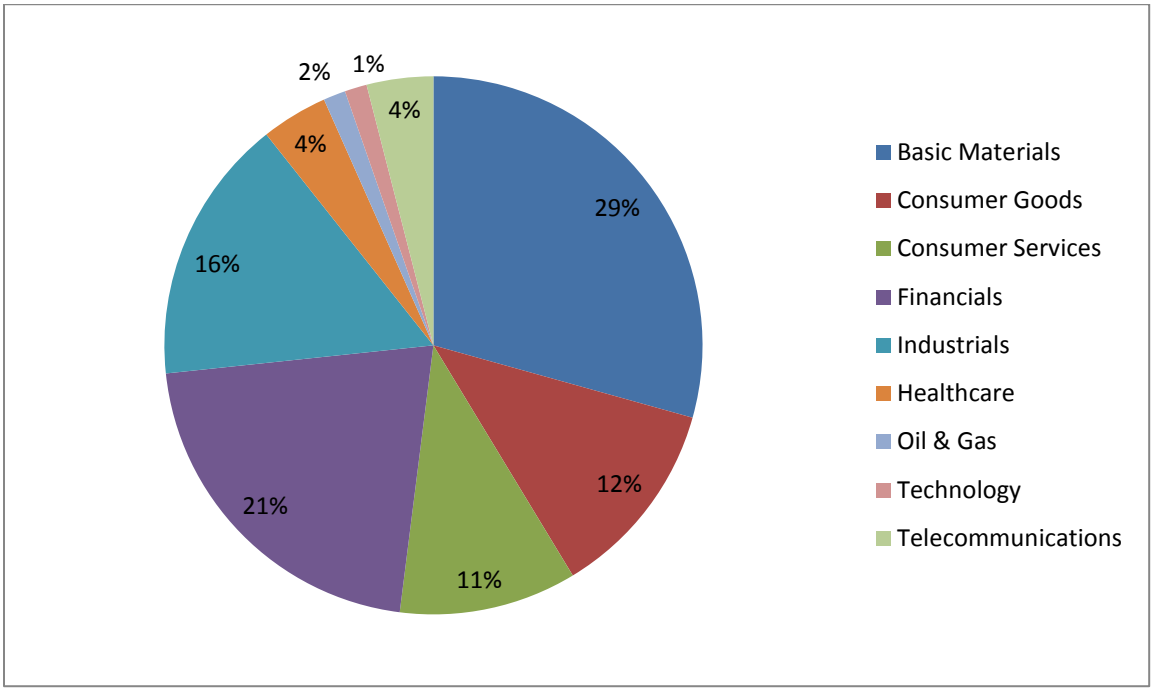

Figure 3-4: Sector Contribution to SRI Index in Number of Companies

Source: JSE, 2014

The majority of the SRI Index constituents come from the Basic Materials (29%), Financial (21%), Industrial (16%), Consumer Goods (12%) and Consumer Services (11%) sectors with a combined total of 89%. The remaining 11% is divided between the Healthcare, Telecommunications, Oil and Gas and Technology sectors. Due to the fact that the SRI Index is used as a benchmark for sustainability practices, a comparison of the environmental sustainability efforts between SRI Index constituents and non-SRI Index constituents are included in the study.

Companies listed on the Main Board of the JSE must comply with stringent requirements according to the King III code of corporate governance. One of these requirements is that listed organisations must publish an integrated annual report detailing their social, environmental and financial performance. Integrated annual reports combine annual financial statements and sustainability reports that used to

be published separately. Sustainability and integrated annual reports are easily accessible and valuable sources of information when wanting to examine the supply chain and sustainability practices of organisations (Ellram, Kirchoff & Tate, 2009). According to a report compiled by the Carbon Disclosure Project (CDP), South African companies included in the JSE Top 100 are performing well with regards to sustainability reporting given that the CDP response rate for 2013 was 83%; the second highest response rate in the world. Roughly 70% of the JSE Top 100 companies are listed on the SRI Index. Disclosure in sustainability reports has improved in general, and there has also been an increase in the number of companies that have voluntarily set emissions reductions targets. However, this increased commitment has not translated into the necessary emissions reductions required to keep the global temperature increase below two degrees Celsius particularly since the level of carbon dioxide in the atmosphere exceeded 400 parts per million during 2013 (CDP, 2013).

Table 3-2 displays the sector response rates and average disclosure scores for 2013 of the JSE 100 and the Global 500.

Table 3-2: Sector Response Rates and Disclosure Scores: JSE 100 vs Global 500

Sector	Response Rate		Mean Disclosure Score	
	JSE 100	Global 500	JSE 100	Global 500
Consumer Services	83%	77%	74	83
Consumer Goods	83%	88%	80	81
Energy & Materials	91%	78%	90	81
Financials	61%	75%	84	79
Health Care	100%	83%	79	82
Industrials	82%	77%	83	83
IT & Telecommunication	75%	75%	82	80
Utilities	NA	74%	NA	91
TOTAL sample	**83%**	**81%**	**83**	**81**

Source: CDP, 2013

It is clear that most of the sectors on the JSE 100 outperformed the sectors on the Global 500 with total response rates of 83% and 81% respectively. Health Care had an excellent response rate of 100%, as did Energy and Materials with a response rate of 91% when compared with 83% and 78% for their respective Global 500 counterparts. The JSE 100 Financials sector had the poorest response rate at 61%; 14% lower than the response rate for the Global 500. The JSE 100 Consumer Goods sector also performed below the Global 500 with response rates of 83% and 88% respectively. IT and Telecommunications for the JSE 100 and the Global 500 both had response rates of 75%, thus indicating

South African companies are on par with their global counterparts. It appears that South African companies in the JSE 100 have higher response rates for most sectors when compared with the Global 500 (CDP, 2013).

With regards to the average (mean) disclosure scores, the picture is slightly different. Although the JSE 100 Health Care sector had the highest response rate, it had the second lowest mean disclosure score at 79. The JSE 100 sector with the largest gap in mean disclosure scores was Consumer Services with a mean disclosure score of 74 compared with 83 for the Global 500. The JSE 100 Consumer Goods sector also had a mean disclosure score lower than its Global 500 counterpart at 80 and 81 respectively. The JSE 100 sector with the highest mean disclosure score was Energy and Materials at 90 compared with 81 for the Global 500. The mean disclosure scores were close for the majority of the sectors indicating that South African companies are performing relatively well compared to the rest of the world. The overall JSE 100 and Global 500 response rates and mean disclosure scores for the two samples were similar at 83% and 81%, and 83 and 81 respectively (CDP, 2013).

Although it appears that sustainability reporting efforts have improved, a study undertaken by KPMG found that the level of reporting on the impact of supply chains on sustainability is relatively low. It is imperative that organisations realise the potential of supply chains to do damage to the social and natural environment and also the potential to create and maintain sustainable business operations. By including supply chain issues and opportunities in transparent integrated reports, companies will allow investors, consumers, the government and the general public to know how they are managing the complex challenges associated with adapting to global warming, increasing regulations and rising consumer pressure (KPMG, 2013). Figure 3-5 displays the level of detail discussed on the impact of supply chains on sustainability (expressed as a percentage) in the annual reports of the Fortune Global 250.

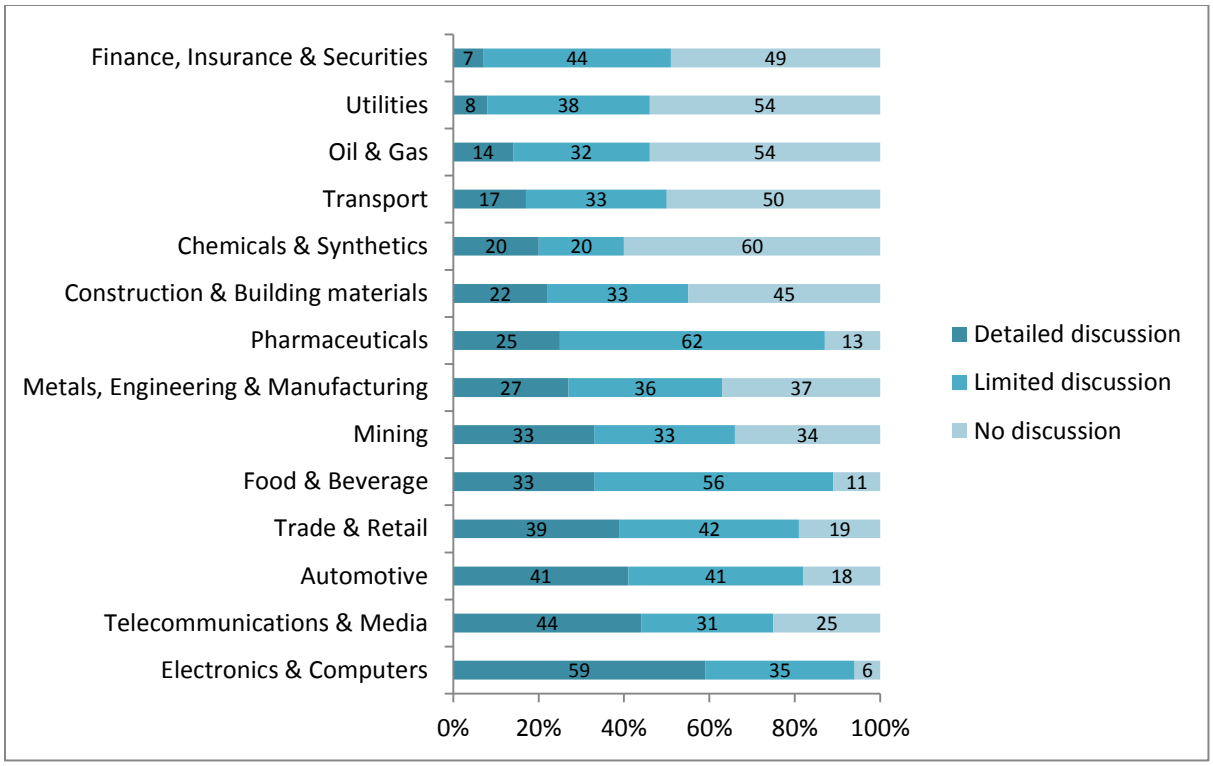

Figure 3-5: Detail included in Annual Reports on the Impact of Supply Chains on Sustainability

Source: KPMG, 2013

From Figure 3-5, it is clear that the Electronics and Computers sector provide the most detailed discussions of the sustainability impacts of their supply chains and the Finance, Insurance and Securities sector provide the least detailed discussion of their supply chain sustainability impacts. The sectors performing best at providing at least some discussion on supply chain sustainability impacts include Electronics and Computers, Food and Beverage and Pharmaceuticals. The fact that energy intensive sectors with heavy environmental impacts such as Chemicals and Synthetics, Utilities, Oil and Gas and Transport all have "no discussion" scores of 50% or more is a cause for concern. These sectors contribute significantly to carbon emissions and environmental degradation and have the potential to significantly reduce their environmental impact and mitigate the effects of global warming. It is of the utmost importance that South African companies appreciate current global reporting trends and make improvements to reflect the international movement towards developing sustainable organisational practices (KPMG, 2013).

3.4 Conclusion

It is clear that the largest sectors of the JSE include Basic Materials, Industrials, Financials and Consumer Goods and Services. These sectors, with the exception of the Financials sector, are similar in that they all have extensive supply chain networks and are relatively energy intensive. Given the contribution of these sectors to the economy and the environmental impact of their operations, it is necessary to examine their sustainability reporting practices in greater detail. The findings of this study may facilitate organisations in these sectors in reducing their emissions and the negative financial implications of the carbon tax.

The topic of supply chain sustainability has been researched thoroughly across the globe; however, less research has been done on the disclosure of sustainable supply chain management practices in sustainability reports, especially for developing countries such as South Africa (Morhardt, 2009). This study aims to address this issue by investigating the current supply chain sustainability reporting practices of South African organisations listed on the Main Board of the JSE due to the fact that public companies face greater levels of scrutiny with regards to their published reports. A comparison is done between sectors and between companies listed on the SRI Index with those that are not. Chapter 4 provides a detailed description of the research design and methodology that was used to collect data and analyse results.

Chapter 4: Research Design & Methodology

4.1 Introdutcion

This chapter will outline the research design and methodology that were utilised in this study. The first section discusses the combination of primary and secondary research followed by an outline of the chosen design and methodology. The data collection and fieldwork are described with regards to sample design and measurement instruments. The techniques and programs used in the data analysis for this study are discussed in section 4.5 followed by limitations of the study and assumptions that were made.

4.2 Primary & Secondary Research

This study consists of a combination of both primary and secondary research methods to provide an analysis of the environmental sustainability practices of organisations listed on the JSE.

The secondary research that was conducted was based on the use of the Internet to investigate company websites, annual financial reports, sustainability reports and academic articles and publications. Secondary research was critical for this study due to the fact that very few privately owned companies are willing to disclose their annual reports on the Internet, whereas listed companies must disclose their reports as part of the listing requirements on the JSE.

The primary research method that was utilised includes the use of content analysis on the reports obtained from the Internet. Content analysis can be understood as “the systematic observation and quantitative description of the manifest content of communication” (Babin & Zikmund, 2010: 253). The primary research that was conducted in this study was based on the primary data that was collected from Integrated Annual Reports and Sustainability Reports from company websites on the Internet. These documents provided the information that was needed to extract data using qualitative content analysis software. Statistical analyses were performed on the data using Statistica software.

4.3 Research Design & Methodology

The design and methodology for this study are based on a research project being undertaken by Professor James R. Stock from the University of South Florida. The aim of his research was to investigate the supply chain sustainability practices of retail and manufacturing organisations through their annual sustainability reports. This study is adapted to suit the South African context and statistical analyses are included to enhance the significance of the results.

This study is conducted utilising a hybrid of qualitative and quantitative research. The qualitative research aspects of this study include the content analysis of the Integrated Annual Reports and Sustainability Reports of companies listed on the Mainboard of the JSE using the qualitative software analysis tool NVivo. The quantitative research aspects of this study include the numerical coding of the observations obtained from the qualitative software analysis in addition to the statistical tests performed on the data to produce objective results.

With regards to temporal classification, this study is cross-sectional in nature and encompasses data from publically available sustainability and integrated annual reports from the latest available financial year.

4.4 Data Collection & Fieldwork

4.4.1 Sample Design

The target population for this study is all organisations in South Africa with a particular focus on organisations that have intense supply chain and logistics requirements. The sample frame for this study is all organisations listed on the JSE in the Mainboard due to the online availability of their sustainability and integrated annual reports. The sectors and the number of companies in each sector are shown in Table 4-1.

Table 4-1: Sectors, Companies and % Contributions to the JSE

Sector Description	Number of Companies: total	Sector % of the JSE
Basic Materials	70	22%
Financials	93	29%
Healthcare	8	2%
Industrials	69	21%
Consumer Goods	23	7%
Oil &Gas	6	2%
Other Consumer Services	16	5%
Retailers	25	8%
Technology	11	3%
Telecommunications	4	1%
TOTAL	**325**	**100%**

Source: McGregor BFA, 2014

The non-probability methods of judgement and convenience sampling were used to select the sample units for the study. Judgement sampling consists of the selection of sample units based on the researcher's individual judgement regarding a specific relevant characteristic (Babin & Zikmund, 2010: 424). Convenience sampling consists of the selection of sample units "that are most conveniently available" (Babin & Zikmund, 2010: 423). These sampling techniques are best suited to the study due to data limitations and the risk of low response rates from private organisations.

The JSE Mainboard consists of nine sectors, however, for the purposes of this study Consumer Services was divided into two categories: Retailers and Other Consumer Services. It was necessary to investigate retail organisations separately as they have extensive supply chain operations that have potentially significant environmental impacts. After performing an initial statistical analysis, four of the sectors were found to have insufficient data producing insignificant results. To ensure the reliability of the results, it was decided that only sectors with extensive supply chains and sufficient data to produce significant results would be included in the final analyses. Table 4-2 presents the sectors, their inclusion or exclusion from the study and the reason for their inclusion or exclusion.

Table 4-2: Sector Inclusions/ Exclusions from the Study

Sector	Included/ Excluded	Reason
Basic Materials	Included	Significant data, extensive supply chain
Industrials	Included	Significant data, extensive supply chain
Retailers	Included	Significant data, extensive supply chain
Consumer Goods	Included	Significant data, extensive supply chain
Financials	Excluded	Significant data, limited supply chain
Other Consumer Services	Excluded	Insignificant data
Technology	Excluded	Insignificant data
Healthcare	Excluded	Insignificant data
Oil &Gas	Excluded	Insignificant data
Telecommunications	Excluded	Insignificant data

The total number of companies in the sectors included in the study is 187; however, the total sample size for the data analysis conducted in this study is 155 companies. This is due to a number of limitations including annual reports for some companies being unavailable online; some reports were available, but were from before the 2012 financial year and some annual reports were incompatible with the NVivo software. The total number of companies included in the study that are constituents of the SRI Index is

52, which equals 33.5% of the sample for the study. The breakdown of the sample size by sectors is shown in Table 4-3.

Table 4-3: Sectors and Companies Included in the Study

Sector Description	Number of Companies	% of the Sample
Basic Materials	52	34%
Industrials	59	38%
Consumer Goods	20	13%
Retailers	24	15%
TOTAL	**155**	**100%**

The fieldwork for this study was conducted by searching the Internet for Sustainability Reports and Integrated Annual Reports for the organisations in the sectors listed in Table 4-3. The latest available reports were downloaded from company websites during February 2015. For the majority of the reports (64%), the reporting year of 2014 was used as this was the most recent reporting period where complete reports were available. The most recent reporting period for 32% of the companies included was 2013 and the most recent reporting period for the remaining 4% of companies was 2012.

Possible errors that could have occurred include a non-response error in that not all companies had recent publically available reports and not all reports were compatible with the software used to perform the qualitative analysis. Administrative errors could also have occurred in the form of a sample selection error. Due to the fact that companies listed on the JSE were selected because of the availability of their annual reports, the sample may not be perfectly representative of all South African organisations. To minimise the probability of errors occurring, care was taken in every step of the research process to ensure valid and reliable results. All limitations and assumptions are described in Sections 4.5 and 4.6 to ensure that the reader understands fully where potential errors may have occurred.

4.4.2 Measurement Instruments

The measurement instrument utilised for this study is the qualitative software analysis tool NVivo 10. The software located the keywords in the reports and counted the frequency that pre-determined words or phrases are mentioned in the sustainability and integrated annual reports of organisations included in the study.

The first level of scale measurement that was utilised in this study was nominal scale measurement. The nominal scale relates to the coding of the sectors and to the classification of companies according to whether they are part of the SRI Index or not. The second level of scale measurement that was utilised in this study was ratio scale measurement. The ratio scale relates to the frequency count of the pre-determined words or phrases were searched for on NVivo 10 for each organisation included in the study.

4.5 Data Analysis

There were two phases of analysis for this study. The first phase was a content analysis of the sustainability and integrated annual reports using NVivo 10, and the second phase consisted of non-parametric statistical analysis using Statistica. The content analysis was based on an established *a priori* list of 34 keywords relating to supply chain management and sustainability. Thirteen keywords relating to supply chain management and 21 keywords relating to sustainability were identified based on Professor Stock's research and the literature reviewed for this study. The keywords identified in addition to Professor Stock's list, relate to supply chain activities discussed in South African supply chain literature and the impending carbon tax. These keywords include procurement, sourcing, carbon emissions, carbon footprint, carbon tax, environmental management and triple bottom line. These keywords are relevant given the financial impact of supply chain activities on business, and the potential of supply chain activities to reduce negative environmental impacts, in particular carbon emissions. The 34 keywords identified for this study are presented in Table 4-4.

Table 4-4: Supply Chain and Sustainability Keywords

Supply Chain Keywords	Sustainability Keywords
Inventory	Carbon Emissions
Logistics	Carbon Footprint
Packaging	Carbon Tax
Procurement	Energy
Recycling	Energy Conservation
Refurbishment	Energy Efficiency
Remanufacturing	Environmental Management
Reverse Logistics	Environmental Performance Indicators
Sourcing	Global Reporting Initiative
Supply Chain	GRI
Supply Chain Management	GRI Guidelines
Transportation	International Organisation for Standardisation
Warehousing	ISO
	ISO 14000
	ISO 14001

Supply Chain Keywords	Sustainability Keywords
	ISO 14001 Certification Renewable Energy Sustainability Sustainability Framework Sustainability Metrics Triple Bottom Line

NVivo 10 software was used to perform the qualitative data analysis on the sustainability reports and integrated annual reports of organisations in the sectors selected for this study. The program provided data on the number of times pre-determined keywords were mentioned in the reports of individual organisations in addition to providing the words used most frequently before and after each of the keywords. This information could prove useful when delving deeper into topics such as the application of ISO standards and preparation efforts for the impending carbon tax. The keyword frequencies provide an indication of the supply chain sustainability-related themes that are currently considered and included in the reporting of South African organisations. Keywords with less than ten observations were excluded from the statistical analyses.

The data analysis was performed using Statistica to extract both descriptive statistics and inferential statistics. Due to the fact that the data had a non-normal distribution, non-parametric statistical tests were utilised to determine the significance of the data at a 5% level of significance. The level of significance determines whether or not the null hypothesis is rejected and whether the results drawn from the sample are applicable to the general population (Keller, 2012: 365). If the statistical tests used in this study produce a p-value result of less than 0.05, the null hypothesis is rejected and there is sufficient evidence to support the alternative hypothesis (Keller, 2012: 363). In this study there are three hypotheses:

Hypothesis 1:

H_0: there are no significant differences in the supply chain sustainability reporting practices of organisations listed on the JSE

H_a: there are significant differences in the supply chain sustainability reporting practices of organisations listed on the JSE

Hypothesis 2:

H_0: there are no significant differences in the supply chain sustainability reporting practices between the Basic Materials, Industrials, Consumer Goods and Retailers sectors

H_a: there are significant differences in the supply chain sustainability reporting practices between the Basic Materials, Industrials, Consumer Goods and Retailers sectors

Hypothesis 3:

H_0: there are no significant differences in the supply chain sustainability reporting practices between companies listed on the SRI Index and companies that are not

H_a: there are significant differences in the supply chain sustainability reporting practices between companies listed on the SRI Index and companies that are not

The Kruskal-Wallis test was used to perform a multivariate statistical analysis to determine whether there are differences in supply chain sustainability reporting practices and whether there are differences in these practices between the Basic Materials, Industrials, Consumer Goods and Retail sectors. The Kruskal-Wallis test is the non-parametric test in place of an ANOVA analysis due to the non-normal distribution of the data and the assumptions of ANOVA not being met. It is used to compare the mean frequencies of the keywords in general, and to compare the mean frequencies between the Basic Materials, Industrials, Consumer Goods and Retailers sectors (Keller, 2012: 757). If the p-value of the Kruskal-Wallis test is less than 0.05, there are significant differences in the mean frequencies of the keywords in general and between the selected sectors.

The Mann-Whitney U test was used to perform a bivariate statistical analysis to determine if there are differences in supply chain sustainability reporting practices between companies that are constituents of the SRI Index and companies that are not. The Mann-Whitney U test is the non-parametric test used in place of the independent sample t-test due to the non-normal distribution of the data. It is used to compare the mean frequencies of the keywords between SRI Index and non-SRI Index companies to determine whether there is a significant difference in their supply chain and sustainability reporting practices (Keller, 2012: 727). If the p-value of the Mann-Whitney U test was less than 0.05, there are significant differences in the mean frequencies of the keywords between companies listed on the SRI Index and those that are not.

The second research objective is to investigate the preparation efforts for the carbon tax due for implementation in 2016. To obtain the results for this objective a combination of the results from the statistical tests and qualitative information from the content analysis were used. The Kruskal-Wallis test was used to determine whether there are differences in the mean frequencies of keywords related to the carbon tax between the selected sectors. The Mann-Whitney U test was used to determine whether there are significant differences in the mean frequencies of these keywords between companies listed on the SRI Index with those that are not. If the p-values of these tests were less than 0.05, there are significant differences in the mean frequencies of carbon tax related keywords between the selected sectors and companies listed on the SRI Index and those that are not. These results are enhanced by the qualitative findings of the content analysis regarding the words used most commonly before and after the carbon tax related keywords in the sustainability and integrated annual reports.

The final objective is to determine the "readiness" of JSE listed organisations for the 2016 carbon tax. To obtain the results for this objective the findings from the first two objectives were utilised in addition to information gathered from the literature review. The combination of quantitative and qualitative information found in this study helps to ensure an accurate depiction of the readiness of South African organisations for the implications of the carbon tax.

4.6 Limitations

There were a number of limitations for this study affecting the data collection and analysis processes. The first limitation is that there are few comprehensive sources of information on the supply chain sustainability practices of South African organisations leading to the need to collect primary data. The second limitation has to do with the lack of data available from private companies, which is why public organisations listed on the JSE were selected for the study. There were also limitations with regards to time and money resources. These resource limitations contributed to the decision to use public organisations with readily available data as opposed to contacting private organisations and obtaining proprietary data.

Another limitation is that not all of the companies listed in the sectors included in the study had appropriate data available as some of the annual reports were too old (prior to 2012) or not available from their websites. In addition, a small number of reports could not be exported into the NVivo 10 software analysis program and these were excluded from the study.

With regards to data analysis, a number of the pre-selected variables (key words or phrases) had too few observations to have any statistical relevance and were therefore excluded from the study.

4.7 Assumptions

Assumptions were made with regards to the sustainability and integrated annual reports that were collected for data analysis purposes. It was assumed that only companies with reports for the reporting periods 2012 – 2014 would be included in the study. It was also assumed that companies whose primary operations are not based in South Africa were excluded from the study as this may influence the results due to different reporting requirements in other countries.

Due to the supply chain intensive nature of the retail sector, it was assumed that retailers and providers of other consumer services would be separated and that only the retail sector would be included in the study. It was also assumed that companies in the Consumer Goods sector would be representative of manufacturing companies in South Africa.

4.8 Conclusion

The research design and methodology for this study were driven by the lack of available data on supply chain sustainability in South Africa and resource limitations of the researcher. The study consisted of a hybrid of primary and secondary research utilising the Internet to collect reports and draw best practice guidelines from academic literature in addition to performing content analysis and statistical tests. Due to the nature of this study, a combination of qualitative and quantitative research was necessary to extract relevant data and obtain reliable results.

The sample that was chosen for this study include companies from the Basic Materials, Industrials, Consumer Goods and Retail sectors listed on the JSE. The NVivo 10 software analysis program extracted relevant data from the annual reports of these companies and Statistica was used to perform the Kruskal – Wallis and Mann – Whitney U tests on selected supply chain and sustainability related keywords. The major limitations of this study were primarily related to data availability and assumptions were made regarding the inclusion of the selected sectors.

Chapter 5: Results

5.1 Introduction

The main objective of this study is to investigate the supply chain sustainability reporting practices of organisations listed on the JSE. This objective was achieved through a combination of content analysis using qualitative software, quantitative statistical analyses and information gathered from the literature review. This chapter consists of three sections. The first section discusses the results of the investigation into the supply chain sustainability reporting practices and includes a comparison between the selected sectors and between companies listed on the SRI Index with those that are not. The second section discusses the preparation efforts for the impending carbon tax based on results from the statistical analyses for the carbon tax related keywords and qualitative findings from the content analysis. The chapter concludes with a discussion of the general "readiness" of South African organisations for the implications of the carbon tax. The discussion draws from the results from the first two objectives of this study.

5.2 Supply Chain Sustainability Reporting Practices of South African Organisations

5.2.1 Descriptive Statistics

The results show that the majority of companies include supply chain related keywords in their sustainability and integrated annual reports as shown in Table 5-1. The concepts of "inventory", "procurement", "supply chain" and "logistics" are mentioned by at least 68% of the companies included in the study. "Logistics", "procurement", "supply chain", "inventory" and "packaging" are the supply chain related terms mentioned most frequently in the study. The keyword "logistics" is discussed by 68% of the companies in the study and is mentioned over 1000 times, whilst "procurement" is discussed by 79% of companies and is also mentioned over 1000 times. It is good to see that 60% of companies included "recycling" in their reports and that the keyword was mentioned over 550 times. "Remanufacturing" and "reverse logistics" were the keywords with the lowest observations at three companies each, and the smallest frequencies. These keywords were excluded from further analysis for having less than ten observations in total.

Table 5-1: Supply Chain Keywords Total Frequencies

All Companies		
Supply Chain Keyword	**Number of Companies**	**Frequency**
Inventory	124	932
Logistics	106	1078
Packaging	69	885
Procurement	123	1077
Recycling	93	551
Refurbishment	25	76
Remanufacturing	3	11
Reverse Logistics	3	7
Sourcing	78	306
Supply Chain	107	994
Supply Chain Management	39	89
Transportation	57	170
Warehousing	44	124

Table 5-2 displays the number of companies and the frequencies for supply chain related words for each of the sectors included in the study. The keywords “procurement”, “inventory” and “recycling” are mentioned by at least 65% of companies in the Basic Materials sector. “Procurement” and “inventory” are the keywords mentioned most frequently by Basic Materials companies. Both concepts are mentioned over 300 times. Other words mentioned frequently include “packaging”, “supply chain” and “recycling”. The supply chain related keywords mentioned least frequently by companies in the Basic Materials sector are “reverse logistics”, “remanufacturing”, “warehousing” and “refurbishment”. Each of these words was included in less than ten companies’ reports and the keyword “reverse logistics” was not mentioned at all. “Inventory”, “procurement”, “supply chain” and “logistics” were discussed by at least 69% of the companies in the Industrials sector. “Logistics” and “packaging” were the concepts mentioned most frequently by companies in the Industrials sector. “Logistics” was mentioned over 600 times and “packaging” was mentioned over 400 times. Other words mentioned frequently include “procurement”, “supply chain”, “inventory” and “recycling” all mentioned over 200 times. The supply chain related keywords mentioned least frequently in the Industrials sector are “reverse logistics”, “remanufacturing” and “refurbishment”. These words were mentioned less than ten times, and “reverse logistics” was not mentioned at all in this sector.

“Logistics”, “supply chain”, “packaging” and “inventory” were discussed by at least 80% of the Consumer Goods companies. Only one company in the Consumer Goods sector did not discuss the keyword

"procurement", which was mentioned 284 times. "Supply chain" and "logistics" were mentioned almost 200 times and "packaging" and "inventory" were also mentioned frequently. The supply chain related words that were mentioned least frequently were "remanufacturing", "reverse logistics" and "transportation". Both "remanufacturing" and "reverse logistics" were not mentioned at all by companies in the Consumer Goods sector. In the Retail sector, "inventory" was mentioned by 88% of companies and "sourcing", "supply chain", "procurement" and "logistics" were mentioned by at least 79% of companies included in the study. "Supply chain" and "inventory" were mentioned most frequently at 299 and 225 times respectively. "Procurement" and "sourcing" were also mentioned frequently at over 120 times each. The supply chain related words mentioned least frequently in the Retail sector were "remanufacturing" and "reverse logistics". Three companies in the Retail sector were the only companies in the study to mention "reverse logistics" and no companies mentioned "remanufacturing".

Table 5-2: Supply Chain Keywords Frequency by Sector

Supply Chain Keyword	Basic Materials		Industrials		Consumer Goods		Retailers	
	Number of Companies	Frequency	Number of Companies	Frequency	Number of Companies	Frequency	Number of Companies	Frequency
Inventory	38	327	49	265	16	115	21	225
Logistics	29	115	41	669	17	197	19	97
Packaging	14	241	27	427	16	150	12	67
Procurement	39	343	46	321	19	284	19	129
Recycling	34	204	35	233	10	48	14	66
Refurbishment	8	24	4	6	5	12	8	34
Remanufacturing	1	6	2	5	0	0	0	0
Reverse Logistics	0	0	0	0	0	0	3	7
Sourcing	22	41	22	44	14	96	20	125
Supply Chain	29	208	42	288	16	199	20	299
Supply Chain Management	11	31	13	30	8	16	7	12
Transportation	20	54	23	94	5	6	9	16
Warehousing	8	15	20	60	8	11	8	38

Table 5-3 displays the number of companies and the frequencies of the supply chain related keywords mentioned by companies included in the SRI Index and those that are not. Ninety percent (90%) of the companies on the SRI Index included the keyword "procurement" in their reports and at least 75% of companies included "supply chain", "inventory" and "logistics" in their reports. "Supply chain" was the

most frequently mentioned keyword at 627 times, followed by "logistics", "packaging" and "procurement", which were all mentioned over 500 times. The supply chain related words that were mentioned least frequently by companies in the SRI Index are "remanufacturing" and "reverse logistics", which were both mentioned four times by one company. "Inventory" was mentioned by 79% of the companies and "procurement", "logistics" and "supply chain" were mentioned by at least 62% of companies not included in the SRI Index. The keyword "inventory" was also the most frequently mentioned at 608 times, followed by "procurement" and "logistics", which were mentioned over 500 times. The supply chain related keywords that were mentioned least frequently by companies not included in the SRI Index were also "remanufacturing" and "reverse logistics".

Table 5-3: Supply Chain Keywords Frequency by Index

Supply Chain Keyword	SRI Index		Non-SRI Index	
	Number of Companies	Frequency	Number of Companies	Frequency
Inventory	43	333	81	608
Logistics	39	576	67	502
Packaging	29	545	40	342
Procurement	47	512	76	565
Recycling	36	252	57	299
Refurbishment	12	32	13	44
Remanufacturing	1	4	2	7
Reverse Logistics	1	4	2	3
Sourcing	33	191	45	116
Supply Chain	43	627	64	374
Supply Chain Management	16	37	23	52
Transportation	24	76	33	94
Warehousing	19	57	25	67

It appears that the range in the frequencies of the sustainability related keywords is larger than the range in frequencies for the supply chain related keywords. As shown in Table 5-4, the concepts of "sustainability" and "energy" have the highest number of observations and the highest frequencies by a large margin. "Sustainability" is discussed by 97% of the companies included in the study and is mentioned over 5000 times, whilst "energy" is discussed by 90% of companies and is mentioned over 3000 times. Other concepts that are discussed frequently include "GRI", "ISO" and "environmental management". These keywords are discussed by at least 50% of companies and are mentioned over 400 times. "Carbon footprint" and "renewable energy" are mentioned over 200 times. "Sustainability metrics", "ISO 14001 certification", "ISO 14000", "sustainability framework", "GRI Guidelines" and

"International Organisation for Standardisation" were the sustainability related keywords with the lowest observations and the smallest frequencies. They were excluded from further statistical analysis for having less than ten observations.

Table 5-4: Sustainability Keywords Total Frequencies

All Groups		
Sustainability Keyword	**Number of Companies**	**Frequency**
Carbon Emissions	61	176
Carbon Footprint	83	285
Carbon Tax	34	115
Energy	139	3144
Energy Conservation	10	13
Energy Efficiency	30	79
Environmental Management	90	400
Environmental Performance Indicators	10	11
Global Reporting Initiative	75	165
GRI	77	466
GRI Guidelines	9	9
International Organisation for Standardisation	9	10
ISO	86	453
ISO 14000	5	5
ISO 14001	47	151
ISO 14001 Certification	3	6
Renewable Energy	45	240
Sustainability	150	5044
Sustainability Framework	7	10
Sustainability Metrics	2	9
Triple Bottom Line	14	24

Table 5-5 displays the number of companies and the frequencies of sustainability related keywords for each of the sectors included in the study. The keywords "sustainability", "energy" and "environmental management" were discussed by at least 85% of the companies in the Basic Materials sector. "Energy" and "sustainability" are the keywords mentioned most frequently. "Sustainability" was mentioned over 1700 times and "energy" was mentioned over 1600 times. Other words mentioned frequently include "environmental management" at 242 times and "GRI" at 210 times. The sustainability related keywords mentioned least frequently in the Basic Materials sector include "energy conservation", "environmental performance indicators", "GRI Guidelines", "International Organisation for Standardisation", "ISO 14000", "ISO 14001 certification", "sustainability framework" and "sustainability metrics". All of these words were included in less than ten companies' reports and were mentioned less than ten times. At

least 85% of the companies in the Industrials sector discussed "energy", mentioned over 700 times, and "sustainability", mentioned over 1800 times. Other keywords mentioned frequently in the Industrials sector include "ISO", "GRI" and "renewable energy". The sustainability related keywords mentioned least frequently in the Industrials sector include "energy conservation", "environmental performance indicators", "GRI Guidelines", "International Organisation for Standardisation", "ISO 14000", "ISO 14001 certification", "sustainability framework" and "sustainability metrics". Each of these words was mentioned in less than ten companies' reports less than ten times.

Every company in the Consumer Goods sector discussed the keyword "sustainability" and only one company did not mention the keyword "energy". "Sustainability" was mentioned over 700 times and "energy" was mentioned 400 times. At least 70% of the companies in the Consumer Goods sector mentioned the keywords "environmental management", "ISO", "GRI", "carbon emissions" and "carbon footprint". The sustainability related keywords mentioned least frequently in the Consumer Goods sector include "carbon tax", "energy conservation", "GRI Guidelines", "International Organisation for Standardisation", "ISO 14000", "ISO 14001 certification", "sustainability framework", "sustainability metrics" and "triple bottom line". The keyword "ISO 14001 certification" was not mentioned at all by the companies in the Consumer Goods sector. In the Retail sector, every company discussed the keywords "energy" and "sustainability". "Energy" was mentioned over 200 times and "sustainability" was mentioned over 700 times. The keyword "carbon footprint" was also mentioned frequently relative to the remaining keywords for this sector. The Retail sector had the highest number of sustainability related keywords with a total frequency of zero. These words include "GRI Guidelines", "International Organisation for Standardisation", "ISO 14000", "ISO 14001" and "ISO 14001 certification".

Table 5-5: Sustainability Keywords Frequency by Sector

Sustainability Keyword	Basic Materials		Industrials		Consumer Goods		Retailers	
	Number of Companies	Frequency	Number of Companies	Frequency	Number of Companies	Frequency	Number of Companies	Frequency
Carbon Emissions	18	55	20	57	14	39	9	25
Carbon Footprint	25	64	29	91	14	68	15	62
Carbon Tax	20	66	6	34	3	3	5	12
Energy	46	1685	50	788	19	400	24	271
Energy Conservation	5	8	2	2	1	1	2	2
Energy Efficiency	11	35	9	15	5	9	5	20
Environmental Management	44	242	28	99	15	52	3	7
Environmental	4	4	0	0	4	5	2	2

Sustainability Keyword	Basic Materials		Industrials		Consumer Goods		Retailers	
	Number of Companies	Frequency	Number of Companies	Frequency	Number of Companies	Frequency	Number of Companies	Frequency
Performance Indicators								
Global Reporting Initiative	25	67	28	60	12	22	10	16
GRI	28	210	28	151	14	77	7	28
GRI Guidelines	3	3	4	4	2	2	0	0
International Organisation for Standardisation	6	7	0	0	3	3	0	0
ISO	29	133	35	212	15	99	7	9
ISO 14000	1	1	3	3	1	1	0	0
ISO 14001	19	57	19	69	9	25	0	0
ISO 14001 Certification	2	5	1	1	0	0	0	0
Renewable Energy	14	50	22	142	7	45	2	3
Sustainability	49	1734	57	1856	20	743	24	711
Sustainability Framework	2	2	1	4	3	3	1	1
Sustainability Metrics	0	0	0	0	1	3	1	6
Triple Bottom Line	6	11	5	10	2	2	1	1

As shown in Table 5-6, at least 96% of the companies in the SRI Index discussed the keywords “energy”, mentioned over 1600 times, and “sustainability”, mentioned over 2500 times. At least 60% of companies discussed the keywords “carbon emissions”, “environmental management”, “GRI”, “Global Reporting Initiative”, “ISO” and “carbon footprint”. “GRI” was mentioned 239 times and “carbon footprint”, “environmental management”, “ISO” and “renewable energy” were all mentioned over 100 times. The sustainability related keywords mentioned least frequently by companies in the SRI Index are “energy conservation”, “environmental performance indicators”, “GRI Guidelines”, “International Organisation for Standardisation”, “ISO 14000”, “ISO 14001 certification”, “sustainability framework”, “sustainability metrics” and “triple bottom line”. All of these words were included in the reports of less than ten companies and were mentioned ten times or less. Ninety seven percent (97%) of the companies not included in the SRI Index discussed “sustainability” in their reports and 86% of the companies discussed the keyword “energy”. “Sustainability” was mentioned over 2500 times and “energy” was mentioned over 1500 times. Other keywords discussed by at least 50% of the companies include “ISO” and “environmental management”. The keywords mentioned most frequently include “environmental management”, “GRI” and “ISO” all mentioned over 200 times, and “carbon footprint” and “renewable energy” mentioned over 100 times. The sustainability related keywords mentioned least frequently by companies not included in the SRI Index are “energy conservation”, “environmental

performance indicators", "GRI Guidelines", "International Organisation for Standardisation", "ISO 14000", "ISO 14001 certification", "sustainability framework" and "sustainability metrics". "ISO 14001 certification" and "sustainability metrics" were not mentioned at all by these companies.

Table 5-6: Sustainability Keywords Frequency by Index

Sustainability Keyword	SRI Index		Non-SRI Index	
	Number of Companies	Frequency	Number of Companies	Frequency
Carbon Emissions	31	88	30	88
Carbon Footprint	35	116	48	169
Carbon Tax	20	79	14	36
Energy	50	1607	89	1537
Energy Conservation	7	10	3	3
Energy Efficiency	19	47	11	32
Environmental Management	31	192	59	208
Environmental Performance Indicators	5	5	5	6
Global Reporting Initiative	33	74	42	91
GRI	32	239	45	227
GRI Guidelines	3	3	6	6
International Organisation for Standardisation	3	3	6	7
ISO	34	173	52	280
ISO 14000	2	2	3	3
ISO 14001	24	82	23	69
ISO 14001 Certification	3	6	0	0
Renewable Energy	20	135	25	105
Sustainability	50	2541	100	2503
Sustainability Framework	6	9	1	1
Sustainability Metrics	2	9	0	0
Triple Bottom Line	2	2	12	22

5.2.2 Kruskal-Wallis: Sector Comparison

The Kruskal-Wallis test was performed to determine whether there are significant differences in the mean frequencies of the keywords between the selected sectors. When there were fewer than five observations, no mean frequency was calculated resulting in the display of not applicable (NA). When the p-value is less than 0.05, the results show that there are significant differences in the mean frequencies of the keywords between the sectors.

Table 5-7 shows the Kruskal-Wallis p-values and the mean frequencies for the supply chain related keywords. The keywords with significant differences in the mean frequencies between sectors are "procurement", "sourcing" and "supply chain" all with a p-value less than 0.01. The Consumer Goods sector had the highest mean frequency for the keywords "procurement" and "sourcing" at 14.947 and 6.857 respectively. For the keyword "supply chain", the Retail sector had the highest mean frequency at 14.950.

Table 5-7: Kruskal-Wallis Sector Comparison of Sustainability Keywords

Supply Chain Keyword	Kruskal-Wallis: p-value	Basic Materials	Industrials	Consumer Goods	Retailers
Inventory	0.0501	8.842	5.408	7.188	10.714
Logistics	0.1000	3.966	16.317	11.588	5.105
Packaging	0.2500	17.357	15.815	9.375	5.583
Procurement	0.0000	8.795	6.978	14.947	6.789
Recycling	0.6000	6.000	6.657	4.800	4.714
Refurbishment	0.6600	3.000	1.500	2.400	4.250
Sourcing	0.0000	1.909	2.000	6.857	6.250
Supply Chain	0.0000	7.414	6.857	12.438	14.950
Supply Chain Management	0.8000	2.818	2.308	2.000	1.714
Transportation	0.2800	2.700	4.087	1.200	1.778
Warehousing	0.2300	1.875	3.000	1.375	4.750

Table 5-8 shows the Kruskal-Wallis p-values and the mean frequencies for the sustainability related keywords. The keywords with significant differences in the mean frequencies between sectors are "energy", "Global Reporting Initiative" and "ISO". The keywords "energy" and "ISO" had p-values of less than 0.01 and "Global Reporting Initiative" had a p-value of 0.04. The Basic Materials sector had the highest mean frequency for the keywords "energy" and "Global Reporting Initiative" at 36.630 and 2.680 respectively. The sector with the highest mean frequency for the keyword "ISO" was the Consumer Goods sector at 6.600.

Table 5-8: Kruskal-Wallis Sector Comparison of Sustainability Keywords

Sustainability Keyword	Kruskal-Wallis: p-value	Basic Materials	Industrials	Consumer Goods	Retailers
Carbon Emissions	0.9200	3.056	2.850	2.786	2.778
Carbon Footprint	0.2200	2.560	3.138	4.857	4.133

Sustainability Keyword	Kruskal-Wallis: p-value	Basic Materials	Industrials	Consumer Goods	Retailers
Carbon Tax	0.3800	NA	NA	NA	NA
Energy	0.0000	36.630	15.760	21.053	11.292
Energy Conservation	0.4100	1.600	1.000	NA	1.000
Energy Efficiency	0.7200	3.182	1.667	1.800	4.000
Environmental Management	0.1600	5.500	3.536	3.467	2.333
Environmental Performance Indicators	0.4700	1.000	NA	1.25	1.000
Global Reporting Initiative	0.0400	2.680	2.143	1.833	1.600
GRI	0.4800	7.500	5.393	5.500	4.000
ISO	0.0000	4.586	6.057	6.600	1.286
ISO 14001	0.6100	3.000	3.632	2.778	NA
Renewable Energy	0.4700	3.571	6.455	6.429	1.500
Sustainability	0.3500	35.388	32.561	37.150	29.625
Triple Bottom Line	0.4700	1.833	2.000	1.000	NA

Table 5-9 shows the significant differences in the mean frequencies of supply chain and sustainability related keywords between sectors.

Table 5-9: Significant Differences in Mean Frequencies between Sectors

Keyword	Sector 1	Sector 2	Kruskal-Wallis p-value
Supply Chain	Industrials	Consumer Goods	0.0167
Supply Chain	Industrials	Retailers	0.0003
Inventory	Industrials	Retailers	0.0428
Procurement	Industrials	Consumer Goods	0.0079
Procurement	Retailers	Consumer Goods	0.0242
Sourcing	Basic Materials	Retailers	0.0033
Sourcing	Industrials	Retailers	0.0034
Energy	Industrials	Basic Materials	0.0235
ISO	Retailers	Basic Materials	0.0330
ISO	Retailers	Industrials	0.0046
ISO	Retailers	Consumer Goods	0.0108

Referring to Table 5-7, for the key word “supply chain”, the Industrials sector has a lower mean frequency at 6.857 compared to the Consumer Goods sector at 12.438 and Retailers at 14.950. The Industrials sector also has a significantly lower mean frequency at 5.408 compared to the Retail sector at 10.714 for “inventory”. The Consumer Goods sector has a significantly higher mean frequency at 14.947

for “procurement” compared to the Industrials sector at 6.978 and the Retail sector at 6.789. With regards to “sourcing”, the Retail sector has a significantly higher mean frequency at 6.250 compared to Basic Materials at 1.909 and Industrials at 2.000. “Energy” and “ISO” were the only sustainability related key words to have significant differences between some of the sectors. Basic Materials had a significantly higher mean frequency for “energy” at 36.630 when compared with the Industrials sector at 15.760. For the key word “ISO”, there were significant differences in mean frequencies between all of the sectors. The Retail sector had the lowest mean frequency at 1.286 compared with Basic Materials at 4.586, Industrials at 6.057 and Consumer Goods at 6.600.

The results show that there are some significant differences in the mean frequencies of supply chain and sustainability related keywords included in this study. The supply chain keywords that are significantly different from other keywords include “procurement”, “sourcing” and “supply chain”. The sustainability related keywords that are significantly different from other keywords include “energy”, “Global Reporting Initiative” and “ISO”. The null hypothesis that there are no significant differences in these supply chain sustainability reporting practices is rejected. The results also show that there are a number of significant differences in the supply chain sustainability reporting practices between the Basic Materials, Industrials, Consumer Goods and Retail sectors. Six supply chain and sustainability related keywords had p-values less than 0.05 as shown in Table 5-9. The null hypothesis that there are no significant differences in these supply chain sustainability reporting practices between sectors is rejected.

Consumer Goods and Retail companies are giving critical consideration to their sourcing/ procurement activities to minimise input costs and are considering the impact supply chain activities are having on their operations. Given the scale of supply chain operations in the Retail sector, it is logical that these companies include discussions on their supply chains more than the other sectors. It is understandable that the Basic Materials sector would have the highest focus on energy due to the energy intensive nature of their operations and the extensive listing requirements for mining companies included in the sector. These results also show that the Retail sector is less concerned with energy and international standards such as ISO when compared with the other sectors. This could indicate that their primary focus is on financial considerations given the extensive nature of their operations and the limited attention being paid to important environmental considerations.

5.2.3 Mann-Whitney U Test: SRI Index versus Non-SRI Index

The Mann-Whitney U Test was performed to determine whether there is a significant difference in the mean frequencies of keywords between SRI Index companies and non-SRI Index companies. When there were fewer than five observations no mean frequency was calculated resulting in the display of not applicable (NA). When the p-value is less than 0.05, the results show that there are significant differences in the mean frequencies of the keywords between SRI Index and non-SRI Index companies.

Table 5-10 shows the Mann-Whitney p-values and the mean frequencies for the supply chain related keywords. The supply chain related keywords with significant differences between SRI Index and non-SRI Index companies are “procurement”, “recycling” and “supply chain”. “Recycling” and “supply chain” had p-values less than 0.01 and “procurement” had a p-value of 0.0219. For all three significant keywords, companies in the SRI Index had higher mean frequencies than companies not included in the SRI Index. SRI Index companies had a mean frequency of 10.894 for the keyword “procurement” compared with a mean frequency of 7.434 for companies not included in the SRI Index. For the keyword “recycling” SRI Index companies had a mean frequency of 7.000 compared with a mean frequency of 5.246 for companies not included in the SRI Index. The keyword “supply chain” had the largest difference in mean frequencies at 14.581 for SRI Index companies and 5.844 for non-SRI Index companies.

Table 5-10: Mann-Whitney U Test Index Comparison for Supply Chain Keywords

Supply Chain Keyword	Mann-Whitney U Test: p-value	SRI Index Mean Frequency	Non-SRI Index Mean Frequency
Inventory	0.3429	7.744	7.506
Logistics	0.1058	14.769	7.493
Packaging	0.8872	18.793	8.550
Procurement	0.0219	10.894	7.434
Recycling	0.0013	7.000	5.246
Refurbishment	0.6120	2.667	3.385
Sourcing	0.1843	5.788	2.578
Supply Chain	0.0000	14.581	5.844
Supply Chain Management	0.6345	2.313	2.261
Transportation	0.8007	3.167	2.849
Warehousing	0.6346	3.000	2.680

Table 5-11 shows the Mann-Whitney p-values and the mean frequencies for the sustainability related keywords. The sustainability related keywords with significant differences between SRI Index and non-SRI Index companies are “energy”, “environmental management” and “sustainability”. The keywords

"energy" and "sustainability" had p-values of less than 0.01 and "environmental management" had a p-value of 0.0121. For all three significant keywords companies in the SRI Index had higher mean frequencies than companies not included in the SRI Index. For the keyword "energy" SRI Index companies had a mean frequency of 32.140 compared with a mean frequency of 17.270 for non-SRI Index companies. SRI Index companies had a mean frequency of 6.194 for the keyword "environmental management" compared with a mean frequency of 3.525 for non-SRI Index companies. SRI Index companies had a mean frequency of 50.820 compared with 25.030 for non-SRI Index companies for the keyword "sustainability". This difference was the largest with SRI Index companies having a mean frequency double that of non-SRI Index companies.

Table 5-11: Mann-Whitney U Test Index Comparison for Sustainability Keywords

Sustainability Keyword	Mann-Whitney U Test: p-value	SRI Index Mean Frequency	Non-SRI Index Mean Frequency
Carbon Emissions	0.5332	2.839	2.933
Carbon Footprint	0.9208	3.314	3.521
Carbon Tax	0.2543	3.950	2.571
Energy	0.0000	32.140	17.270
Energy Conservation	0.4161	NA	NA
Energy Efficiency	0.8858	2.474	2.909
Environmental Management	0.0121	6.194	3.525
Environmental Performance Indicators	0.4237	1.000	1.200
Global Reporting Initiative	0.3897	2.242	2.167
GRI	0.2357	7.469	5.044
ISO	0.9042	5.088	5.385
ISO 14001	0.6036	3.417	3.000
Renewable Energy	0.1669	6.750	4.200
Sustainability	0.0000	50.820	25.030
Triple Bottom Line	0.3354	NA	NA

The results show that there are some significant differences in the supply chain sustainability reporting practices between SRI Index and non-SRI Index companies. Six supply chain and sustainability related keywords had p-values less than 0.05 as shown in Table 5-10 and 5-11. The null hypothesis that there are no significant differences in these supply chain sustainability reporting practices between SRI and non-SRI Index companies is rejected.

There are significant differences between SRI and non-SRI Index companies for the keywords "procurement", "recycling", "supply chain", "energy", "environmental management" and "sustainability". The mean frequencies for each of these keywords are higher for SRI Index companies compared to non-SRI Index companies. This means that SRI Index companies discuss these supply chain and sustainability practices in their annual reports significantly more than companies that are not SRI Index constituents. It is understandable that SRI Index constituents discuss sustainability related practices more than companies that are not as the Index consists of companies with the best in class social responsibility and environmental sustainability practices.

5.3 Preparation Efforts for the 2016 Carbon Tax

The second objective for this study is to investigate preparation efforts for the carbon tax due for implementation in 2016. There are three keywords included in this study relating to the concept of the carbon tax including "carbon emissions", "carbon footprint" and "carbon tax". Although none of these keywords had significant results for the sector comparison and the SRI Index and non-SRI Index comparison, the absolute frequencies can be used as an indication of the level of awareness of these concepts.

Figure 5-1 shows the sector contribution to the total frequency for the keywords "carbon emissions", "carbon footprint" and "carbon tax". The Industrials sector had the highest contribution to the total frequencies for the keywords "carbon emissions" and "carbon tax" at 33% and 32% respectively. Basic Materials contributed 31% to the total frequency for the keyword "carbon emissions" and the Retail sector contributed the least at 14%. The Consumer Goods sector contributed 24% to the keyword "carbon footprint" and Basic Materials and the Retail sector each contributed 22%. For the keyword "carbon tax", the Basic Materials sector had by far the highest contribution at 57% followed by the Industrials sector at 30%. The Consumer Goods sector had by the far the lowest contribution at 3% followed by the Retail sector at 10%.

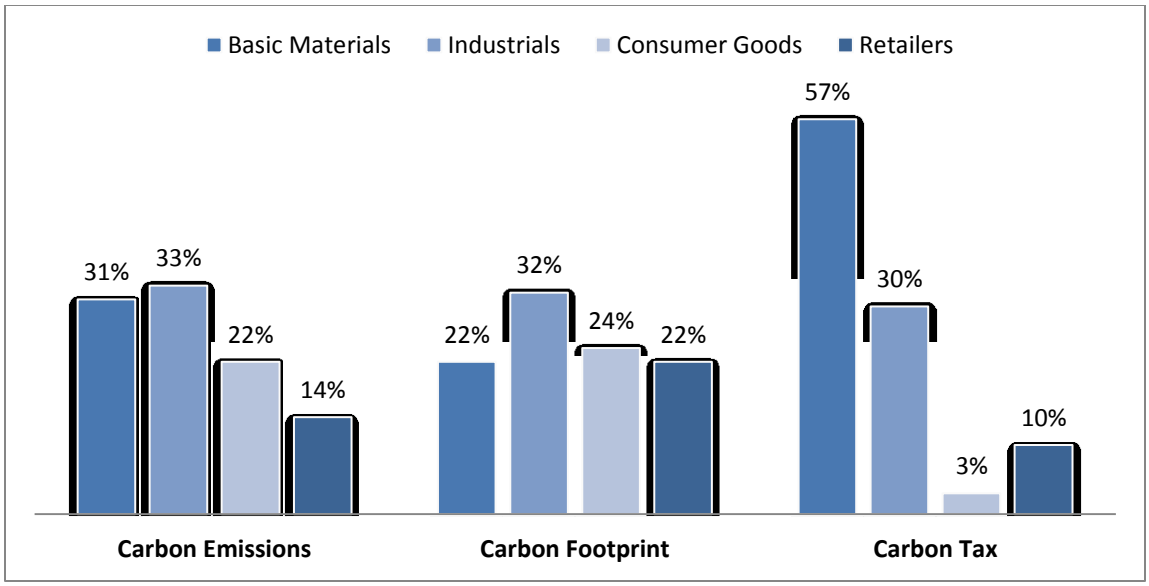

Figure 5-1: Sector Contribution to Carbon Emissions, Carbon Footprint and Carbon Tax

From this it is clear that the Basic Materials and Industrials sectors are aware of the concepts relating to the carbon tax and discuss them frequently. Although the Consumer Goods and Retail sectors are aware of these concepts given their inclusion in the annual reports, there is room for greater discussion particularly with regards to the keywords “carbon emissions” and “carbon tax”.

Table 5-12 displays the words mentioned most frequently before and after the keywords “carbon emissions”, “carbon footprint” and “carbon tax”. These words provide valuable context to support the findings on the level of awareness of the impending carbon tax. Every sector discusses the reduction of carbon emissions and words such as Key Performance Indicators (KPIs), strategic and savings represent the fact that companies are considering the reduction of their emissions as a strategic objective that can be accomplished through the use of KPIs resulting in savings that benefit their bottom line. With regards to “carbon footprint”, companies in all of the sectors mention words such total, group and our indicating that they have taken responsibility for the impact the full scope of their operations have on the environment. The Industrials and Retail sectors both mention reduction of their carbon footprints, which makes sense given the nature of their operations and the inherent potential to reduce emissions. The Basic Materials sector emphasises transportation, tonnes, product and operations, which is relevant to their industry due to the large quantities of raw materials that must be transported from the source to development facilities or ports for export. With regards to “carbon tax”, the Consumer Goods sector did not mention the keyword frequently enough to identify words mentioned most frequently before and after. The remaining sectors all use the word proposed before carbon tax, which shows that

companies are aware of the impending carbon tax and are considering its implications by including it in their annual reports. The words used most frequently after carbon tax all relate to policy and legislation and the Basic Materials sector also mentions implications of the tax, which shows that companies are following government announcements and supports the fact that they are considering the impact of the tax on their businesses.

Table 5-12: Common Words Preceding and Following Keywords by Sector

Sector	Keyword	Common Words Preceding	Common Words Following
Basic Materials	Carbon Emissions	Specified, Internal, Reduce	Criteria, KPIs
	Carbon Footprint	Total, Our, Improved, Group	Transportation, Tonnes, Product, Operational
	Carbon Tax	Impending, National, Proposed	Implications, Legislation, Policy, Scheme
Industrials	Carbon Emissions	Absolute, Environmental, Lower, Performance, Reducing, Spend	tCO2e, Strategic, Waste
	Carbon Footprint	Group's, Our, Reducing	Assessment, Reduction
	Carbon Tax	Monitor, Proposed	Policy, Strategy
Consumer Goods	Carbon Emissions	Reduce, Reducing, Total	Identifying
	Carbon Footprint	Company's, Group's, Our, Product, Reducing	Analysis, Considerations, Total
	Carbon Tax		
Retailers	Carbon Emissions	Absolute, Electricity, Reduce, Resultant, Store	Savings
	Carbon Footprint	Our, Group's, Total	Reduction, Study
	Carbon Tax	National, Proposed	Legislation

Figure 5-2 shows the contribution of the SRI Index and non-SRI Index companies to the total frequency for the keywords “carbon emissions”, “carbon footprint” and “carbon tax”. Companies in the SRI Index and companies in the non-SRI Index mentioned the keyword “carbon emissions” equally with a 50:50 split in the contribution. For the keyword “carbon footprint”, companies not included in the SRI Index contributed 59% to the total frequency with the remaining 41% contribution coming from companies in the SRI Index. With regards to “carbon tax”, companies in the SRI Index had the highest contribution at 69% compared with the 31% contribution from companies not included in the SRI Index.

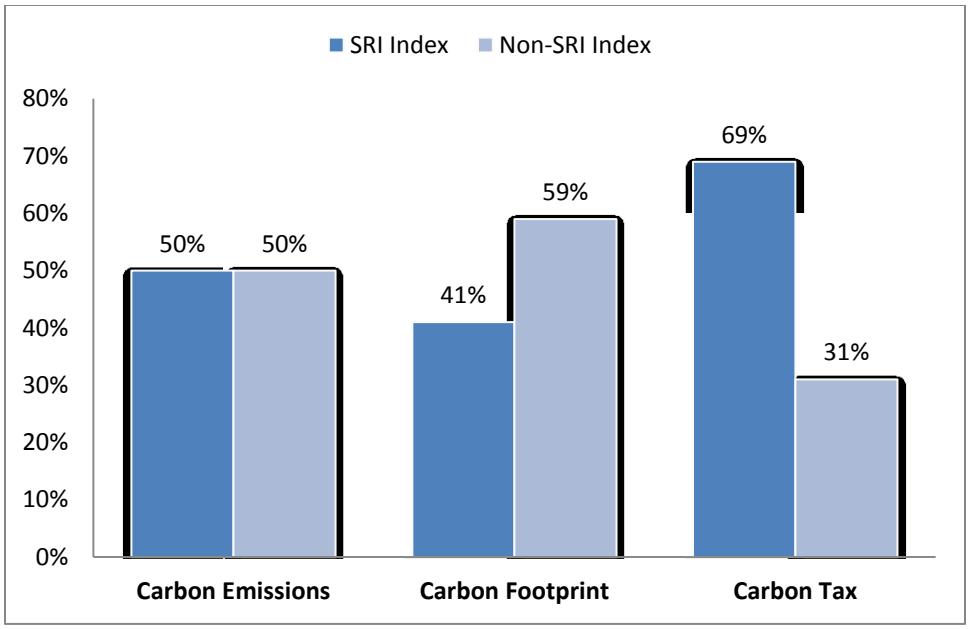

Figure 5-2: SRI Index and Non-SRI Index Contribution to Carbon Emissions, Carbon Footprint and Carbon Tax

From this it is clear that the contributions of companies in the SRI Index and companies not included in the SRI Index differ for each of the keywords. The split in contributions of 50:50 is unexpected as there are fewer companies included in the SRI Index. That being said, the greatest difference in contributions is for the keyword carbon tax and there is much room for improvement by companies not included in the SRI Index.

Table 5-13 displays the words mentioned most frequently before and after the keywords. With regards to the keyword "carbon emissions", all companies are providing an indication of their responsibility through the use of words such as our and group. Companies not included in the SRI Index emphasise the reduction in emissions and companies included in the SRI Index emphasise the importance of KPIs and the strategic implications of emissions on a business. Once again there are indications of responsibility with the use of the words group and our by all companies for the keyword "carbon footprint". SRI Index companies focus on improvement, reduction and reporting when it comes to carbon footprints and companies not included in the Index focus on assessment. This shows that all companies are aware of the need for measurement, management and disclosure of their carbon footprints. For the keyword "carbon tax", the focus of all companies is the same as they all use the word proposed before and the words legislation and policy after discussing the carbon tax. This proves that all companies are aware of

the impending tax and are following the legislation and policy changes suggested by the South African government.

Table 5-13: Common Words Preceding and Following Keywords by Index

Index	Keyword	Common Words Preceding	Common Words Following
SRI Index	Carbon Emissions	Specified, Absolute, Our	KPIs, Our, Strategic
	Carbon Footprint	Baseline, Curent, Our, Total	Associated, Improvement, Products, Reduction, Report
	Carbon Tax	Proposed	Legislation, Policy
Non-SRI Index	Carbon Emissions	Group, Reduce	Reduced
	Carbon Footprint	Group's, Our	Assessment
	Carbon Tax	Proposed	Legislation, Policy

From these results it is clear that companies are discussing important concepts relating to the implementation of the carbon tax in 2016. It is a sign that necessary changes are being discussed at the very least, which indicates a move in the right direction towards decarbonising supply chains. Although there is room for improvement, particularly for certain sectors' discussions of certain keywords, it would be beneficial to include the reports of privately owned companies and the remaining sectors of the JSE to support these findings.

5.4 "Readiness" Index for the 2016 Carbon Tax

The final objective for this study is to determine the "readiness" for the 2016 carbon tax of JSE listed organisations in the selected sectors. The discussion for this objective is based on the findings of the previous two objectives, observations from the content analysis and information gathered from the literature review.

It appears that although a number of the supply chain and sustainability related keywords had significant differences in their mean frequencies, the keywords "carbon emissions", "carbon footprint" and "carbon tax" did not. The null hypotheses that there are no significant differences in these words between the selected sectors and between SRI Index and non-SRI Index companies were not rejected. This means that although companies are discussing these concepts and are preparing for the implementation of the carbon tax, the results from the statistical tests used in this study are not significant.

Based on the findings for the preparation efforts of South African organisations, it appears that companies in the Basic Materials sector are discussing the carbon tax more than companies in the other sectors; however, companies in the Industrials sector are discussing carbon emissions and carbon footprints more than companies in other sectors. Table 5-14 shows the total frequencies and number of companies for the keywords “carbon emissions”, “carbon footprint” and “carbon tax”.

Table 5-14: Total Frequency and Number of Companies for Carbon Emissions, Carbon Footprint and Carbon Tax

Keyword	Total Frequency	Total Number of Companies
Carbon Emissions	176	61
Carbon Footprint	285	83
Carbon Tax	115	34

It is clear that “carbon footprint” was the keyword mentioned most frequently and by the most companies. Over 50% of the companies included in the study discussed “carbon footprint”; however, only 22% discussed “carbon tax”. Clearly companies are aware of the impact of their emissions and carbon footprints; however, further information is necessary to determine whether they are ready for the implications of the carbon tax.

Table 5-15 shows the total frequencies for the carbon tax related keywords for each sector. It also shows the total weighted frequencies; the total frequencies for each of the carbon tax related keywords divided by the number of companies in each sector that mentioned the keywords.

Table 5-15: Total Frequency and Weighted Frequency by Sector for Carbon Tax Keywords

Sector	Total Frequency	Weighted Frequency
Basic Materials	185	2.972
Industrials	182	3.885
Consumer Goods	110	2.881
Retailers	99	3.104

Based on total frequency, the Basic Materials and Industrials sectors discuss carbon tax related concepts more than the Consumer Goods and Retail sectors. However, based on the weighted frequency, the Industrial sector discusses carbon tax related concepts more than any of the other sectors. The Industrials sector discussed “carbon emissions” and “carbon footprint” more frequently than the other

sectors most likely because of the scale of emissions of their operations. This is supported by the fact that the sector used words such as “lower” and “reducing” before these keywords.

When considering the qualitative content analysis results, the Basic Materials sector mentions legislation and policy changes frequently when discussing the carbon tax. Many companies discuss their strategic objectives with regards to reducing their emissions and discuss the implications of the tax on their bottom line. They understand that the tax places additional financial risk on their operations. Some companies feel that the tax will be particularly harsh for the manufacturing industry. The Basic Materials sector appears to understand the increased pressure the tax will place on organisations and discuss other potential environmental taxes for the future. The Industrials sector also discusses legislation and policy changes and mention ongoing collaboration with the South African government. Companies discuss the need for strategic plans and partnerships and the need to monitor their emissions so that the financial implications of the tax can be minimised. The financial and environmental risk associated with the tax is discussed and it appears that companies understand that climate change related risks will remain significant in the future. Companies in the Consumer Goods sector discuss the need to monitor and reduce their emissions to mitigate the effects of the carbon tax. Companies discuss the need for energy efficiency and reducing resource consumption and it appears that they understand the significance of climate change and its implications on manufacturing organisations. Ultimately the carbon tax is not discussed by many companies in the Consumer Goods sector and is only mentioned three times in their sustainability and integrated annual reports. The Retail sector discusses the carbon tax in relation to changing legislation and the collaborative nature of the government’s planned tax implementation. Retail companies also mention the effects of volatile energy and electricity prices, which in conjunction with the tax place increased financial strain on their operations. To further support this, companies are discussing the effect of the tax on operational costs and this has encouraged their plans to perform accurate emissions calculations and the resulting carbon tax estimates. These companies appear to understand that the tax could have a critical impact on their financial bottom line; however, the tax is not discussed frequently in conjunction with emissions, costs and risk reduction strategies.

Ultimately, it appears that companies in all sectors are discussing carbon emissions and the impending carbon tax and many have begun preparing for the tax by adjusting their plans, strategies and operations. With regards to the overall level of “readiness”, it seems that some companies are more ready for the tax than others. Based on the results of this study and information gathered in the

literature review, it appears that companies in the Basic Materials sector are the most ready for the impending carbon tax. There are also many companies in the Industrials sector that appear to be ready for the tax; however, the "readiness" of companies in the Consumer Goods and Retail sectors needs improvement.

Although the results show that all of the sectors included in the study discuss all of the carbon tax related concepts, the Basic Materials and Industrials sectors discuss these concepts in greater detail and more frequently compared to the Consumer Goods and Retail sectors. This finding is emphasized by the fact that the Basic Materials and Industrials sectors had significantly higher mean frequencies for the sustainability related keywords that had p-values less than 0.05. It is interesting to note that in Table 3-2, the mean disclosure scores for the JSE sectors included in this study have a similar ranking to the findings stated here. Table 3-2 shows that the JSE 100 Energy & Materials sector had a mean disclosure score of 90 and the Industrials sector had a mean disclosure score of 83. The Consumer Goods and Consumer Services (including retail companies) sectors had mean disclosure scores of 80 and 74 respectively. Although the mean disclosure scores for the JSE 100 represent different information, the disclosure scores would include discussions on topics such as supply chain, sustainability and carbon emissions. It is understandable that the Basic Materials sector is more prepared for the impending carbon tax given that these companies have different and more stringent listing requirements than companies operating in the Industrials, Consumer Goods or Retail sectors, particularly with regards to environmental impacts and sustainability.

5.5 Conclusion

With regards to investigating the supply chain sustainability reporting practices of organisations listed on the JSE, the results show that companies in the Basic Materials, Industrials, Consumer Goods and Retail sectors all discuss supply chain and sustainability concepts in their sustainability and integrated annual reports. The supply chain related keywords mentioned most frequently were logistics and procurement and the sustainability related keywords mentioned most frequently were energy and sustainability. The results of the Kruskal-Wallis test (used to determine whether there are significant differences in the supply chain sustainability reporting practices between the sectors) showed that three supply chain related keywords had significant p-values, namely; procurement, sourcing and supply chain. In addition, there were three sustainability related keywords that had significant p-values, namely; energy, Global Reporting Initiative and ISO. The Kruskal-Wallis test also showed that the Consumer Goods and Retail sectors have significantly higher mean frequencies than the Basic Materials

and Industrials sectors for supply chain related keywords. However, the Basic Materials and Industrials sectors have significantly higher mean frequencies than the Retail industry for sustainability related keywords. The results of the Mann-Whitney U test (used to determine whether there are significant differences in the supply chain sustainability reporting practices between SRI Index and non-SRI Index companies) showed that three supply chain related keywords had significant p-values, namely; procurement, recycling and supply chain. In addition, there were three sustainability related keywords that had significant p-values, namely; energy, environmental management and sustainability. Companies that are constituents of the SRI Index had significantly higher mean frequencies for these keywords than companies that are not.

With regards to the investigation of the preparation efforts of South African organisations for the 2016 carbon tax, it appears that many companies understand the strategic significance of the tax and have begun taking necessary actions to minimise the impact of the tax on their financial bottom line. Companies have started measuring their emissions and have begun emissions reduction programs which will mitigate the financial risk associated with the tax. These steps will also ensure that these organisations are reducing the negative impact of their operations on the environment. It appears that companies in all of the sectors included in the study discuss concepts such as carbon emissions, carbon footprint and carbon tax in their sustainability and integrated annual reports. It seems that the majority of companies have begun preparing for the carbon tax; however, there is room for improvement.

With regards to the “readiness” of JSE listed organisations for the carbon tax, the results of this study in conjunction with findings from the literature review show that some organisations are more ready than others and the same is true for the sectors included in this study. Ultimately, it appears that the Basic Materials and Industrials sectors are more prepared than the Consumer Goods and Retail sectors. All of the sectors discuss carbon tax related concepts and are implementing changes to their current practices to adapt to the new tax regime. Although some companies have taken greater strategic and operational steps to deal with the consequences of the tax than others, all South African organisations could increase their efforts to reduce their emissions, encourage sustainable development and ensure that their supply chains are efficient and environmentally friendly.

Chapter 6: Conclusions and Recommendations

6.1 Introduction

This document has provided a thorough introduction to the study followed by an in-depth review of literature relating to supply chain sustainability and the South African context. The research design and methodology were detailed and the results were discussed with regards to the supply chain sustainability reporting practices of South African organisations, preparation efforts for the 2016 Carbon Tax and a "Readiness" Index for the 2016 Carbon Tax.

This chapter will present the conclusion of the paper based on the literature reviewed and the results that were discussed in Chapter 5. Section 6.2 will present the conclusions followed by recommendations for future research.

6.2 Conclusions

It is clear from the literature reviewed for this study that organisations around the world are aware of the need for sustainable development and environmentally friendly operations. The adoption of sustainable practices in organisations is driven by numerous internal forces such as improving efficiency, reducing costs and facilitating supply chain sustainability, in addition to external forces such as consumer pressure, rising fuel prices and changing legislation (World Economic Forum, 2009). Although organisations are aware of the importance of organisational sustainability they are in different stages of implementation. Some companies are in the beginning stages where they only implement sustainable practices due to legislation changes. Other companies embrace a holistic perspective that encompasses financial, social and environmental objectives in all decision making. South African companies are utilising international tools such as ISO standards and the GRI sustainability reporting guidelines, which facilitate the use of best practices and international standards.

The themes of sustainable development, corporate governance, corporate social responsibility and corporate sustainability are all interlinked and provide support structures for one another. South Africa is noted for its excellent corporate governance standards and the development of the King III report. The quality of corporate reporting in this country ensures that organisations consider stakeholder dialogue and transparency in their sustainability reporting practices to help ensure good corporate social responsibility. Value creation, human capital management and environmental management are also considered as part of corporate sustainability strategies. There are numerous financial and non-

financial benefits that outweigh associated costs as a result of incorporating corporate social responsibility and corporate sustainability into corporate strategies and operations.

Although the terms “green supply chain management” and “sustainable supply chain management” are often used interchangeably, green supply chain management falls under the scope of sustainable supply chain management. Sustainable supply chain management can be achieved regardless of the supply chain model or structure an organisation utilises. For the purposes of this study two supply chain models were described, namely; the SCOR Model and a generic supply chain model. Both of these models ultimately consist of the same practices, all of which can be made more efficient and environmentally friendly. Many supply chain decarbonisation opportunities are available from minor adjustments such as optimised networks, reverse logistics and recycling to major strategic changes such as energy efficient buildings and clean vehicle technologies. Organisations need to determine which decarbonisation opportunities are realistic given the scope of their operations and their available resources.

The South African government is committed to transforming to a low-carbon economy, which necessitates companies finding ways to decarbonise their supply chain activities. A carbon tax costing R120 per tonne of carbon dioxide equivalent is due to be implemented in 2016 as part of the national transformation. This tax could have significant financial implications on many organisations, particularly those that have energy intensive operations. The mining sector and other primary sectors which have traditionally formed the base of the economy are all energy intensive and must begin reducing the negative environmental impact of their operations as soon as possible. The JSE, the largest stock exchange on the African continent, has stringent listing requirements, which will facilitate listed companies in reducing their emissions. It is imperative that public companies set high standards with regards to the sustainability of their practices given the transparent and widely available nature of their reports and publications. Companies that are renowned for their social responsibility are included in the SRI Index, which investors use as an indication that organisations are considering the triple bottom line and not just profitability.

With regards to the investigation of the current supply chain sustainability reporting practices of JSE listed organisations, it is evident that the majority of the companies included in the sample mention supply chain and sustainability concepts in their sustainability and integrated annual reports. There were few significant differences in the supply chain sustainability reporting practices between the Basic Materials, Industrials, Consumer Goods and Retail sectors. There were also few significant differences in the supply chain sustainability reporting practices between SRI Index and non-SRI Index companies.

The most frequently mentioned supply chain concepts were logistics, procurement and supply chain, which is a positive indication that companies are considering the impact of their supply chains with a particular focus on sourcing and procurement practices. The Basic Materials sector mentioned inventory and procurement most frequently and did not mention reverse logistics at all. The Industrials sector mentioned logistics and packaging most frequently and also did not mention reverse logistics at all. The Consumer Goods sector mentioned procurement most frequently and did not mention remanufacturing and reverse logistics practices. Supply chain and inventory were the supply chain related keywords mentioned most frequently by the Retail sector; however, remanufacturing was not discussed in their reports. The most frequently mentioned sustainability related concepts were sustainability and energy. These keywords were mentioned more frequently than any other keyword included in the study.

Other keywords that were mentioned often included environmental management, GRI and ISO, which provides evidence that companies are considering international best practices and the effect of their operations on the environment. Energy and sustainability are the keywords mentioned most frequently by all of the sectors showing that there is consistency in the sustainability reporting practices of companies listed on the JSE. The Basic Materials and Industrials sectors included no discussion in their reports on sustainability metrics. The Industrials sector also included no discussion on environmental performance indicators and International Standard for Organisation. The Consumer Goods and Retail sectors included no discussion on ISO 14001 certification in their reports, and Retail companies did not mention GRI Guidelines, International Organisation for Standardisation, ISO 14000 and ISO 14001. Although energy and sustainability were mentioned most frequently, there was no significant difference in the mention of sustainability between the sectors.

The results of the Kruskal-Wallis test (used to determine whether there are significant differences in the supply chain sustainability reporting practices between the sectors) show that procurement, sourcing and supply chain were the supply chain related keywords that had significant p-values. The sustainability related keywords that had significant p-values include energy, Global Reporting Initiative and ISO. The Consumer Goods and Retail sectors had significantly higher mean frequencies than the Industrials and Basic Materials sectors for supply chain related concepts including supply chain, inventory, procurement and sourcing. The Basic Materials and Industrials sectors had significantly higher mean frequencies than the Consumer Goods and Retail sectors for the keywords energy and ISO.

With regards to the comparison between SRI Index and non-SRI Index companies, the supply chain related keywords mentioned least frequently are remanufacturing and reverse logistics. SRI Index

companies mentioned supply chain, logistics, packaging and procurement most frequently and non-SRI Index companies mentioned inventory, procurement and logistics most frequently. The sustainability related keywords mentioned most frequently are energy and sustainability. Companies in the SRI Index discuss every sustainability related keyword even though the frequencies are not always large. Companies not included in the SRI Index do not mention the keywords ISO 14001 certification and sustainability metrics at all.

The results of the Mann-Whitney U test (used to determine whether there are significant differences in the supply chain sustainability reporting practices between SRI Index and non-SRI Index companies) show that procurement, recycling and supply chain were the supply chain related keywords that had significant p-values. The sustainability related keywords that had significant p-values include energy, environmental management and sustainability. Companies included in the SRI Index had significantly higher mean frequencies than companies not included in the SRI Index for the keywords procurement, recycling, supply chain, energy, environmental management and sustainability.

It is important to note that although supply chain and sustainability concepts are being discussed in integrated annual and sustainability reports, there is limited discussion on a number of important sustainable supply chain concepts such as reverse logistics, remanufacturing and refurbishment. These practices can facilitate organisations in reducing emissions, mitigating negative environmental impacts and minimising costs. There was also limited discussion on crucial sustainability concepts such as environmental performance indicators, GRI Guidelines, ISO standards and sustainability frameworks and metrics. These concepts relate to international standards and best practices that South African organisations can use as a baseline from which to develop and improve sustainable operations.

With regards to the investigation of the preparation efforts for the impending carbon tax, it is clear that although companies in all sectors are discussing carbon tax related concepts, the discussions are relatively limited at this point. The Basic Materials and Industrials sectors have relatively high frequencies for the keywords carbon emissions, carbon footprint and carbon tax; however, the Consumer Goods and Retail sectors should increase their discussion of the carbon tax in particular. With regards to the SRI Index, the results show that there is room for improvement from all companies particularly with regards to discussions on carbon footprints and the impending carbon tax. The fact that companies are discussing reductions in their emissions, the strategic implications of the carbon tax and the changing legislation of the government provide evidence that South African organisations are preparing for the implications of the tax. There is still some cause for concern as organisations must

continue managing and reducing their carbon footprints and greenhouse gas emissions to mitigate the financial impact of the carbon tax and reduce the associated risk. South African organisations must increase their focus on sustainable supply chain practices, particularly given the instability of the current economic climate and the global shift towards sustainable development.

With regards to the "readiness" of JSE listed organisations for the carbon tax it appears that some organisations are more prepared than others. This finding holds true for the sectors included in this study. From the literature reviewed and the statistical results of this study, it appears that the Basic Materials and Industrials sectors are more prepared and therefore more ready compared to the Consumer Goods and Retail sectors. All of these sectors discuss the carbon tax, carbon emissions and carbon footprints in their sustainability and integrated annual reports by referring to changes in current practices to prepare for the tax by reducing emissions and ensuring the efficiency of their operations. Although some companies have made good progress in the reduction of their emissions and the disclosure of environmental performance, all South African organisations should increase their efforts to reduce their emissions, encourage sustainable development and ensure that their supply chains are efficient and environmentally friendly. This will facilitate their environmental and financial performance; crucial in the uncertainty of climate change, volatile energy prices and an unstable domestic economy.

6.3 Recommendations for Future Research

Further research on this topic is warranted to support and expand on the findings of this study. It would be beneficial to include all sectors of the economy to produce more generalizable results that could be used as a holistic indication of sustainable supply chain practices for the South African economy. That being said, the cooperation of privately owned companies is necessary to gather more data to achieve a significant number of observations in all sectors.

It is imperative to delve deeper into the findings of this study by including more keywords such as other relevant ISO standards to discover the full range of the discussion on supply chain practices and sustainability. It would also be beneficial to conduct this study over a number of years to determine the changes that have occurred particularly when policy changes such as implementing a carbon tax occur. Furthering the study through qualitative research in the form of in-depth interviews and focus groups with relevant industry members would provide detailed information on the exact nature of supply chain operations and the extent to which sustainable practices are implemented. Gaining further industry support in the form of participants in online questionnaires and surveys would provide additional details

from a larger sample of the population thus producing more generalizable results with higher levels of significance. With significant data collected over a number of years, further statistical analyses could be performed and patterns and areas in need of improvement could be more easily identified.

Given the relatively low level of discussion on concepts relating to carbon emissions and the impending implementation of the carbon tax in South Africa, further investigation into the preparation efforts of companies to reduce their emissions and carbon footprints and mitigate the financial impact of the tax is necessary. This can also be achieved by including more companies in the study, by including more sectors in the study and by including additional relevant keywords in the study. In-depth interviews and focus groups would also provide valuable details on the ways in which organisations are managing and measuring their environmental impacts and the ways in which they have incorporated the impending carbon tax into their organisational strategies.

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Appendix

Table 0-1: Supply Chain Strategy Best Practices

Best Practice	Explanation
Develop business case for environmental sustainability	Identify the drivers and benefits associated with environmental sustainability practices
Establish strategic orientation for sustainability	Plan for environmental sustainability and establish an organization vision, mission and values statement
Align objectives and strategies	Ensure that business and environmental sustainability strategies and objectives are aligned
Develop environmental sustainability culture	Obtain support from employees and develop a shared vision through communication and encouragement
Value-seeking approach	The organization actively seeks to create value through innovation and continuous improvement
Management commitment and support	Commitment from senior management and support from mid-level management for environmental sustainability
Sustainability information management	Ensure the collection, analysis and management of environmental sustainability information
Cross-functional cooperation	Ensure that all business functions cooperate for environmental sustainability improvements
Increase education and training of staff	Ensure that all staff receive relevant training and necessary education with regards to environmental sustainability
Hire and promote environmentally conscious staff	The organization seeks to build an environmentally conscious workforce through hiring and promoting appropriate staff
Measurement and reward systems linked to sustainability	Environmental sustainability metrics are utilized and rewards are linked with sustainability efforts and performance
Environmental management system exists	The organization has implemented an environmental management system (EMS)
ISO 14001 certification	The organisation's EMS is certified according to the ISO 14001 standard
Environmental compliance and auditing programs	The organization ensures compliance through the use of internal and independent external auditing services
Publicise environmental efforts and accomplishments	The organization ensures that the public is aware of current environmental sustainability efforts and accomplishments

Source: Murphy & Poist, 2000; Aronsson & Brodin, 2006; Srivastava, 2007; Lai, Sarkis & Zhu, 2008; Pagell & Wu, 2009 and Best, Chadee, Poole & Wiesner, 2010

Table 0-2: Supply Chain Design Best Practices

Best Practice	Explanation
Full supply chain involvement	All members of the supply chain are involved in the design of products, packaging and processes
Design for reducing hazardous materials	The use of hazardous materials should be minimized or eliminated from processes, packaging and products
Design for reusing products/ parts/ packaging	Products, packaging and processes should be designed in order to facilitate the reuse of products, parts and packaging
Design for recycling of product & packaging	Products, packaging and processes should be designed in order to facilitate the recycling of materials and parts
Design for remanufacturing & refurbishment	Products and processes should be designed in order to facilitate remanufacturing and refurbishment activities
Design for resource use efficiency & reduced consumption	Products, packaging and processes should be designed in order to maximize resource use efficiency and reduce consumption of energy, fuel and resources
Redesign logistical system components	Logistical system components should be redesigned in order to facilitate increased environmental efficiency
Environmentally-conscious design	The design of all products, packaging and processes should incorporate environmental sustainability
Life cycle analysis/ assessment	Life cycle analysis/ assessment (LCA) should be performed in order to understand the full impact of the product from the point of origin to the point of consumption

Source: Srivastava, 2007; Eltayeb & Zailani, 2009 and Kumar *et al*., 2011

Table 0-3: Sourcing Best Practices

Best Practice	Explanation
Early supplier involvement	Suppliers should be involved from the beginning of the planning phase in setting objectives and designing products, packaging and processes
Supplier cooperation for environmental objectives	Suppliers cooperate with downstream supply chain members in setting and achieving environmental sustainability objectives
Supplier development	Organizations should collaborate with suppliers to develop said suppliers with regards to environmental sustainability practices
Reduce supplier risk	Organizations should collaborate with suppliers to reduce environmental related risk and ensure supplier continuity

Best Practice	Explanation
Product content requirements	The requirements for product content with regards to the use of recycled and reused materials should be met
Product content constraints	The constraints for product content with regards to reducing and eliminating hazardous materials should be adhered to
Product content labelling	Products should be labelled to reflect the relevant emissions and recycled materials associated with the content
Supplier environmental management systems	Suppliers have implemented environmental management systems
Supplier EMS certification	Suppliers' environmental management systems have been certified according to the ISO 14001 standard
Auditing of supplier environmental performance	Suppliers' environmental performance undergoes independent external auditing
Reject suppliers who lack environmental concerns	Organizations do not source raw materials, component parts, products or packaging from suppliers who are not environmentally sustainable
Buy on total cost	Organizations should buy on total cost including environmental aspects rather than buying on price

Source: Murphy & Poist, 2000; Lai *et* al., 2008; Eltayeb & Zailani, 2009; Pagell & Wu, 2009 and Kumar *et al*., 2011

Table 0-4: Manufacturing Best Practices

Best Practice	Explanation
Lean manufacturing	Lean manufacturing processes such as just-in-time (JIT) should be employed in order to reduce waste
Total quality management (TQM)	Total quality management programs such as Six Sigma should be implemented in order to minimize defects and errors in production thus reducing product returns and waste
Continuous improvement	Continuous improvement (kaizen) practices should be maintained in order to review and correct environmental performance
Production during off-peak capacity	Production should occur during off-peak times in order to utilize available capacity most efficiently
Assess facility location	Facility locations should be assessed in order to determine where optimal locations are and whether current facilities can be moved to optimal locations

Best Practice	Explanation
Assess facility configuration & spatial layout	Facility configuration and spatial layout should be assessed in order to determine the optimal configuration and spatial layout to maximize efficiency and effectiveness
Review partnerships & technologies	Supply chain partnerships and current technologies should be reviewed in order to determine whether changes are necessary to facilitate environmental sustainability objectives
Optimal space utilization	The space utilization of production and warehousing facilities should be optimized in order to enhance efficiency throughout the supply chain
Reduced product handling	Product handling should be minimized in order to reduce product damage and product returns and utilize labour and equipment resources efficiently
Standardized equipment	Standardized equipment should be used where possible in order to minimize costs and facilitate supply chain efficiency
Cross-docking facilities	Unloading incoming shipments and placing cargo directly onto outgoing carriers will reduce time, storage, handling and labour costs facilitating supply chain efficiency
Minimize/ eliminate use of hazardous materials	The use of hazardous materials during production should be minimized to ensure consistency in meeting environmental sustainability objectives
Ensure resource use is efficient	Efficient use of resources and reduced consumption of resources will minimize waste throughout the supply chain and facilitate the meeting of environmental sustainability objectives

Source: Dunn & Wu, 1990; Murphy & Poist, 2000; Pagell & Wu, 2009 and Kumar *et al*., 2011

Table 0-5: Packaging Best Practices

Best Practice	Explanation
Reduce quantity of packaging materials	The overall quantity of packaging materials should be reduced in order to reduce waste throughout the supply chain
Utilize reused packaging material	Packaging materials should be reused where possible to reduce waste, lower emissions and costs and limit negative environmental impacts
Utilize recycled packaging material	Packaging materials should be recycled where possible to reduce waste, lower emissions and costs and limit negative environmental impacts
Reduce amount of air in packaging	The amount of air in packaging should be reduced to lower 'air miles' or the distribution of air in the supply chain

Best Practice	Explanation
Improve pallet configuration	Pallet configurations should be assessed and improved in order to facilitate reduced handling, reduce damages and optimize space utilization for warehousing and distribution
Package consolidation	Packages should be consolidated where possible in order to optimize space utilization for warehousing and distribution
Packaging postponement	Packaging postponement principles should be utilized where possible to ensure resources are used efficiently and limit product returns due to incorrect packaging and labeling
Track & trace systems for identification	Track and trace systems should be implemented to facilitate the identification of products throughout the supply chain

Source: Dunn & Wu, 1990; Aronsson & Brodin, 2006; Kumar *et al*., 2011 and Pålsson, 2014

Table 0-6: Distribution Best Practices

Best Practice	Explanation
Distribution network design	The distribution network should be designed so as to optimize distribution activities and maximize efficiency
Optimal vehicle routing	Vehicle routes should be designed to enhance optimal distribution and minimize total kilometres travelled
Efficient vehicle scheduling	Vehicle schedules should be organized to enhance optimal distribution and minimize the total number of trips required
Fleet & vehicle maintenance and disposal	Vehicles should be maintained and disposed of according to regulations to lower costs, lower the risk of accidents and facilitate environmental sustainability objectives
Minimize transport distance	Transport distance should be minimized in order to utilize resources efficiently, lower emissions and lower costs
Decrease transport speed	Transport speed should be reduced where possible to lower emissions; this can be achieved by using slower modes such as rail and water distribution modes
Travel routes with less congestion	Routes that have lower levels of congestion should be used where possible to minimize idle time, reduce costs and reduce emissions
Reduce vehicle idle time	Idle time should be reduced in order to optimize distribution efficiency and lower emissions
Freight consolidation	Freight should be consolidated in order to optimize space utilization and

Best Practice	Explanation
	minimize the number of trips that are necessary
Full truckloads	Full truckloads should be maintained (as opposed to less-than-full truckloads) in order to lower emissions by minimizing the number of trips that are necessary
Limit deadhead distribution	Deadhead distribution should be limited as vehicles carrying no freight are creating unnecessary costs and excess emissions
Use energy efficient vehicle technologies	Energy efficient vehicle technologies that should be considered and implemented include alternative and hybrid fuel sources such as biofuel
Transport mode selection	The selection of an appropriate transport mode should consider environmental sustainability aspects such as rail and water distribution having lower emissions when compared to road and air distribution
Transport carrier selection	The selection of an appropriate transport carrier should consider environmental sustainability aspects as different carrying companies will have different environmental objectives

Source: Dunn & Wu, 1990; Aronsson & Brodin, 2006; World Economic Forum, 2009 and Kumar *et al*., 2011

Table 0-7: Customer Service and Marketing Best Practices

Best Practice	Explanation
Customer cooperation for eco-design	Customers work with organizations to ensure product and packaging designs are environmentally conscious
Customer cooperation for cleaner production	Customers work with organizations to ensure production processes are cleaner and more environmentally sustainable through lower emissions and waste
Customer cooperation for green packaging	Customers work with organizations to ensure packaging materials are environmentally friendly and are reusable or recyclable to reduce waste and lower emissions
Integrated information systems	Customer information obtained through marketing services is integrated with supply chain information in order to reduce excess inventory and waste
Demand forecasting & sales predictions	Demand is accurately forecast and sales are predicted using the information shared by members of the supply chain in order to reduce product returns, excess inventory and waste

Source: Dunn & Wu, 1990 and Lai *et al*., 2008

Table 0-8: Reverse Logistics Best Practices

Best Practice	Explanation
Sale of excess inventory & materials	Recover investment in inventory and materials through the sale of excess inventory and materials
Sale of scrap & used materials	Recover investment in inventory and materials through the sale of scrap and used materials
Sale of excess equipment	Recover investment in equipment through the sale of excess and unused equipment
Closed loop supply chain	Ensure the supply chain is a closed loop by developing an effective reverse logistics system
Product, packaging & material recovery	The reverse logistics system should be designed to facilitate the recovery of products, packaging and related materials from consumers and retailers
Reusing packaging, products and materials	The reverse logistics system should be designed to facilitate the reuse of packaging, products and materials that have been recovered from consumers and retailers
Recycling packaging, products and materials	The reverse logistics system should be designed to facilitate the recycling of packaging, products and materials that have been recovered from consumers and retailers
Repairing packaging and products	The reverse logistics system should be designed to facilitate the repair of packaging and products that have been recovered from consumers and retailers
Refurbishing products	The reverse logistics system should be designed to facilitate the refurbishment of products that have been recovered from consumers and retailers
Remanufacturing products	The reverse logistics system should be designed to facilitate the remanufacturing of products that have been recovered from consumers and retailers
Disassembly of products	The reverse logistics system should be designed to facilitate the disassembly of products that have been recovered from consumers and retailers

Source: Dunn & Wu, 1990; Rogers & Tibben-Lembke, 2001; Aronsson & Brodin, 2006; Srivastava, 2007; Lai *et al*., 2008; Eltayeb & Zailani, 2009 and Pagell & Wu, 2009

Table 0-9: Waste Management Best Practices

Best Practice	Explanation
Source reduction	The use of energy and resources should be reduced from the source in order to limit waste throughout the supply chain
Pollution prevention	Pollution of all forms should be prevented as much as possible from the point of origin to the point of consumption in order to limit negative environmental impacts
Responsible disposal	Disposal of all materials especially hazardous materials must be done responsibly in order to limit negative environmental impacts
Noise emissions	Noise emissions should be limited throughout the supply chain in order to contribute to healthy surrounding environments
Carbon emissions	Carbon emissions (measured by carbon footprint analysis) must be reduced throughout the supply chain to limit negative environmental impacts
Air pollutant emissions	Air pollutants such as those containing harmful sulphur and nitrogen compounds must be reduced throughout the supply chain to limit negative environmental impacts
Liquid waste emissions	Liquid waste that is disposed of into open water or sewer systems must be reduced throughout the supply chain to limit negative environmental impacts
Solid waste emissions	Solid waste generated throughout the supply chain must be reduced to limit negative environmental impacts
% Recycled waste	The % of recycled waste relates to the % of solid waste that is recycled throughout the supply chain in order to enhance environmental sustainability efforts

Source: Murphy & Poist, 2000; Rogers & Tibben-Lembke, 2001; Srivastava, 2007 and Supply Chain Council, 2012