Evaluation of the current state of carbon disclosures of South Africa's largest listed entities

A research report submitted by

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I Abstract

This thesis has explored carbon reporting within integrated and sustainability reports of South African companies. In addition, this thesis has assessed if any significant differences exist in the quantity and quality of carbon disclosures between high and low carbon industries. Content analysis has been used to evaluate the nature and quality of carbon disclosures of 50 JSE-listed entities. This evaluation was performed using a comprehensive carbon disclosure checklist. In assessing the quality of disclosures, seven quality indices were developed: density, attribute, management orientation, integration, assurance, repetition and overall. To assess the differences between the high and low carbon industries, Mann-Whitney U tests were used.

The findings of this thesis suggest that carbon disclosures are ultimately used as a tool of impression management, rather than promoting accountability and substantive action. This thesis has found that high carbon industries report a significantly greater quantity and quality of carbon disclosures in integrated reports. This finding suggests that the high carbon industries respond to threats of legitimacy and credibility by increasing the quantity and quality of disclosures in their integrated reports. In addition, this thesis has found that high carbon entities potentially use external assurance to legitimise their GHG (Greenhouse gas) activities. This thesis would assist practitioners and legislators in understanding the current deficiencies in carbon reporting and develop responses to address such deficiencies.

II Acknowledgements

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Contents Page

Chapter 1: Introduction

Climate change has become one of the greatest threats to the sustainability of the planet (Ackerman & Stanton, 2008; CDP, 2017a; Citigroup, 2015; Intergovernmental Panel on Climate Change [IPCC], 2014a; Stern et al., 2006). According to the IPCC, in a period of just over a century, climate change has raised global temperatures on average by 0.85 degrees Celsius (IPCC, 2014b). Global temperature is expected to increase significantly in the decades to come if no substantial mitigating action is taken (Stern, 2006; IPCC, 2014a; IPCC, 2014b; Citigroup, 2015). This increase in global temperatures is attributable to the increase in anthropogenic greenhouse gas emissions (IPCC, 2014a). Corporations have emitted a significant portion of these emissions (Heede, 2014; IPCC, 2014b; CDP, 2017).

As a result, various forms of external stakeholder pressures have highlighted the need for organisations to remain accountable for their carbon footprint. This is seen through the recent Paris Agreement (United Nations, 2016), market-oriented emission trading, carbon taxes, and the need for organisations to maintain good customer relationships (Sarkis et al., 2010; National treasury, 2015; Braam et al., 2016; Bui and De Villiers, 2017).

The CDP (formerly the Carbon Disclosure Project) is an evidently clear representation of external stakeholder pressure. With the value of trillions of dollars of organisational assets at risk of being significantly impaired because of climate change (Stern, 2006; Ackerman and Stanton, 2008; CDP, 2016), investors have called for companies to disclose carbon related information through the CDP programme (CDP, 2016).

1.1 Statement of problem

Companies have attempted to disclose their carbon footprint in line with various generally accepted frameworks (Hrasky, 2011; Borghei et al., 2016; CDP, 2016). However, the prior research argues that such disclosures are often inadequately applied and subject to manipulation in pursuit of legitimacy (Solomon and Lewis, 2002; Jones, 2010; Hrasky, 2011; Atkins and Maroun, 2015; Cho et al., 2015a; Stent and Dowler, 2015). This weakness creates an incomplete perception of an enterprise and reduces the usefulness of non-financial disclosures (Atkins and Maroun, 2015; Michelon et al., 2015; Stent and Dowler, 2015; Haji and Hossain, 2016). This potential inadequacy in carbon disclosure is yet to be investigated in a South African context.

1.2 Purpose of paper and research questions

The purpose of this research is to explore the state of carbon reporting by large South African listed companies. This research deals with two sub-questions:

1. Is there a significant difference in the quantity of carbon reporting between high and low carbon industries?

2. Is there a significant difference in the quality of carbon reporting between high and low carbon industries?

1.3 Significance of the study

There is limited research on non-financial reporting which focuses on specific environmental issues in South Africa. This study is the first to assess the state of carbon reporting by South African companies and explore possible deficiencies in existing reporting practices. In a South African context this study is especially important considering the possible imposition of a carbon tax on corporate entities (National treasury, 2015).

Additionally, this paper has studied the quality of non-financial carbon disclosures being especially important since quality is rarely studied. This study has attempted to quantify the amount of repetition which exists within integrated and sustainability reports. This is a common concern with the current form of non-financial reporting (Solomon and Maroun, 2012; Atkins and Maroun, 2015; du Toit et al., 2017). To date this is one of very few studies which have attempted this and the first to attempt this in a South African context.

This study has also sought to apply legitimacy theory to how South African companies report on their carbon footprint. This study is relevant, given the interest shown in the environment by the accounting community (Georg and Justesen, 2017) and is also relevant to stakeholders interested in how large JSE (Johannesburg Stock Exchange) listed companies account for their carbon footprint.

1.4 Limitations and delimitations

- This research has a relatively small sample size of 50 companies. This is so because of the time-consuming nature of interpretive research. This sample size has limited the ability of the results being extrapolated. Nonetheless, this is in keeping with an interpretive tradition (Maroun and Jonker, 2014; Leedy and Ormrod, 2015).
- Larger companies tend to disclose more voluntary information (Cho et al., 2015b), the result of larger companies having greater economic resources at their disposal and more stakeholder scrutiny (Bowrin, 2013; Qiu et al., 2016). This has distorted the results of this study and may not provide a complete account of the state of carbon reporting for all South African companies (Raemaekers et al., 2016).
- Only stand-alone integrated, annual and sustainability reports (or equivalent reports) were assessed. This study has not assessed information on a company's website or additional reports provided by the company. In limiting the scope of this study to the

above reports this study may not provide a holistic view of all disclosures of the selected entities.

- Voluntary environmental disclosures are inherently biased because such disclosures are *voluntary* in nature (Deegan and Rankin, 1996; Andrea et al., 2015; Cho et al., 2015a; Braam et al., 2016). This raises the issue of a self-selection bias where a company *chooses* disclosures which promote a positive view of that company (Andrea et al., 2015). This bias has inherently swayed the results of this study as this study has not assessed the tone (positive, neutral and negative) of carbon disclosures.
- The data collection process required significant involvement and judgement from the researcher; so, the results of this study are subjective in nature. This is nonetheless an inherit characteristic of interpretive research (Creswell, 2009). This interpretive approach has detracted from the validity and reliability of this study in a positivist sense (Leedy and Ormrod, 2015). Nonetheless, this interpretive approach is more appropriate for assessing subjectively constructed reports (Carels et al., 2013) – see Section 1.5 for assumptions. Section 3.3 discusses the data collection processes.

1.5 Assumptions

- This paper assumes that accounting is a social construct influenced by societal and political influences (Hopwood, 1987; Carnegie and Napier, 1996; Ravenscroft and Williams, 2009; Maroun and Jonker, 2014). From this, this study presumes that an interpretive study is more appropriate (over a purely positivist study) in assessing carbon disclosures.
- The researcher has assumed that the nature of disclosures can be reliably assessed using existing disclosure frameworks based on prior academic and professional literature.
- The researcher has assumed that the quality indicators adapted from Michelon et al. (2015), Hrasky (2011) and those interpretively developed provide a fair indication of the quality of carbon reporting.
- The researcher has assumed that companies disclose information relating to their carbon footprint in a truthful and accurate manner.

1.6 Definition of terms/acronyms

Table 1: Definitions	
Anthropogenic	Carbon emissions which originate from human activity (Heede, 2014).
CDP	Formerly known as the Carbon Disclosure Project (GRI, 2016f).
GHG	Greenhouse Gas (carbon dioxide, methane, nitrous oxide and fluorinated gases) (IPCC, 2014b).
IASB	The International Accounting Standards Committee Board (Borghei et al., 2016).
IIRC	International Integrated Reporting Council (IIRC, 2013).
IPCC	The Intergovernmental Panel on Climate Change is an international body founded by the World Meteorological Organization and the United Nations Environment Programme (IPCC, 2014b).

Chapter 2: Literature review

2.1 Climate change and accounting

As indicated in Chapter 1, climate change has become one of the greatest threats to the sustainability of the planet (Ackerman & Stanton, 2008; CDP, 2017a; Citigroup, 2015; IPCC, 2014a; Stern et al., 2006). These threats include but are not limited to more severe droughts, floods, rising sea levels, mass extinction and significant global economic loss (Stern, 2006; IPCC, 2014b; IPCC, 2014a). The Stern Report (2006) estimates an annual global GDP loss of 5-20%.

To limit the impact of these exponentially growing environmental, societal and economic threats, there needs to be a significant and rapid reduction in global GHG emissions (Stern, 2006; Cadez and Guilding, 2017). Unfortunately, there has been relatively little *substantial* political and corporate action in enforcing policies in reducing carbon emissions (McCright and Dunlap, 2003; Hopwood, 2009). More so, public perception (in Europe and the U.S) of the importance of climate change has weakened over the last few years[1] (McCright and Dunlap, 2011; Scruggs and Benegal, 2012).

The perception of climate change can, however, be regenerated. Accounting can make aspects of an organisation's operations visible and, as a result, governable (Hopwood, 1987). The acknowledgement and understanding of an entity's carbon footprint can potentially lead

[1]The inauguration of US president, Donald Trump – a climate change denialist – is indicative of this changed perception.

to more environmentally friendly decision-making (Hopwood, 1987; Choi et al., 2013). In this regard, accounting can potentially serve as a catalyst in restoring accountability and promoting action to curb a company's carbon emissions (Hopwood, 1987; Hopwood, 2009; de Aguiar and Fearfull, 2010; Georg and Justesen, 2017). This is discussed in more detail in Section 2.2.

2.2 Accountability and non-financial accounting

2.2.1 Accounting for carbon emissions

Accountability is and has always been a core principle of accounting (Edwards, 1989; Ezzamel and Hoskin, 2002; Vollmers, 2009; Murphy et al., 2013). There has been a call for more information on and accountability concerning a company's carbon footprint (Sullivan and Gouldson, 2012; Choi et al., 2013; CDP, 2016; Griffin et al., 2016). With seemingly no support from the IASB to answer this call (Borghei et al., 2016), alternate accounting standards have emerged courtesy of the Global Reporting Initiative (GRI) (GRI, 2016a) and the International Integrated Reporting Council (IIRC, 2013).

From the IIRC comes the <IR> Framework (IIRC, 2013). The framework aids in the creation of an integrated report. This report is defined as:

> *… a concise communication about how an organization's strategy, governance, performance and prospects, in the context of its external environment, lead to the creation of value over the short, medium and long term*. (IIRC, 2013)

This integrated report would "integrate" an entity's financial and non-financial impact on its various forms of capital, providing useful information to a broader stakeholder group (IIRC, 2013; Maroun, 2017). To complement the IIRC reporting standard are the GRI Reporting Standards (GRI, 2016a). These standards provide guidance on how an entity can identify its material stakeholders and report on their social, environmental and economic impacts. Its GRI 305 Emissions standard is especially relevant in the context of carbon reporting (GRI, 2016e).

There are, nonetheless, various problems in the application of such standards. Firstly, there is no universally accepted means of applying the GRI guidelines and the IIRC's framework when preparing a sustainability or an integrated report. This has led to various companies inadequately applying the guidelines or adhering to a tick-box approach (Jones, 2010; Atkins and Maroun, 2015; Michelon et al., 2015). Secondly, because sustainability and integrated reporting is voluntary, companies choose *what* information to disclose (Cho et al., 2015a; Braam et al., 2016). A company can avoid disclosing information which would pose a risk to the reputation of such a company (Solomon and Lewis, 2002; Hopwood, 2009). Instead companies disclose one-sided carbon disclosures to enhance their environmental reputation

and legitimise their operations (Hopwood, 2009; Hrasky, 2011; Cho et al., 2015a; Michelon et al., 2015; Borghei et al., 2016).

2.2.2 Legitimacy theory

Suchman (1995) defines legitimacy as:

> *…a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions. (Suchman, 1995 pg.274)*.

An organisation seeks this legitimacy as it can create the perception that such an organisation is trustworthy, meaningful and credible in the eyes of society (Suchman, 1995). From this perception, societies would be more likely to supply resources to the organisation (Suchman, 1995; De Villiers et al., 2014). Without this legitimacy, an organisation would not be able to assimilate itself within society, leading to its failure (Suchman, 1995; Jones, 2010).

Prior academic literature has argued that sustainability disclosures have been used for the purpose of legitimisation and impression management. (Solomon and Lewis, 2002; Jones, 2010; Hrasky, 2011; Atkins and Maroun, 2015; Cho et al., 2015a; Stent and Dowler, 2015). Such disclosures would construct a narrative of sorts, which deflect, obscure or rationalise an entity's poor social or environmental performance (Hopwood, 2009; Cho et al., 2015a).

This façade would persuade stakeholders that an entity's negative externalities were justified or not necessarily as severe as perceived (Hopwood, 2009; Cho et al., 2015a). In this sense, sustainability disclosures cease to hold an entity accountable but promote its environmental reputation (Cho et al., 2015a; De Villiers et al., 2017). This misuse of sustainability disclosures would include the use of carbon disclosures, as a means of legitimising an entity (Hrasky, 2011; Qian and Schaltegger, 2017).

Ideally, accounting for carbon emissions would allow an entity to understand, manage and reduce its carbon emissions (Andrea et al., 2015). The disclosure of an entity's carbon emissions to the public can also lead to public pressure for better performance (Andrea et al., 2015). Unfortunately, the current form of carbon reporting has not led to any substantial improvements in a corporation's GHG activities (Andrea et al., 2015). A reason for the lack of emancipatory power of carbon disclosures could lie in the poor quality of such disclosures (Andrea et al., 2015). The quality of carbon disclosures is discussed in further detail in Section 2.3.2.

2.2.3 Carbon disclosures and industry: hypothesis development

As explained in Section 2.2.2, organisations would utilise corporate disclosures when faced with legitimacy issues (Hopwood, 2009; Hrasky, 2011). For instance Deegan and Gordon (1996) assert that an association exists between the quantity of environmental disclosures and the number of members in environmental lobbying groups. In addition to this, companies which operate in a more environmentally sensitive context would have quantitatively more environmental disclosures (Patten, 1992; Deegan and Gordon, 1996; Patten, 2002). The more adverse the environmental impact, the greater the number of environmental disclosures (Patten, 2002; De Villiers and van Staden, 2011; Breeda and Frank, 2015). One would, therefore, presume that high carbon industries would disclose a higher number of carbon disclosures, given their larger carbon footprint (Breeda and Frank, 2015).

RQ 1: Is there a significant difference in the quantity of carbon reporting between high and low carbon industries?

Prior research has produced mixed results on whether or not carbon intensive industries report a greater number of carbon disclosures (Hrasky, 2011; Borghei et al., 2016). Nonetheless, prior literature has neglected South African companies and, as part of this, does not consider the function of the integrated report.

As discussed in Section 2.2.2, conventional sustainability disclosures are, arguably, an example of impression management (Hopwood, 2009; Cho et al., 2015a; Michelon et al., 2015). This has resulted in a disconnect between sustainability reporting and performance (Cho et al., 2015a). Stakeholders cannot be continuously misled by large volumes of disclosure; they will eventually require better quality information which indicates performance. In this sense, providing a large quantity of disclosures may not be useful for managing legitimacy – companies would need to provide high quality disclosures to maintain legitimacy. As high carbon entities would be under more stakeholder scrutiny, such entities would provide higher quality carbon disclosures.

RQ 2: Is there a significant difference in the quality of carbon reporting between high and low carbon industries?

Prior research has measured the quality of carbon disclosures between industries to a limited degree (Hrasky, 2011; Borghei et al., 2016). Where prior research has produced mixed results on whether carbon intensive industries disclose higher quality carbon disclosures (Hrasky, 2011; Borghei et al., 2016). As with the quantity of disclosures, the prior research neglects South African companies and, as part of this, does not consider the use of the integrated report.

As of now, little is known about the current state of carbon reporting by South African companies. In order to gauge the extent of carbon reporting it is necessary to assess the quantity and quality of existing carbon reporting practices. For this purpose, Section 2.3 discusses the development of a comprehensive carbon reporting framework.

2.3 Data Instrument

The data instrument deals with the nature of disclosures (Section 2.3.1) and the quality of disclosures (Section 2.3.2).

2.3.1 Nature of data: Research question 1

For the researcher to assess the quantity of disclosure, the researcher would need to identify the way an entity can disclose its carbon footprint. Fortunately, prior professional and academic literature have prescribed a multitude of disclosure items an entity may follow with regards to their carbon footprint.

The GRI standards are internationally the most widely used sustainability standards (Dumay et al., 2010; Michelon et al., 2015; Borghei et al., 2016). GRI 305: Emissions[2] (GRI, 2016e) has been used extensively to develop the data instrument. Examples of key disclosure items of the GRI 305 include:

> *Gross direct (Scope 1) GHG emissions in metric tons of CO2 equivalent* (GRI, 2016e p. 7).
>
> *GHG emissions intensity ratio for the organization* (GRI, 2016e p. 13).
>
> *GHG emissions reduced as a direct result of reduction initiatives, in metric tons of CO2 equivalent* (GRI, 2016e p. 14).

Energy consumption is one of the greatest contributors to GHG emissions (Stern, 2006; IPCC, 2014b). It would be sensible to include indicators of energy consumption in the GHG disclosure checklist. The following disclosure indicators from *GRI 302: Energy* (GRI, 2016d) have been used to develop the checklist:

> *Total fuel consumption within the organization from non-renewable sources, in joules or multiples, and including fuel types used.* (GRI, 2016d p. 6).
>
> *Total fuel consumption within the organization from renewable sources, in joules or multiples, and including fuel types used.* (GRI, 2016d p. 6).

[2] A standard of the GRI 4 reporting guidelines.

> *Amount of reductions in energy consumption achieved as a direct result of conservation and efficiency initiatives, in joules or multiples.* (GRI, 2016d p. 11).

Additional disclosure items can be drawn from the International Integrated Reporting Framework (IIRC, 2013). The <IR> framework indicates that key risks or opportunities could stem from the external environment (IIRC, 2013), with climate change forming part of the external environment (IIRC, 2013; IPCC, 2014a) . According to the <IR> framework, an entity should disclose:

> *...the key risks and opportunities that are specific to the organization including those that relate to the organization's effects on, and the continued availability, quality and affordability of, relevant capitals in the short, medium and long term.* (IIRC, 2013 p. 27).

> An assessment of *the external environment, and risks and opportunities, with an analysis of how these could affect the achievement of strategic objectives* (IIRC, 2013 p. 29).

> The way *the organization's strategy identifies how it intends to mitigate or manage risks and maximize opportunities.* (IIRC, 2013 p. 14).

> *How the organization tailors its business model and strategy to respond to its external environment and the risks and opportunities it faces* (IIRC, 2013 p. 2).

In addition to the IR Framework, the *GRI 201: Economic Performance* (GRI, 2016c) prescribes additional risk disclosures specifically with regards to climate change. These are prescribed under GRI 201-2. All disclosure items of GRI 201-2 have been used to develop the data instrument. Examples of disclosure items under GRI 201-2 include:

> *A description of the risk or opportunity and its classification as either physical, regulatory, or other* (GRI, 2016c p. 9).

> *The financial implications of the risk or opportunity before action is taken* (GRI, 2016c p. 9).

The *GRI: 102 General Disclosures* also prescribes that *a reference to the external assurance report, statements, or opinions* should be disclosed (GRI, 2016b p. 41).

In addition to professional standards , Borghei et al. (2016) and Hrasky (2011) have identified disclosure items relating to a company's carbon footprint. Hrasky (2011) has identified the following themes:

> *Statements espousing commitment to and recognition of the importance of carbon footprints, global warming and climate change but not indicative of specific action or outcome* (Hrasky, 2011 p. 184).

> *Articulation of targets or objectives to be achieved in the future without associated action* (Hrasky, 2011 p. 184)
>
> *Statements indicating external recognition of positive efforts pertinent to carbon footprints, global warming and climate change* (Hrasky, 2011 p. 184).

Borghei et al. (2016) has identified the following items:

> *The total amount of direct and indirect GHG produced by a business is presented* (Borghei, 2016 p. 21).
>
> *The business disclosure of any information about the achievement of targets in a financial year* (Borghei, 2016 p. 22).
>
> *Disclosures on serious actions to tackle GHG* (Borghei, 2016 p. 23).
>
> *Disclosures on general actions to tackle GHG* (Borghei, 2016 p. 24).

Borghei et al. (2016) define serious actions as the use of new technolgies, carbon sequestration, purchase of carbon credits, etc. Whilst general actions would be defined as research sponsoring, employee training, employee incentives, etc (Borghei et al., 2016). This study used these categories as inspiration for the creation of two broad categories, being commited (derived from serious actions) and symbolic (derived from general actions) actions.

This study has defined symbolic actions as vague actions with no clear link to how such action can directly reduce an entity's GHG emissions. Symbolic actions would consist of initiatives, efficiency improvements alongside any other vague actions indicative of symbolic management (Michelon et al., 2015; Borghei et al., 2016; Georg and Justesen, 2017).

This study has defined committed actions as specific actions which have had or can have a specific outcome in reducing an entity's GHG emissions. Commited action would include the use of new technologies, use of renewable resources and other related actions indicative of behavioural mangament (Borghei et al., 2016).

All the sources described in this section were used to compile a comprehensive data instrument which has been used to analyse the quantity of carbon-related disclosures in annual, integrated and sustainability reports. The chosen method is discussed in Chapter 3. The broad themes of the data instrument are provided below (Table 2) and the complete data collection instrument is provided in Appendix: B.

Table 2: themes of data checklist	
A. Emissions	This includes disclosures relating to an entity's carbon emissions and how such emissions were calculated.
B. GHG intensity	This includes disclosures relating to an entity's GHG intensity ratios and the variables which make up such ratios.
C. Reduction of GHG	This includes the reduction of an entity's GHG emissions in totality or at an individual scope level from a predetermined baseline.
D. Assurance	This includes a disclosure relating to the assurance of an entity's GHG emissions.
E. Actions	This includes the disclosure of either symbolic or committed actions.
F. Energy	This includes the disclosures of an entities renewable fuels, non-renewable fuels, or energy reduction.
G. Integration	This includes any disclosures relating to a company's carbon footprint in relation to a company's risk assessment and/or strategy.
H. Targets	This includes any target set or achieved by a company in relation to its carbon emissions or energy consumption.

2.3.2 Quality of data: Research question 2

In assessing the quality of corporate disclosures, the researcher relies on seven quality indices. These indices were directly inspired by prior academic literature (Hrasky, 2011; Solomon and Maroun, 2012; Michelon et al., 2015) and around common perceptions of what constitutes high and low quality reporting. These indices consist of the density, attribute, management orientation, integration, assurance, repetition and overall index. These indices are summarised in Table 3 and are discussed below.

Table 3: Summary of quality indices		
Index	**Formula**	**Description**
Density	$\frac{1}{k_i}\sum_{j=1}^{k_i} CD_{ij}$	This index measures the dilution of carbon disclosures with a lower index indicative of a more "diluted" report, that lacks conciseness.
Attribute	$\frac{1}{3n_i}\sum_{j=1}^{k_i}(w * CD_{ij})$	This index measures the context of the carbon disclosures. Whether carbon disclosures are primarily quantitative,

Table 3: Summary of quality indices		
Index	**Formula**	**Description**
		qualitative or monetary in nature, with a low attribute index indicative of more qualitative disclosures, and a higher score indicative of more quantitative disclosures.
Management orientation	$\frac{1}{n_i}\sum_{j=1}^{k_i}(m * CD_{ij})$	This index scores the symbolic or substantive nature of a company's disclosures. A high index is indicative of more substantive disclosures and a low index indicates disclosures which are more symbolic in nature.
Integration	$\frac{x_i}{c}$	This is a basic measure of how well a company has integrated carbon disclosures in its reports. A high index would be indicative of a high level of integration within a company's report.
Assurance	a	This measures the level of assurance provided over a company's carbon disclosures. A higher index would be indicative of a higher level of assurance provided over a company's disclosures.
Repetition	$\frac{1}{n_i}\sum_{j=1}^{k_i} RCD_{ij}$	This measures the extent of repetition found within reports. A high index would be indicative of a higher level of repetition within a company's report.
Overall	$\frac{1}{4}(Density + Atrribute + Mangament\ orientation + Assurance\ + Integration - Repetition\ )$	The overall index measures the quality of reporting as a whole, being based on the above-mentioned indices. The higher the index, the greater the quality reporting.

[1] k is the total number of pages within a report.

[2] CD is equal to 1 if a carbon disclosure item is counted as per the data checklist.

[3] n is equal to the total number of disclosures counted as per the data checklist.

[4] w is equal to 1 if the disclosed item contained qualitative information, 2 if the disclosed item contained quantified information and 3 if the disclosed item contained monetary information.

[5] m is 0 if the disclosed item contained rhetorical information and 1 if the disclosed item contained committed information.

[6] x is the total number of categories an entity has disclosed carbon related data within as per the data checklist.

[7] c is equal to 36.

[8] a is equal to 0 if no assurance is provided, 0.5 if limited assurance is provided and 1 if reasonable assurance is provided.

[9] RCD is 1 where a disclosure can be categorised as per the data checklist *and* such disclosure item has previously been identified as per the checklist, it is zero otherwise.

Density index

A company should report in a manner which is concise, avoiding excessive and unnecessary detail (IIRC, 2013; GRI, 2016a). Diluting relevant information in long reports makes it harder for users to identify and appreciate the information found within such reports (Michelon et al., 2015). In addition to this, longer reports are generally associated with impression management (Atkins and Maroun, 2015).

From the above, a density index was derived, inspired primarily by Hrasky (2011) and Michelon et al. (2015). This index is the ratio between the total number of disclosures as per the data instrument over the total number of pages within a report (Hrasky, 2011). A high density index is indicative of a more concise report (Michelon et al., 2015). This index has a minimum range of zero (implying low quality) and an unlimited maximum value (indicating high quality). The density index is determined using the following formula:

$$Density = \frac{1}{k_i}\sum_{j=1}^{k_i} CD_{ij}$$

Where k_i is the number of pages found within the report of company *i,* CD_{ij} is 1 where disclosure item *j* for company *i* can be categorised as per the data checklist. CD_{ij} is, otherwise, 0 (Hrasky, 2011; Michelon et al., 2015).

Attribute Index

The attribute of the disclosure would measure the type of information disclosed. This index is a derivation of the *accuracy* index discussed by Michelon et al. (2015). This index assigned a score based on the context of the theme identified. The index scored disclosure items which are purely qualitative as 1, consisting of a quantitative element, as 2 and consisting of a monetary element as 3 (Wiseman, 1982; Botosan, 1997; Michelon et al., 2015). If a disclosure item consists of a mixture of any of the above three classifications, the disclosure item was

scored using the highest scoring classification. Additionally, the quantified and monetary amounts need to relate in some manner to an entity's operations.

A higher attribute index score is indicative of a company disclosing more quantitative and monetary information and higher quality reporting (Michelon et al., 2015; McNally et al., 2017). Quantitative information can meet the needs of investors better whilst monetary information can promote greater economic visibility (Sullivan and Gouldson, 2012; Pitrakkos, 2017). A lower index is indicative of more qualitative disclosures and lower quality reporting. This index has a minimum range of 0.33 (indicative of a wholly qualitative disclosures) with the maximum range being 1. The formula is as follows (Michelon et al., 2015):

$$Attribute \ = \frac{1}{3n_i} \sum_{j=1}^{k_i} (w * CD_{ij})$$

Where n_i is the total number of carbon disclosures found within the report of company *i*, CD_{ij} is 1 where the disclosure item *j* for company *i* can be categorised as per the data checklist, CD_{ij} is 0 otherwise. *w* is 1 if the disclosed item contained qualitative information, 2 if the disclosed item contained quantified information and 3 if the disclosed item contained monetary information (Michelon et al., 2015).

Management orientation index

The management orientation index has assessed if a company has taken a more symbolic or substantive stance towards disclosure relating to its carbon footprint. In this index, disclosures were categorised as "rhetorical" or "committed" disclosures (Borghei et al., 2016; Michelon et al., 2015).

According to Cho et al. (2015a) companies which have more "talk" about sustainability are less likely to disclose their actions relating to sustainability. This "talk" or "rhetoric" disclosure can exist to create a misleading perception of an organisation and its impact on the environment (Cho et al., 2015a; Michelon et al., 2015; Borghei et al., 2016). These rhetoric disclosures communicate generalised statements, not useful information, to users of the company's reports (Hopwood, 2009; Cho et al., 2015a; Michelon et al., 2015; Borghei et al., 2016). Therefore, such disclosures are associated with lower quality reporting. Rhetoric disclosures include disclosures relating to strategies, risks, policies, symbolic actions, context and expectations (Cho et al., 2015a; Michelon et al., 2015; Borghei et al., 2016).

In contrast, committed disclosures are more indicative of the underlying sustainability performance of a company (Hopwood, 2009; Michelon et al., 2015). These disclosures are more objective and able to meet stakeholder demand for information relating to environmental

performance (Andrea et al., 2015). This includes results, targets and committed actions concerning a company's carbon footprint (Michelon et al., 2015; Borghei et al., 2016). Such committed disclosures communicate information which is relevant to stakeholders and is associated with higher quality reporting.

All classifications in the disclosure checklist in Appendix B have been classified as either rhetorical or committed. A high management orientation index is indicative of a company disclosing more information with regards to its actions and results (Michelon et al., 2015). The index scored committed disclosures as 1 and rhetoric disclosures as 0 (Michelon et al., 2015). This index has a range between 0 and 1. Where values closer to 1 indicate that the report consists primarily of committed disclosures (implying higher quality). The formula for the management orientation index is as follows (Michelon et al., 2015):

$$Managment\ orientation\ = \frac{1}{n_i} \sum_{j=1}^{k_i} (m * CD_{ij})$$

Where n_i is the total number of carbon disclosures found within the report of company *i,* CD_{ij} is 1 where disclosure item *j* for company *i* can be categorised as per the data checklist, CD_{ij} is 0 otherwise. *m* is 0 if the disclosed item contained rhetorical information and 1 if the disclosed item contained committed information (Michelon et al., 2015).

Integration Index

Both the King IV code and Integrated Reporting Framework promote the ideal of *integrated thinking* (IIRC, 2013; Institute of Directors in Southern Africa, 2016):

> *Integrated thinking takes into account the connectivity and interdependencies between the range of factors that affect an organization's ability to create value over time* (IIRC, 2013 p.2).

This integrated thinking process consist of factors such as the organisation's effect on its various capitals, strategies and activities (IIRC, 2013). From this, it can be presumed that companies which have more complete carbon disclosures in terms of their strategies, results and activities would display a greater level of integrated disclosures.

Many reports are criticised for having incomplete disclosures (Andrea et al., 2015). So, as a basic measure of integration, this study relies on an integration index primarily inspired by Solomon and Maroun (2012). Using the number of categories an entity has disclosed information in, this study uses this as an indicator of the level of integration within a report.

This index is the ratio between the number of categories in which an entity has disclosed information over the total number of a categories per the data checklist. A high integration index is indicative of a high level of integration within a report (implying higher quality). Whilst a lower index is indicative of a lower level of integration. This index has a minimum value 0 with a maximum value of 1. The index is as follows:

$$Integration = \frac{x_i}{c}$$

Where x_i is the total number of categories in which an entity has disclosed carbon related data as per the data checklist for company *i* and c is the total number of categories as per the data checklist – being 36.

Assurance index

It has been established in prior literature that the audit function can improve the accuracy, reliability and completeness of non-financial disclosures (Marx and Dyk, 2011; Atkins and Maroun, 2015; Michelon et al., 2015; Braam et al., 2016; Cuadrado-Ballesteros et al., 2017). The IAASB prescribes guidance in obtaining reasonable or limited assurance about whether a GHG statement is free from material error (International Auditing and Assurance Standards Board, 2016).

The audit procedures performed of a reasonable assurance engagement are more strenuous in nature. For instance, such procedures involve test of controls, extensive analytical procedures and additional tests around the estimates of GHG emissions (International Auditing and Assurance Standards Board, 2016). It can be inferred that reasonable assurance would improve the reliability of GHG disclosures, compared to limited assurance. This sentiment is echoed by Cuadrado-Ballesteros et al. (2017) who have noted that when information is reasonably assured it can reduce the asymmetry amongst corporate disclosures (as noted as a limitation in Section 1.4).

From the above, an assurance index has been derived in which a higher level of assurance serves as a proxy of higher quality carbon disclosures. As discussed above, reasonable assurance can provide a greater level of assurance (compared to limited assurance) and has a greater weight than all other forms of assurance. This index has a minimum value of 0 (indicative of lower quality) and a maximum value of 1 (implying higher quality). The formula for the assurance index is as follows:

$$Assurance = a$$

Where *a* is 0 if no external assurance is provided over an entity's carbon emissions, 0.5 if limited assurance (or undefined external assurance) is provided and 1 if reasonable assurance is provided.

Repetition Index

It has been noted that excessive repetition exists within integrated reports (Solomon and Maroun, 2012; Atkins and Maroun, 2015; Raemaekers et al., 2016). The IIRC prescribes that such reports need to be concise (IIRC, 2013). To measure repetition, this report has derived a repetition index which indicates how many repeat disclosures are found within a report. A high repetition index is indicative of greater amounts of repetition found within a report (implying lower quality reporting). This index has a minimum range of 0 and a maximum range of 1. The formula for the repetition index is as follows:

$$Repetition\ = \frac{1}{n_i} \sum_{j=1}^{k_i} RCD_{ij}$$

Where n_i is the total number of carbon disclosures found within the report of company *i,* RCD_{ij} is 1 where disclosure item *j* for company *i* can be categorised as per the data checklist *and* such disclosure item has previously been identified as per the checklist, RCD_{ij} *is 0 otherwise*.

Overall quality index

To assess the quality of disclosures as a whole, this study has combined the six aforementioned indices into one combined index – the overall quality index. The overall quality index inspired by Michelon et al. (2015), is determined as follows:

$$\text{Quality} = \frac{1}{4}(Density\ Index + Attribute\ Index + Mangament\ orientation\ Index + Assurance\ Index + Integration\ Index - Repetition\ Index)$$

Chapter 3: Methodology

This chapter is structured as follows: Section 3.1 contains a brief overview of the method used in this study. Section 3.2 discusses the population and sample selected. Section 3.3 discusses how the research instrument was derived and used to address the research questions. Section 3.4 discusses the data analysis. Section 3.5 discusses how validity and reliability are ensured in this study.

3.1 Research paradigm

This study adopts an interpretive research approach. This requires significant judgement from the researcher as part of the data collection and analysis process (Creswell, 2009).

Nonetheless, given the incomparable and subjective nature of the current form of non-financial reporting (Carels et al., 2013; EY, 2015), an interpretative approach is an appropriate framework for assessing carbon disclosures (Hrasky, 2011; Breeda and Frank, 2015; Borghei et al., 2016). The methods used to address each research question are discussed below.

3.2 Population and sample

The integrated and sustainability reports (or equivalents[3]) from the JSE's largest listed companies have been examined. Integrated reports are selected as such reports are the primary form of communication to stakeholders (Rensburg and Botha, 2014; Atkins and Maroun, 2015). Sustainability reports have been selected for their concentration of sustainability related disclosures. South African companies have been chosen as South Africa is the perceived leader in integrated reporting (PwC, 2012; Rensburg and Botha, 2014). In addition, as discussed in Section 1.4, there is currently no prior research on how South African companies report on their carbon emissions.

Large companies have been selected, as large companies tend to disclose more voluntary environmental disclosures (De Villiers and Alexander, 2014; Romi and Longing, 2016). Only the 2016 reports were assessed as this study aims to explore the nature of carbon reporting at a single point in time. A detailed longitudinal analysis is deferred for future research (see Section 5.4).

The selected companies are grouped into high carbon and low carbon groups. The basic materials and industrials industries are carbon intensive (high carbon) (Bergmann et al., 2007; Hrasky, 2011; Borghei et al., 2016). The financials, healthcare, telecommunications and consumer goods/services industries are less carbon intensive (low carbon) (Hrasky, 2011; Borghei et al., 2016). The largest companies by market capitalisation per group have been selected[4]. There are, in total, 25 high carbon entities and 25 low carbon entities. These companies have been disclosed in Appendix A. The industries were aggregated into high and low carbon groups because of the insufficient number of companies within an industry. This is an inherent limitation which reflects the size of the South African capital market.

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[3] Such reports would need to be a downloadable document which was not fragmented. Additionally, GRI 4 checklist labeled as sustainability reports were not considered.

[4] There is bias in the selection of this sample as indicated in Section 1.4. However, the sample is selected as a result of smaller companies' potentially disclosing little to no carbon disclosures. In these cases, the researcher would not be able to obtain sufficient data limiting the study's exploratory potential.

The final sample size is consistent with comparable prior research (Hrasky, 2011; Borghei et al., 2016; Raemaekers et al., 2016). In addition, the relatively small sample size (compared with positivist studies) and purposive sampling reflects the exploratory nature of this study and is not a threat to validity and reliability (Merkl-Davies et al., 2011; Stent and Dowler, 2015; Mansoor and Maroun, 2016)[5].

3.3 Data collection

Content analysis has been used to collect data relating to carbon disclosures of a sample of JSE-listed companies. Content analysis is a research technique used to make valid inferences and to highlight trends or differences within texts (Krippendorff, 2013; Mansoor and Maroun, 2016). This has made it the most common method used for assessing and scoring the extent of social and environmental disclosures by both international (Wiseman, 1982; De Villiers and van Staden, 2011; Hrasky, 2011; Samkin et al., 2014; Borghei et al., 2016) and South African sustainability reporting research (Marx and Dyk, 2011; Solomon and Maroun, 2012; De Villiers et al., 2014; Mansoor and Maroun, 2016).

The coding scheme for the content analysis has been developed based on the guidance provided by Beattie et al. (2004) and Krippendorff (2013). The recording unit for this study is a phrase, clause or theme (Samkin et al., 2014; Mansoor and Maroun, 2016). A theme can be anything longer or shorter than a sentence but is not normally longer than a paragraph (Beattie et al., 2004).

The information identified in the reports have been codified into 36 mutually exclusive categories (as defined in Appendix B). These categories (found within the disclosure checklist) were developed interpretively following a similar approach to Merkl-Davies et al. (2011), Solomon and Maroun (2012) and de Aguiar and Fearfull (2010). Refer to Section 2.3.1 which discusses the different sources used to compile the carbon reporting checklist. The reliability and validity of the coding scheme is discussed in Section 3.5.

All data are collected from the integrated and sustainability reports of the companies listed in Appendix A. These reports have been downloaded from the websites of the respective companies listed in Appendix A. The data has been collected from the integrated and sustainability reports separately. Thereafter the data was collected from the integrated and

[5] As indicated in Section 1.4, the aim of this research is not to extrapolate results. This research aims to explore and highlight the nature and quality of carbon disclosures in integrated and sustainability reports.

sustainability reports collectively. The data collection process for research question 1 and 2 took place concurrently.

3.3.1 Research question 1: assessing the quantity of carbon disclosures

To complete the checklist in Appendix B, each report was reviewed to gain an outline and understanding of the key sections of the report (Carels et al., 2013; Mansoor and Maroun, 2016; Raemaekers et al., 2016). The reports were then analysed in detail by section to identify disclosure items which relate to the categories found within the checklist of Appendix B (Raemaekers et al., 2016). Where disclosure is located a score of 1 was assigned. Zero was awarded for non-disclosure.

The scores were tallied according to the disclosure categories for all 36 categories defined in Appendix B. This is similar to the approach taken by Raemaekers et al. (2016), Solomon and Maroun (2012) and Borghei et al. (2016). The data collection process involved a degree of subjectivity as the classification of the information into the various categories is subject to the researcher's judgement (as discussed in Section 3.1). The disclosure themes are, however, grounded in the prior literature and, at this point, only the presence or absence of disclosures is considered. This limits the extent of subjectivity in the data collection process.

The total points per category of the data checklist for each company have been aggregated in a spreadsheet. This data collection process was reviewed by an external third party to ensure accuracy and consistency (see Section 3.5 for more information with regards to the validity and reliability of the data collection process).

3.3.2 Research question 2: assessing the quality of carbon disclosures

Research question 2 deals with the quality of reporting. The same approach as used for research question 1 (Section 3.2.1) was followed. The reports were analysed on a line-by-line basis for the quality elements outlined in Section 2.3.2. The points allocated were determined as per Section 2.3.2 (see Table 3). The researcher has assessed and counted the number of repeat disclosures, qualitative disclosures, quantitative disclosures, monetary disclosures, committed disclosures, rhetoric disclosures and pages in each report (see Section 2.3.2 for more detail as to the definitions of these disclosures). The researcher recorded a brief description of the disclosures found to ensure repeat disclosures can be accurately counted. As with question 1, this data collection process was reviewed by an external third party to ensure the accuracy and consistency of the data collection process.

The total points for each category (as per the checklist) and dimension (i.e. quantitative, committed etc.) of data have been aggregated to a spreadsheet for each company. When collecting data from the integrated and sustainability reports collectively, the researcher

scored repetition across both reports. More so, the researcher identified and collected data on the type of assurance provided (none, internal, limited and reasonable) over an entity's carbon emissions.

3.4 Data analysis

The analysis of data, like the data collection process, was performed first for the integrated reports and then collectively for the sustainability and integrated reports. No separate analysis was performed on sustainability reports because there were only 32 separate sustainability reports issued by the companies selected. More so, no combined analysis was performed separately for the companies that issued sustainability reports given the relatively small number of companies[6].

3.4.1 Research question 1: analysis of quantity

The final score sheets were evaluated using descriptive statistics. The scores were assessed for each carbon intensity category and for all 50 selected companies in total. As the data was non-parametric (see Section 3.5), two Mann-Whitney U tests were used to determine if there is a significant difference in the quantity of carbon disclosures between high carbon and low carbon industries (Leedy and Ormrod, 2015). This was done for the integrated report scores and combined scores (scores which factor the sustainability reports). Essentially the Mann-Whitney U test has assessed whether the differences between the two groups has arisen out of chance (the null hypothesis) or as result of industry (the alternative hypothesis).

3.4.2 Research question 2: analysis of quality

The final score sheets for all dimensions of quality were evaluated using descriptive statistics. As the data for the quality of disclosures was non-parametric (see Section 3.5), Mann-Whitney U tests were used. 14 Mann-Whitney U tests were performed across the overall quality index and the various components of quality. This was done for the integrated report scores and combined scores.

3.5 Validity and reliability

The following validity and reliability considerations are relevant:

[6] There were 17 sustainability reports for low carbon entities and 15 for high carbon entities; given such a small number of reports, no separate analysis was performed. This has been added as an area for future research in Section 5.4 below.

- Grounding the data collection instrument in the academic and professional literature ensures the validity and reliability of the data instrument (Appendix B) (Creswell and Clark, 2011).
- A pilot study was performed on 20 companies from Appendix A (10 high carbon and 10 low carbon) to ensure the applicability of the data instrument (Creswell and Clark, 2011; Borghei et al., 2016; Raemaekers et al., 2016). This pilot study was used to collect data for the analysis of the quantity and quality of disclosures. From the pilot study adjustments were made to the disclosure checklist to ensure that it could be applied reliably and consistently.
- The data collection process was reviewed by an external third party. This would ensure some degree of consistency and objectivity in the data collection process.
- To use a t-test, the following three assumptions need to have been met: (1) no significant outliners exist in the data, (2) the variances between the data groups are equal and (3) the data is approximately normally distributed (Leedy and Ormrod, 2015; Soni et al., 2015; Raemaekers et al., 2016). A Kolmogorov-Smirnov and the Shapiro-Wilk tests were performed to assess the normality of the data. The distribution of the data compared to normality is shown in Appendix C. The results of the test indicated the data deviates significantly from normality for most of the data. As a result, only non-parametric testing was used for this thesis.
- The non-parametric equivalent of the t-test would be the Mann-Whitney U test (Huck, 2007; Leedy and Ormrod, 2015). This non-parametric test would also be more suitable for smaller sample sizes.
- The data was parametric for the integration and overall quality integrated reporting scores. In addition to this, the data was also parametric for the management orientation, integration, repetition, and overall combined scores. 6 additional t-tests were performed over the above data sets; where the results of the t-tests corroborated with the results of the Mann-Whitney U tests.

Chapter 4: Summary of results

Section 4.1 provides the results for the quantity of disclosures across the high and low carbon groups. Section 4.2 provides the results for the seven dimensions of quality identified in Section 2.3.2. Section 4.1 and 4.2 shows the results for both the integrated reporting scores and the combined scores (scores which factor the sustainability reports). Section 4.3 provides a summary of the empirical results and how such results answer the two research questions.

4.1 Quantity of disclosures

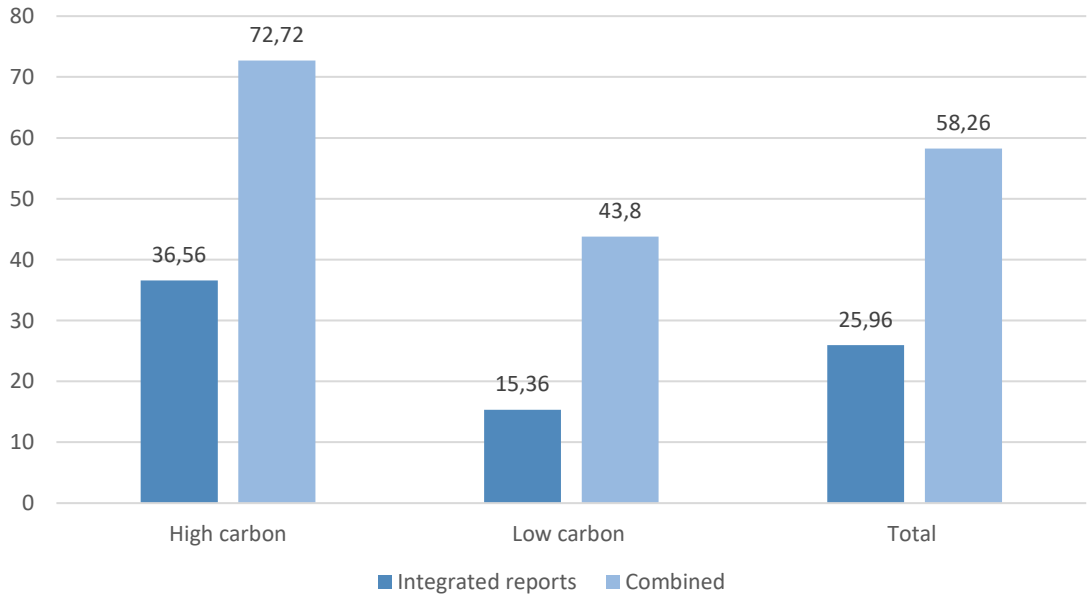
Tables 4 and 5 present the descriptive and inferential results for the integrated reporting and combined quantity scores for high carbon, low carbon and all sampled companies. Figure 1 presents the average quantity of disclosures for high carbon, low carbon and all sampled companies.

Table 4: Statistics for quantity of integrated reporting scores			
Integrated report	**High carbon**	**Low carbon**	**Total**
Mean	36.56	15.36	25.96
Median	28	12	17
Minimum	5	0	0
Maximum	108	45	108
Standard deviation	30.14	12.94	25.33
Significance (two tail)			**0.0056*** **

Table 5: Statistics for quantity of combined scores			
Combined	**High carbon**	**Low carbon**	**Total**
Mean	72.72	43.8	58.26
Median	59	43	43.5
Minimum	6	0	0
Maximum	209	173	209
Standard deviation	59.82	38.28	51.80
Significance (two tail)			**0.0952***

* Difference is significant at 10%
** Difference is significant at 5%
*** Difference is significant at 1%

Figure 1: Mean quantity scores



4.2 Quality of disclosures

Density

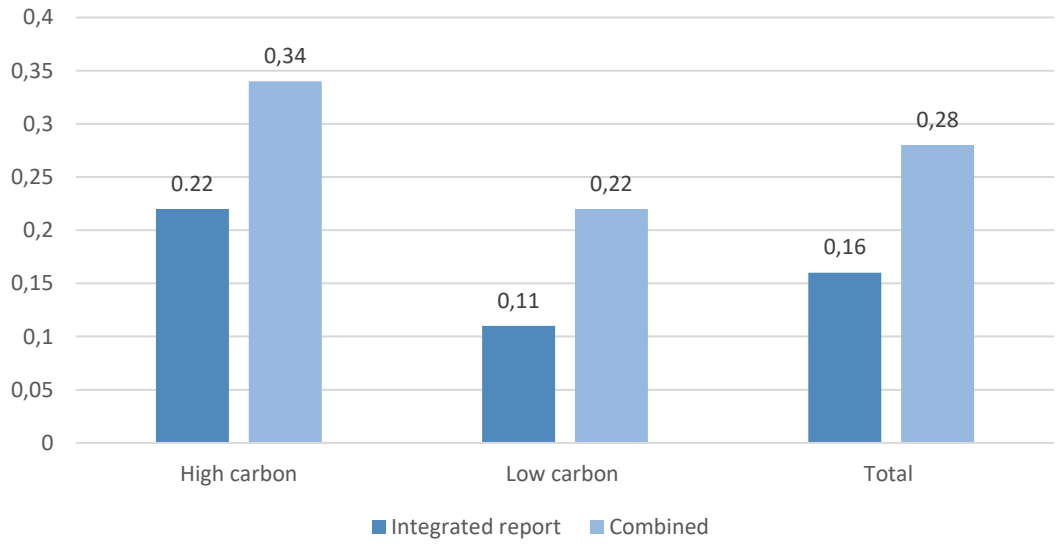
Tables 6 and 7 present the descriptive and inferential results for the integrated reporting and combined density scores for high carbon, low carbon and all sampled companies. Figure 2 presents the average density scores for high carbon, low carbon and all sampled companies.

Table 6: Statistics for density scores for integrated reports			
Integrated report	**High carbon**	**Low carbon**	**Total**
Mean	0.22	0.10	0.16
Median	0.19	0.08	0.11
Minimum	0.03	0	0
Maximum	0.80	0.32	0.80
Standard deviation	0.18	0.09	0.15
Significance (two tail)			**0.007*** **

Table 7: Statistics for density scores for combined scores			
Combined	**High carbon**	**Low carbon**	**Total**
Mean	0.34	0.22	0.28
Median	0.33	0.19	0.23
Minimum	0.03	0.00	0.00
Maximum	0.80	0.57	0.80
Standard deviation	0.22	0.17	0.20
Significance (two tail)			**0.061***

* Difference is significant at 10%
** Difference is significant at 5%
*** Difference is significant at 1%

Figure 2: Mean density index scores



Attribute

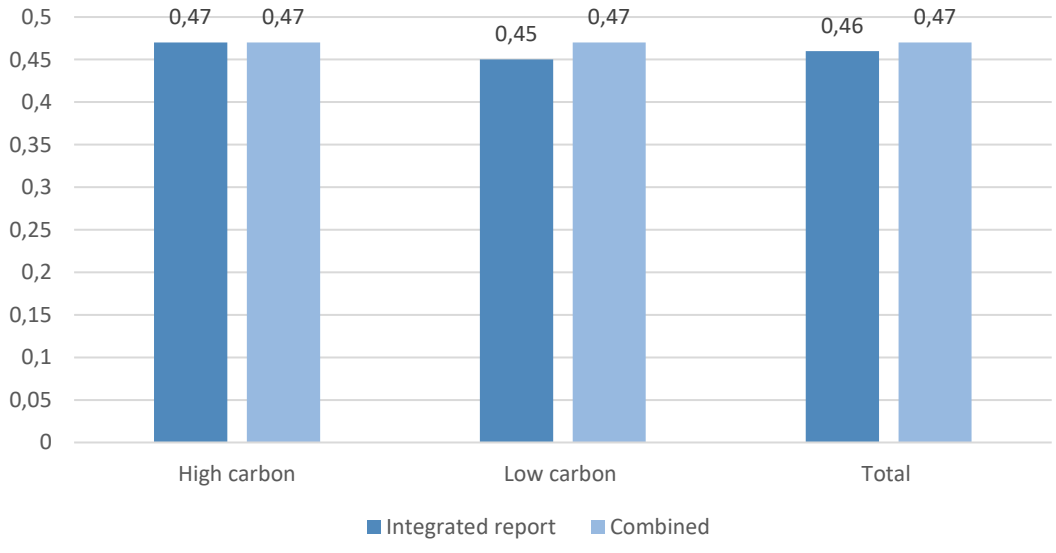
Tables 8 and 9 present the descriptive and inferential results for the integrated reporting and combined attribute scores for high carbon, low carbon and all sampled companies. Figure 3 presents the average attribute scores for high carbon, low carbon and all sampled companies.

Table 8: Statistics for attribute scores for integrated reports			
Integrated reports	**High carbon**	**Low carbon**	**Total**
Mean	0.47	0.45	0.46
Median	0.45	0.5	0.46
Minimum	0.38	0	0
Maximum	0.67	0.60	0.67
Standard deviation	0.08	0.13	0.11
Significance (two tail)			**0.961†**

Table 9: Statistics for attribute scores for combined scores			
Combined	**High carbon**	**Low carbon**	**Total**
Mean	0.47	0.47	0.47
Median	0.46	0.5	0.47
Minimum	0.38	0.00	0.00
Maximum	0.58	0.58	0.58
Standard deviation	0.05	0.12	0.09
Significance (two tail)			**0.143†**

† No significant difference found

Figure 3: Mean attributre scores



Management orientation

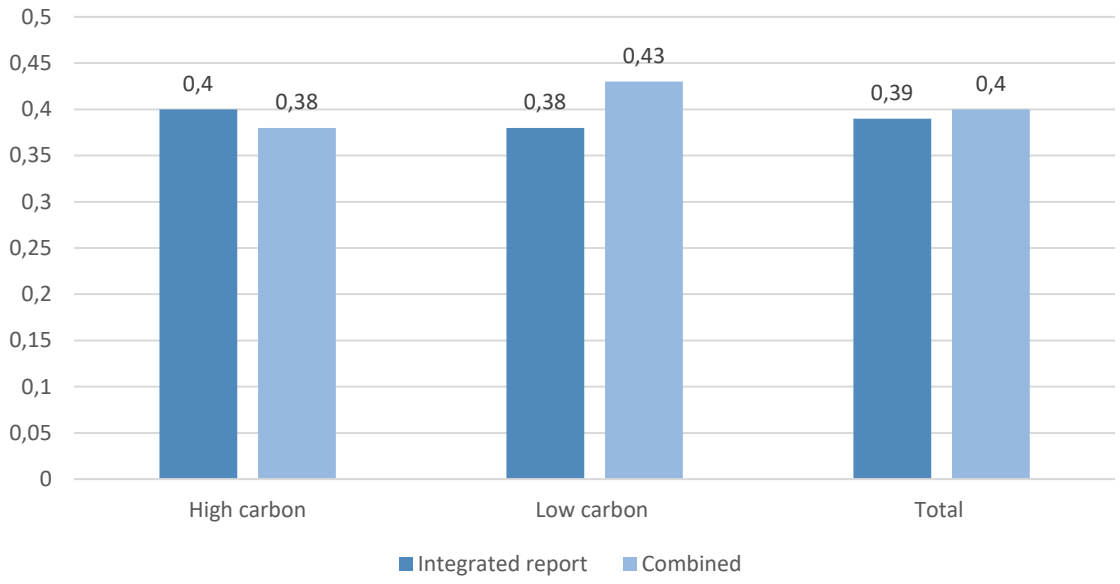
Tables 10 and 11 present the descriptive and inferential results for the integrated reporting and combined management orientation scores for high carbon, low carbon and all sampled companies. Figure 4 presents the average management orientation scores for high carbon, low carbon and all sampled companies.

Table 10: Statistics for management orientation scores for integrated reports			
Integrated report	**High carbon**	**Low carbon**	**Total**
Mean	0.40	0.38	0.39
Median	0.38	0.38	0.38
Minimum	0.13	0	0
Maximum	0.86	0.86	0.86
Standard deviation	0.20	0.26	0.23
Significance (two tail)			**1.000†**

Table 11: Statistics for management orientation scores for combined scores			
Combined	**High carbon**	**Low carbon**	**Total**
Mean	0.38	0.43	0.40
Median	0.39	0.41	0.40
Minimum	0.17	0.00	0.00
Maximum	0.59	0.77	0.77
Standard deviation	0.12	0.21	0.17
Significance (two tail)			**0.211†**

† No significant difference found

Figure 4: Mean management orientation scores



Integration

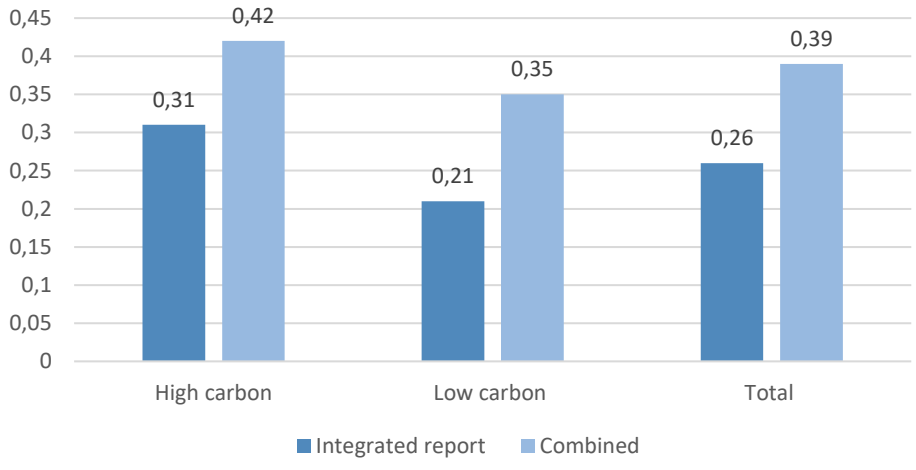
Tables 12 and 13 present the descriptive and inferential results for the integrated reporting and combined integration scores for high carbon, low carbon and all sampled companies. Figure 5 presents the average integration scores for high carbon, low carbon and all sampled companies. Appendix D provides the frequency of counts per carbon category as defined in Appendix B. Appendix D has this count for the integrated reporting and combined quantity scores per carbon category for high carbon, low carbon and all sampled companies.

Table 12: Statistics for integration scores for integrated reports			
Integrated report	**High carbon**	**Low carbon**	**Total**
Mean	0.31	0.21	0.26
Median	0.31	0.19	0.25
Minimum	0.08	0	0
Maximum	0.61	0.53	0.61
Standard deviation	0.15	0.14	0.23
Significance (two tail)			**0.017****

Table 13: Statistics for integration scores for combined scores			
Combined	**High carbon**	**Low carbon**	**Total**
Mean	0.42	0.35	0.39
Median	0.44	0.39	0.40
Minimum	0.08	0.00	0.00
Maximum	0.72	0.78	0.78
Standard deviation	0.18	0.19	0.19
Significance (two tail)			**0.214**†

* Difference is significant at 10%
** Difference is significant at 5%
† No significant difference found

Figure 5: Mean integration scores



Assurance

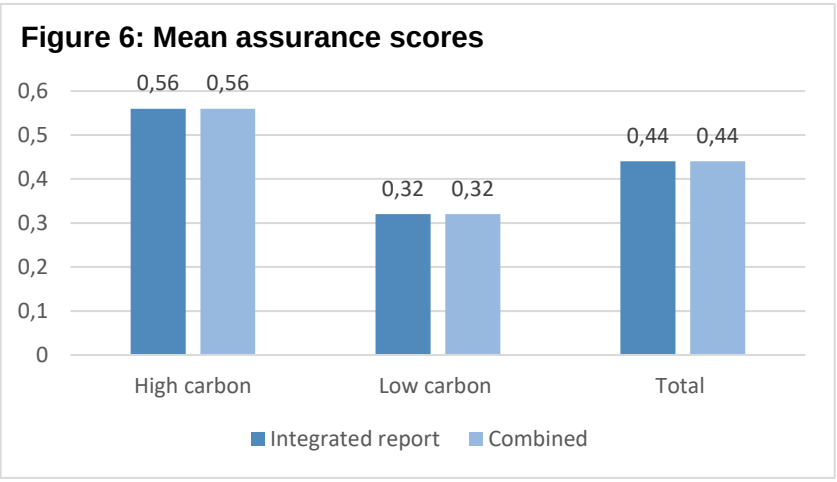
Tables 14 and 15 present the descriptive and inferential results for the integrated reporting and combined assurance scores for high carbon, low carbon and all sampled companies. Figure 6 presents the average assurance scores for high carbon, low carbon and all sampled companies.

Table 14: Statistics for assurance scores for integrated reports			
Integrated report	**High carbon**	**Low carbon**	**Total**
Mean	0.56	0.32	0.44
Median	0.50	0.50	0.50
Minimum	0.00	0	0
Maximum	1.00	0.50	1
Standard deviation	0.36	0.25	0.33
Significance (two tail)			**0.013****

Table 15: Statistics for assurance scores for combined scores[7]			
Combined	**High carbon**	**Low carbon**	**Total**
Mean	0.56	0.32	0.44
Median	0.50	0.50	0.50
Minimum	0.00	0	0
Maximum	1.00	0.50	1
Standard deviation	0.36	0.25	0.33
Significance (two tail)			**0.013****

* Difference is significant at 10%
** Difference is significant at 5%

Figure 6: Mean assurance scores



[7] Please note the assurance scores will remain the same across the integrated reporting and combined scores. This is the result of the score being determined based on whether or not an entity provides assurance over their emissions. This determination is not necessarily specific to either the integrated report or sustainability report – but rather scored separately from such reports. Also note assurance statements are scored separately (for the other indices) as part of the disclosure checklist in Appendix B if present in the integrated or sustainability report.

Repetition

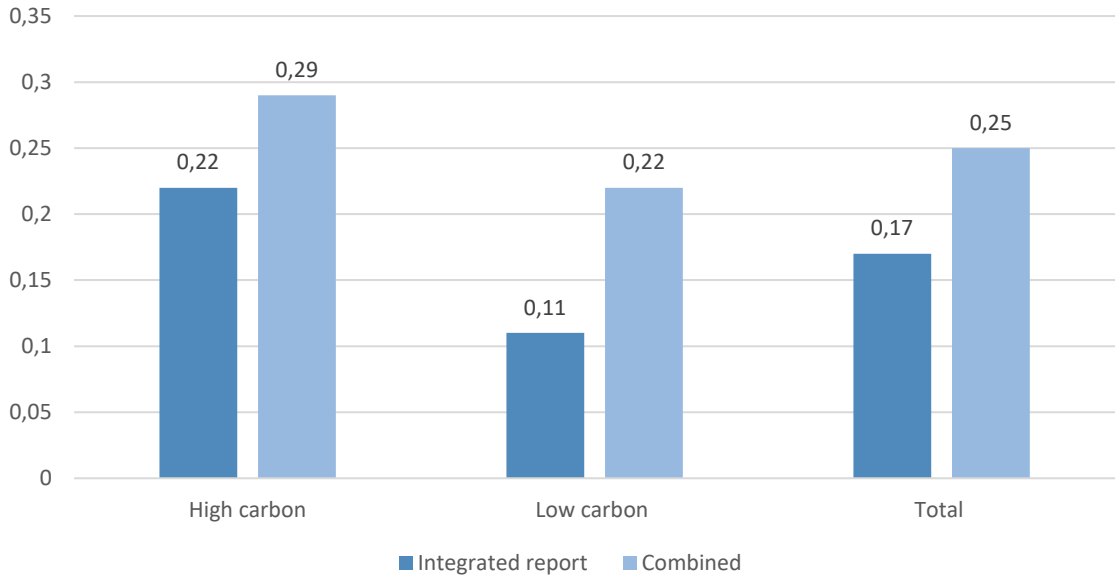
Tables 16 and 17 present the descriptive and inferential results for the integrated reporting and combined repetition scores for high carbon, low carbon and all sampled companies. Figure 7 presents the average repetition scores for high carbon, low carbon and all sampled companies.

Table 16: Statistics for repetition scores for integrated reports			
Integrated report	**High carbon**	**Low carbon**	**Total**
Mean	0.22	0.11	0.17
Median	0.23	0.11	0.17
Minimum	0.00	0	0
Maximum	0.38	0.31	0.38
Standard deviation	0.12	0.11	0.13
Significance (two tail)			**0.003*****

Table 17: Statistics for repetition scores for combined reports			
Combined	**High carbon**	**Low carbon**	**Total**
Mean	0.29	0.22	0.25
Median	0.29	0.23	0.27
Minimum	0.00	0.00	0.00
Maximum	0.57	0.49	0.57
Standard deviation	0.16	0.15	0.16
Significance (two tail)			**0.153**†

* Difference is significant at 10%
** Difference is significant at 5%
*** Difference is significant at 1%
† No significant difference found

Figure 7: Mean repetition scores



Overall Score

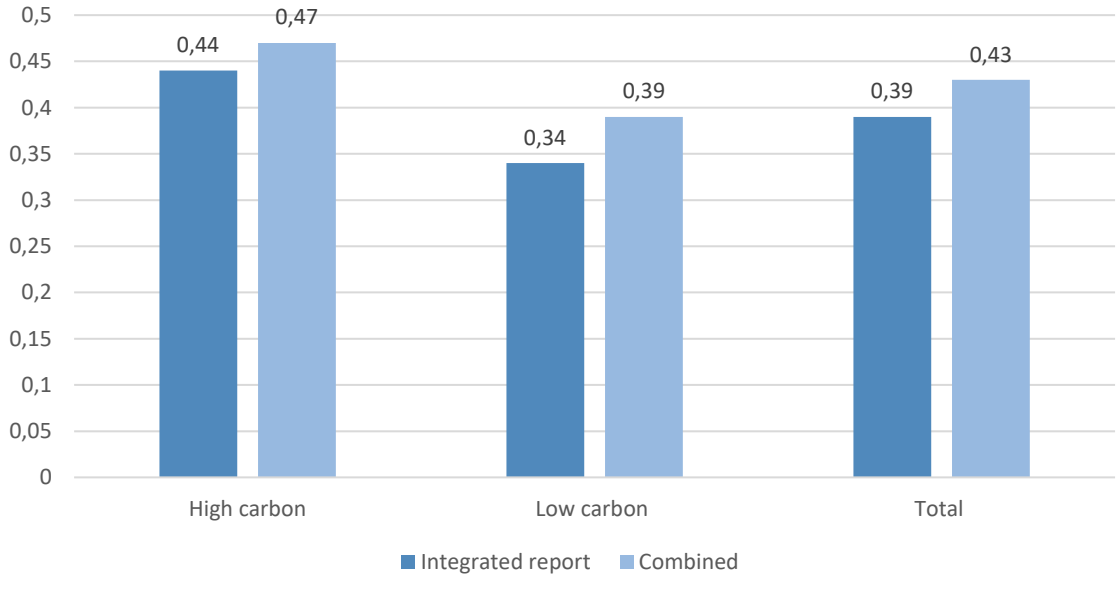
Tables 18 and 19 present the descriptive and inferential results for the integrated reporting and combined overall scores for high carbon, low carbon and all sampled companies. Figure 8 presents the average overall scores for high carbon, low carbon and all sampled companies.

Table 18: Statistics for overall scores for integrated reports			
Integrated report	**High carbon**	**Low carbon**	**Total**
Mean	0.44	0.34	0.39
Median	0.43	0.34	0.41
Minimum	0.08	0.00	0
Maximum	0.73	0.60	0.73
Standard deviation	0.16	0.15	0.16
Significance (two tail)			**0.037****

Table 19: Statistics for overall scores for combined scores			
Combined	**High carbon**	**Low carbon**	**Total**
Mean	0.47	0.39	0.43
Median	0.52	0.43	0.46
Minimum	0.08	0.00	0.00
Maximum	0.73	0.61	0.73
Standard deviation	0.17	0.15	0.16
Significance (two tail)			**0.128**†

* Difference is significant at 10%
** Difference is significant at 5%
† No significant difference found

Figure 8: Mean overall scores



4.3 Summary of results

Table 20: Mean disclosure scores for integrated report scores and significance levels				
	High carbon	**Low carbon**	**Total**	**Significance**
Quantity	36.56	15.36	25.96	**0.006*** **
Density	0.22	0.11	0.16	**0.007*** **
Attribute	0.47	0.45	0.46	0.961†
Management orientation	0.40	0.38	0.39	1.000†
Integration	0.31	0.21	0.26	**0.017** **
Assurance	0.56	0.32	0.44	**0.013** **
Repetition	0.22	0.11	0.17	**0.003*** **
Overall	0.44	0.34	0.39	**0.037** **

Table 21: Mean disclosure scores for combined scores and significance levels				
	High carbon	**Low carbon**	**Total**	**Significance**
Quantity	72.72	43.8	58.26	**0.095***
Density	0.34	0.22	0.28	**0.061***
Attribute	0.47	0.47	0.47	0.143†
Management orientation	0.38	0.43	0.40	0.211†
Integration	0.42	0.35	0.39	0.214†
Assurance	0.56	0.32	0.44	**0.013****
Repetition	0.29	0.22	0.25	0.153†
Overall	0.47	0.39	0.43	0.128†

* Difference is significant at 10%
** Difference is significant at 5%
*** Difference is significant at 1%
† No significant difference found

The first research question is:

> **RQ 1: Is there a significant difference in the quantity of carbon reporting between high and low carbon industries?**

A significant difference (at the 1% level) exists in the quantity of disclosures between the high and low carbon industries (p **0.0056 < 0.01**) in integrated reports (see Table 20). However, there is no significant difference in the quantity of disclosures between the high and low carbon

industries for the combined scores – only a marginal difference exists with a 10% alpha (p **0.0952 < 0.1**) (see Table 21).

The second research question is:

> **RQ 2: Is there a significant difference in the quality of carbon reporting between high and low carbon industries?**

A significant difference exists in the density, integration, assurance, repetition and overall quality dimensions between high and low carbon industries in integrated reports (see Table 20). No significant difference exists in all quality dimensions (except for assurance) between high and low carbon industries for the combined scores, (a marginal difference exists in the density dimension (p **0.061 < 0.1)** for the combined scores) (see Table 21).

4.4 Assessment of outliers

When assessing Tables 4 and 5, it is noted that the minimum score for low carbon companies is 0. The company that had scored 0 is RMH, this was followed by Sanlam and Steinhoff International which scored 2 (for the combined scores). Two of such companies were holding companies (RMH and Steinhoff). Regarding the high carbon entities, the company that scored five for the integrated reporting score was Impala Platinum. This company most likely had few carbon disclosures in their integrated report as a result of the company disclosing such items in their sustainability report - whereby the score had increased to 60 for the combined score.

The remaining low scoring companies for the high carbon combined scores were Imperial Holdings and KAP Industrial Holdings (with both companies scoring 6). With both companies also being holding companies. The above companies were kept in the samples selected given that the purpose of study was exploratory in nature. Whereby there was no established context as to what would constitute an outlier that is anomalous from the sample selected.

Nonetheless, such data may suggest that the nature of an entity's operations (i.e. a holding company) may possibly influence the quantity of carbon information reported by a company. Future academic research may investigate the difference in carbon reporting based on a more refined categoric split amongst the entities being assessed (rather than the more basic high and low carbon split).

Chapter 5: Analysis and conclusion

This chapter is structured as follows: Section 5.1 provides an analysis of the results. Section 5.2 discusses the implications of this study. Section 5.3 discusses the contributions made by this study. Section 5.4 discusses the limitations of this paper and the areas for future research.

5.1 Analysis

This section is structured as follows: Sections 5.1.1 discusses the differences between the disclosures of the two selected groups and the possible reasons for these differences. Section 5.1.2 discusses how assurance can be used to confer legitimacy to an entity's GHG activities. Section 5.1.3 discusses the quality dimensions and the underlying implications of such quality scores. Section 5.1.4 provides a summary of the key findings of this paper.

5.1.1 Carbon reporting, industry and legitimacy theory

As discussed in Section 2.2.1, there has been a call for information regarding a company's carbon footprint (Sullivan and Gouldson, 2012; Choi et al., 2013; Breeda and Frank, 2015; CDP, 2016; Griffin et al., 2016). Companies have clearly responded to this call as indicated in Table 20 which shows that the average number of carbon disclosures amounted to 25.96 items in integrated reports.

As discussed in Section 4.3, the quantity and quality of carbon disclosures differ within the primary report between the high and low carbon companies. High carbon companies had a significantly higher quantity and quality of carbon disclosures in their integrated reports (Table 20). These high carbon companies would face greater external pressures to provide such information (see Section 2.2.3). The findings reaffirm the results of the prior research which shows that, as environmental impact increases, companies face more scrutiny from stakeholders and increase the quantity and quality of their disclosures to respond to threats of legitimacy and credibility (Patten, 2002; Hopwood, 2009; Simnett et al., 2009; De Villiers and van Staden, 2011). In addition, the findings indicate that legitimacy theory holds true in a developing African context, where much prior research concerning legitimacy theory has taken place in Europe, America and Australia (Hopwood, 2009; Cho et al., 2015a; Michelon et al., 2015; Duff, 2017).

Differences in the quantity of reporting may also suggest that South African companies have attempted to apply the principle of materiality prescribed by the <IR> framework:

> *An integrated report should disclose information about matters that substantively affect the Organization's ability to create value over the short, medium and long term (IIRC, 2013 p.5)*

Firstly, when companies are in a high carbon industry, CO_2 emissions are more likely to be a material part of their environmental policy management than is the case for low carbon companies. In this context, high carbon emitters tend to report more information on their carbon emissions (on average) than other organisations do (Table 20).

Secondly, when disclosures in sustainability reports are considered (in addition to those provided in integrated reports), the average disclosures by high carbon emitters increased by

99% from 36.56 to 72.72 disclosure items (Figure 1, Section 4.1). The average low carbon disclosure score increased by *185%* from 15.36 to 43.8 disclosure items (Figure 1, Section 4.1). This indicates that low carbon entities tend to concentrate their carbon disclosures in alternate reports such as a sustainability report while high carbon producers tend to include their disclosures in the integrated report (which is the primary report to stakeholders). In other words, when carbon emissions are material (as is the case for high environmental impact industries) the disclosures are included in the primary (rather than secondary) report to stakeholders (see De Villiers and Alexander, 2014). This finding provides additional evidence on the relevance of legitimacy theory for understanding carbon reporting practices.

The fact that high carbon companies would focus their carbon disclosures in their primary report (the integrated report) is consistent with the findings of De Villiers and van Staden (2011). De Villiers and van Staden (2011) argue that firms would use their primary report to manage their legitimacy by signalling that they are taking issues included in the primary report seriously. As a result, the findings in this study show that sampled companies take cognisance of *where* information is communicated to maximise the potential of such disclosures enhancing or maintaining credibility.

5.1.2 Assuring carbon disclosures

It has been established that the assurance function can result in more accurate, reliable and complete disclosures (Marx and Dyk, 2011; Atkins and Maroun, 2015; Michelon et al., 2015; Braam et al., 2016; Cuadrado-Ballesteros et al., 2017; Green et al., 2017; Maroun, 2018). Given that the high carbon companies had both significantly higher assurance and integration scores (Table 20), there may be a link between assurance and the completeness of disclosures. In other words, assuring carbon emissions may lead to more complete and integrated carbon disclosures.

The significantly greater assurance scores (Table 20) also provide evidence of a legitimisation strategy used by high carbon companies. The audit function confers legitimacy on the subject matter of the audit engagement (Power, 2003; Robson et al., 2007; Maroun and Solomon, 2014). In the case of carbon reporting, high carbon emitters are under more scrutiny form stakeholders and are, therefore, more likely to have their carbon emissions assured. This may possibly act as a signal to stakeholders that such disclosures are reliable and that carbon reporting is being taken seriously (Simnett et al., 2009).

5.1.3 The facade

Finally, prior literature has argued that there is a disconnect between sustainability disclosures and sustainable management and decision making (Atkins et al., 2015; Cho et al., 2015a; De

Villiers et al., 2017). This “disconnect” between an entity’s actions and reporting is clearly shown by the low total average management orientation score of 0.39 (Table 20). This shows that on average, 61% of carbon-related disclosures were rhetorical and generic in nature. This indicates that, on average, the majority of disclosures provide little or no information on the underlying sustainability *performance* of an enterprise[8].

It is possible that this rhetoric-orientated reporting is used to sway stakeholders rather than to present neutral facts (Cho et al., 2015a; Michelon et al., 2015; De Villiers et al., 2017). In doing so, such disclosures are simply used as tools of impression management. (Solomon and Lewis, 2002; Jones, 2010; Hrasky, 2011; Atkins et al., 2015; Breeda and Frank, 2015; Cho et al., 2015a; Stent and Dowler, 2015)

The remaining quality dimensions reaffirm this disconnect between reporting and action. The average total attribute score of 0.46 indicates that most of an entity’s carbon disclosures are qualitative in nature[9] (Table 20). This suggests that South African companies do not have adequate systems and protocols to measure and report quantitative carbon information. With insufficient systems to measure carbon related information, it would be difficult to manage an entity’s GHG activities in any meaningful manner. This finding reaffirms the view of the prior literature that companies have difficulties defining and quantifying their sustainability disclosures (Solomon and Maroun, 2012; PwC, 2014; De Villiers et al., 2017; McNally et al., 2017).

The average total integration score of 0.26 (Table 20) indicates that the selected South African companies have not integrated their carbon disclosures throughout their primary reports[10]. Read with the average total attribute score of 0.46 (Table 20), the low integration score suggests that there are limited or superficial links to an entity’s risk assessment, strategies, actions and key performance indicators (McNally et al., 2017). The low integration score would also suggest that there is bias in the selection of carbon disclosures within integrated reports (noted as a limitation in Section 1.4).

This low level of integration would imply that South African companies do not internalise the relevance of carbon management in their core business model but see it only as an ancillary part of a business (Bui and De Villiers, 2017; McNally et al., 2017). Overall the individual quality indices suggest that carbon disclosures are ultimately used as tool to *manage*

[8] See Section 2.3.2 for description of management orientation index.
[9] See Section 2.3.2 for description of attribute index.
[10] See Section 2.3.2 for description of integration index.

stakeholder expectations rather than ensure accountability to stakeholders (De Villiers et al., 2017).

5.1.4 Key findings

The key findings are summarised in Table 22.

Table 22: Key findings	
1.	High carbon South African companies increase the quantity and quality of their carbon disclosures in their primary reports in response to threats to legitimacy. There may also be evidence to suggest South African companies adhere to the principle of materiality when preparing integrated reports (Section 5.1.1).
2.	South African companies take cognisance of where carbon disclosures are located to maximise the ability of such information legitimising such companies where South African companies would use the integrated report as the primary means to manage their legitimacy (Section 5.1.1).
3.	High carbon companies would use external assurance as a tool to legitimise their carbon footprint (Section 5.1.2).
4	Carbon disclosures are, however, used primarily as a tool for impression management rather than as a device for enhancing accountability and driving substantive action (Section 5.1.3).

5.2: Implications

The possibility of carbon reporting being used as a tool of impression management may highlight the need for additional and more prescriptive guidance on how to report on carbon emissions. It may also be necessary to legislate certain aspects of carbon-related reporting and support this with sanctions for non-compliance. The prior research argues that assurance of sustainability disclosures may be one way of improving the quality of information communicated to stakeholders (Simnett et al., 2009; Michelon et al., 2015). As a result, in addition to legislating carbon reporting, it may be useful to consider introducing mandatory assurance for high carbon sectors.

The need for assurance may be especially relevant if the findings reported in this thesis are used as an indicator of the extent to which companies have internalised the requirement to prepare a high quality report. South Africa is widely regarded as a leader of integrated reporting and listed companies have been preparing integrated reports since 2010 (Atkins & Maroun, 2015; Maroun, 2017). As a result, the low quality scores and possibility of impression management are surprising. They suggest that companies are either struggling to collect/interpret carbon related data and report on their carbon impact or are simply viewing

carbon reporting as an exercise in satisfying stakeholder expectations (see De Villiers et al., 2017; McNally et al., 2017; Naynar et al., 2018). Having mandatory assurance of these disclosures may be a possible solution for addressing these limitations.

Finally, the extent to which stakeholders are engaging with South African companies should be considered. The low quality scores may be the result of stakeholders failing to understand what information an integrated report should contain or not being proactive in demanding higher quality reporting. Unless stakeholders play an active role in holding companies accountable, low quality carbon reporting may continue notwithstanding South Africa's transition to integrated reporting.

5.3 Contributions

This thesis makes the following key contributions:

- The findings show that South African companies are affected by legitimacy considerations. Much of the prior research on legitimacy theory and how it impacts corporate reporting is based in an American, European or an Australasian setting (Cho et al., 2015a; Duff, 2017; Hopwood, 2009; Michelon et al., 2015). This thesis shows that the operationalisation of legitimacy theory in these jurisdictions applies equally in South Africa.
- Related closely to the above, the extent to which South African companies report on their carbon emissions has not been considered by the prior research. The international literature ignores South Africa (see Borghei et al., 2016; Breeda & Frank, 2015; Hrasky, 2011).
- The South African specific research has considered sustainability, corporate governance and integrated reporting in general (Solomon and Maroun, 2012; De Villiers and Alexander, 2014; De Villiers et al., 2014) but has not specifically dealt with carbon disclosures. As a result, this thesis makes an important empirical contribution.
- This thesis makes a valid practical contribution. Based largely on the work of Michelon et al. (2015), it outlines and describes the application of a measurement tool which can be used to gauge the quantity and *quality* of carbon disclosures. This tool can be applied in other areas of sustainability reporting research. It can also be used by regulators and other stakeholders interested in assessing the quality of corporate reporting.

5.4 Limitations and future research

The limitations and areas for future research of this thesis are as follows:

- The relatively small sample size of only large JSE-listed entities limits the ability of the results of this study being generalised across all corporate entities. As a result, future research can explore carbon reporting across different jurisdictions and examine if the quantity and quality differ.
- The small sample size for companies that had issued sustainability reports had limited this study's ability in performing a separate inferential statistical analysis on such companies. Future research may expand on this sample to allow such statistical analysis to be performed.
- The data presented in Appendix D provides the reader with more insight into the nature of how the sampled companies had disclosed their carbon related information. The data presented in this Appendix could assist future researchers in refining the data instrument used in this study.
- More so it prompts further analysis as to which carbon categories companies focus their disclosures within and which categories are either being ignored or underreported. Given the purpose of this study, this had not been investigated by the researcher. Nonetheless, this may be an area for future additional research.
- Future research may also consider a longitudinal analysis of carbon disclosures. This thesis only provides details on carbon reporting at a single point in time. Understanding how carbon reporting changes as South Africa's integrated reporting framework matures will provide an interesting avenue for additional research.
- The quality dimensions identified in Section 2.3.2 may have been influenced by the quantity of disclosures, swaying the results of the quality metrics. Also, these metrics may not provide a holistic account of all possibly quality dimensions. Future researchers should consider the need for more exploratory studies which examine how quality is understood and measured by different stakeholders.
- Related closely to the previous point, materiality should be taken into account. The quality index used in this thesis does not consider whether or not information included or excluded in an integrated report is material. As a result, as part of the process of evaluating how stakeholders understand quality, future researchers need to consider how materiality is defined and operationalised.

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Appendix A: Companies selected

	High carbon companies	**Industry**	**Market capitalisation in billions of Rands as at the 21st of July 2017**
1	Glencore plc	Basic materials	768,55
2	BHP Billiton plc	Basic materials	461,85
3	Anglo America plc	Basic materials	259,31
4	Sasol Ltd	Basic materials	239,66
5	South32 Ltd	Basic materials	149,72
6	Mondi plc	Basic materials	125,89
7	Remgro Ltd	Industrials	113,36
8	Anglo American Platinum Ltd	Basic materials	84,01
9	The Bidvest Group Ltd	Industrials	56,55
10	Kumba Iron Ore Ltd	Basic materials	56,36
11	Sappi Ltd	Basic materials	51,12
12	AngloGold Ashanti Ltd	Basic materials	50,97
13	Gold Fields Ltd	Basic materials	40,05
14	Imperial Holdings Ltd	Industrials	36
15	Sibanye Gold Ltd	Basic materials	32,57
16	Exxaro Resources Ltd	Basic materials	31,93
17	Assore Ltd	Basic materials	27,71
18	Impala Platinum Holdings Ltd	Basic materials	27,08
19	Barloworld Ltd	Industrials	24,46
20	Northam Platinum Ltd	Basic materials	21,26
21	KAP Industrial Holdings	Industrials	20,82
22	African Rainbow Minerals	Basic materials	18,4
23	Reunert Ltd	Industrials	13,75
24	AECI Ltd	Basic materials	13,36
25	Nampak Ltd	Industrials	13,24
	Low carbon companies	**Industry**	**Market capitalisation in billions of Rands as at the 21st of July 2017**
1	Anheuser-Busch InBev SA NV	Consumer goods	2517,85
2	British American Tobacco plc	Consumer goods	1861,8
3	Naspers Ltd	Consumer services	1229,92

4	Compagnie Financière Richemont S.A.	Consumer goods	569,61
5	Steinhoff International Holdings N.V.	Consumer goods	291,64
6	FirstRand Ltd	Financials	290,29
7	Vodacom Group Ltd	Telecommunication	268,58
8	Standard Bank Group Ltd	Financials	257,62
9	MTN Group Ltd	Telecommunication	234,25
10	Old Mutual plc	Financials	165,45
11	Sanlam Ltd	Financials	149,72
12	Aspen Pharmacare Holdings Ltd	Health care	125,57
13	Barclays Africa Group Ltd	Financials	124,37
14	Shoprite Holdings Ltd	Consumer goods	119,9
15	Nedbank Group Ltd	Financials	106,23
16	Bidcorp	Consumer goods	103,05
17	Capitec Bank Holdings Ltd	Financials	98,09
18	Mediclinic International Ltd	Health care	90,68
19	Discovery Ltd	Financials	89,2
20	RMB Holdings	Financials	88,98
21	Hammerson plc	Financials	79,01
22	Tiger Brands Ltd	Consumer goods	74,1
23	Growthpoint Properties Ltd	Financials	72,01
24	Investec plc	Financials	66,34
25	Woolworths Holdings Ltd	Consumer goods	65,49

[1] NEPI Rockcastle was excluded from the above selected companies as it was recently listed and no reports were available at the time for data collection.

Appendix B: Carbon disclosure checklist

No.	Indicators	Explanation	Reference	Rhetorical/ Committed	Examples and additional commentary
A. Emissions disclosure					
1.	Total emissions	This is the total amount of GHG emissions produced by an entity in CO_2 equivalent metric tonnes.	(Borghei et al., 2016)	Committed (Michelon et al., 2015; Borghei et al., 2016)	If only the sum of scope 1 and 2 emissions is disclosed, this would still constitute total emissions. If both location and market-based emissions are disclosed, only one of these disclosures was scored (this would apply for categories 2, 3, 4 and 16).
2	Scope 1 emissions	These are direct emissions which arise from company owned or controlled assets in CO_2 equivalent metric tonnes (this includes fugitive emissions).	(GRI, 2016e)	Committed (Michelon et al., 2015; Borghei et al., 2016)	These emissions can be regarded as either direct or scope 1 emissions. A percentage figure for scope 1 emissions was awarded a point only if the total emissions were disclosed. A point was not awarded if the scope 1 emissions were not totalled (i.e. disclosed in a distributed manner).
3.	Scope 2 emissions	These are indirect emissions arising from the production of electricity used by a company in CO_2 equivalent metric tonnes.	(GRI, 2016e)	Committed (Michelon et al., 2015; Borghei et al., 2016)	These emissions can be regarded as either indirect or scope 2 emissions. A percentage figure for scope 2 emissions was awarded a point only if the total emissions were disclosed. A point was not awarded if the scope 2 emissions were not totalled (i.e. disclosed in a distributed manner).

4.	Scope 3 emissions	These are all other indirect emissions which are not scope 2 emissions in CO_2 equivalent metric tonnes.	(GRI, 2016e)	Committed (Michelon et al., 2015; Borghei et al., 2016)	A percentage figure for scope 3 emissions was awarded a point only if the total emissions were disclosed. A point was not awarded if the scope 3 emissions were not totalled (i.e. disclosed in a distributed manner).
5.	Baseline year for total emissions	This is the disclosure of total carbon emissions at the chosen baseline year.	(GRI, 2016e)	Committed (Michelon et al., 2015)	If the previous year's carbon emissions were disclosed, this was assumed to be the baseline year.
6.	Baseline year for scope 1 emissions.	This is the disclosure of the total scope 1 emissions at the chosen baseline year.	(GRI, 2016e)	Committed (Michelon et al., 2015)	If the previous year's carbon scope 1 emissions were disclosed, this would be assumed to be the baseline year.
7.	Baseline year for scope 2 emissions.	This is the disclosure of the total of scope 2 emissions at the chosen baseline year.	(GRI, 2016e)	Committed (Michelon et al., 2015)	If the previous year's scope 2 carbon emissions were disclosed, this would be assumed to be the baseline year.
8.	Baseline year for scope 3 emissions.	This is the disclosure of the total of scope 3 emissions at the chosen baseline year.	(GRI, 2016e)	Committed (Michelon et al., 2015)	If the previous year's scope 3 carbon emissions were disclosed, this would be assumed to be the baseline year.
9.	Indicator of GHG included in emissions disclosure.	These emissions relate to CO_2, SF_6, CH_4, HFC, NF_3 PFC and N_2O.	(GRI, 2016e)	Committed (Michelon et al., 2015)	An entity would need to have a clear and specific breakdown of the GHG emissions included in their emissions disclosures (this does not need to be quantified). A point was awarded per scope and for total emissions.
10.	Disclosure of other significant air emissions.	These include NO_x, SO_x, persistent organic pollutants, volatile organic compounds, hazardous air pollutants, particulate matter or standard categories of air emissions identified in relevant regulations.	(GRI, 2016e)	Committed (Michelon et al., 2015)	A point was awarded for each gas disclosed (sulphur oxide, nitrogen oxide, etc) in tonnes for the 2016 year of assessment. These air emissions need to be specifically identified for a point to be awarded. If the gasses are

					specifically identified and aggregated this would constitute a point in this category.
11.	Biogenic emissions.	CO_2 emissions which arise from a natural source in cubic CO_2 tonnes.	(GRI, 2016e)	Committed (Michelon et al., 2015)	This includes the burning of bagasse. Only the current year figure was scored.
12.	Disclosure of global warming potential (GWP) rates used.	The GWP rate is the relative amount of heat captured by the GHG in relation to CO_2.	(GRI, 2016e)	Committed (Michelon et al., 2015)	A reference to a reputable external document would be sufficient for this category (such as GHG protocol or DEFRA rates). If the actual quantified rates are disclosed, a point was awarded for these rates in totality.
13.	Standards, methodologies, assumptions, and/or calculation tools used.	Disclosure of how the carbon emissions had been quantified.	(GRI, 2016e)	Committed (Michelon et al., 2015)	A reference to a reputable external method would be sufficient for this index (such as GHG protocol or ISO 14064).
14.	Carbon emissions by country.	Emissions have been categorised by the origin country in either a percentage or cubic tonnes.	(GRI, 2016e)	Committed (Michelon et al., 2015)	For this category, a single point was awarded if carbon emissions were disclosed by each *country* making up a company's operations (not general region). A single point was awarded per scope and at an overall emissions level.
15.	Carbon emissions by source, activity or business unit.	Emissions originating from each of the organisations sources, activities or products has been disclosed.	(GRI, 2016e)	Committed (Michelon et al., 2015)	A single point was awarded per scope and at an overall emissions level. The researcher awarded a point for a wide variety in source breakdowns. The researcher would only award a point in this category if the carbon emissions by source were quantified and complete in

					their nature (i.e. added up to the sum of total emissions). If a scope of emissions only consisted of one item (i.e. electricity for scope 2), this would not constitute a point in this category but rather scored in terms of categories 2, 3 and 4.
B. GHG intensity					
16.	GHG emission intensity.	This is a ratio of an organisations total emissions to an organisation specific metric.	(GRI, 2016e)	Committed (Michelon et al., 2015)	This needs to be clearly defined, i.e. a vague percentage would not constitute a point. The denominator needs to be clearly understandable. Only the 2016 metrics were awarded a point. A point was awarded per GHG emissions intensity ratio. A point was only awarded if the GHG intensity ratio is calculated from total emissions (not per scope).
17.	Organisation specific metric.	This indicates that an organisation has disclosed its organisation specific metric in determining its GHG emission intensity.	(GRI, 2016e)	Committed (Michelon et al., 2015)	A direct reference to this metric and *rationale* for the choice of such metric would constitute a point.
18.	Indicator of types of GHG's included in GHG intensity metric.	This is whether the entity has indicated if scope 1, scope 2 and scope 3 emissions have been included in their GHG intensity metric.	(GRI, 2016e)	Committed (Michelon et al., 2015)	A direct reference of the types of emissions (scope 1, 2 and 3) included in the GHG indicator needs to be made for a point to be awarded within this category.
19.	Indicator of types of gases included in GHG intensity metric.	This is an indicator if CO_2, SF_6, CH_4, HFC, NF_3 PFC and N_2O have been included in the GHG intensity metric.	(GRI, 2016e)	Committed (Michelon et al., 2015)	A direct reference of the types of gasses (CO_2, SF_6, CH_4, HFC, NF_3 PFC and N_2O) included in the GHG indicator

					would need to be made for a point to be awarded in this category.
C. Reduction of GHG					
20.	Reduction of GHG.	This is an indicator of the reduction of overall (total) GHG emissions as a result of reduction initiatives in metric tons of CO_2.	(GRI, 2016e)	Committed (Michelon et al., 2015)	A reduction in percentage was awarded a point for this indicator. The base year for the reduction must be indicated or implied in some manner for a point to be awarded. The reduction may not have been the result of demergers, decreased operations or change in methodologies. If it was indicated that the reduction was both due to decreased operations and reduction initiatives, the researcher used his discretion in awarding the point. The reduction must be up to the current year of assessment (i.e. no points were awarded for reductions in the 2015 year of assessment).
21.	Scopes in which reduction is applicable to.	This is the breakdown of the GHG emissions reduction into scope 1, 2 and 3 emissions.	(GRI, 2016e)	Committed (Michelon et al., 2015)	A point per category of emission (scope 1, 2 and 3) reduction was awarded in addition to a point for overall emissions (as per category 20). The reduction must be up to the current year of assessment.
D. Assurance					
22.	Assurance		(Michelon et al., 2015; GRI, 2016a)	Rhetorical (Michelon et al., 2015)	Examples of this include limited or reasonable assurance over most of an entity's disclosed GHG emissions. A

					point was only awarded if it is clearly indicated assurance is provided over total emissions (as defined in category 1) rather than at an individual scope level.
E. Actions					
23.	Disclosure of committed corporate actions.	This is the disclosure of any action indicative of an entity taking substantive action in reducing its emissions or minimising its carbon footprint. For an action to be awarded a point in this category, it needs to be a specific action which can reach a specific outcome which, in turn, has or is likely to reduce the carbon footprint of an entity.	(Michelon et al., 2015; Borghei et al., 2016; Guthrie et al., 2017) and interpretively developed.	Committed (Michelon et al., 2015; Borghei et al., 2016)	Examples include clearly defined uses of new technologies (such as low power air-conditioning), installation of solar panels, use of renewable resources (with detail as to how resources generate energy) and specific and detailed initiatives which have produced substantive results.
24.	Disclosure of symbolic corporate actions.	This is the disclosure of any symbolic action relating to an entity's carbon footprint. These actions, in contrast to committed actions are vague in their context with no clear and direct link in how the action can reduce the carbon footprint of an entity.	(Michelon et al., 2015; Borghei et al., 2016) and interpretively developed.	Rhetorical (Borghei et al., 2016; Georg and Justesen, 2017)	This would include employee training, consumer training, reporting to the CDP, general statements of actions (i.e. using new technology to drive emissions down), improving operating efficiencies, partnerships, collaborations, carbon management programmes/policies/initiatives, special resolutions in support of carbon management practices, vague statements in using energy efficient equipment and vague or seemingly symbolic investments.

F. Energy					
25.	Disclosure of fuel consumed from non-renewable resources.	This is the amount of fuel an entity has consumed from non-renewable resources in joules or a multiple of joules. This category has a narrow scope as energy consumption is not always indicative of an entity's carbon footprint.	(GRI, 2016d)	Committed (Michelon et al., 2015)	A point is awarded only if the total non-renewable fuel in joules is disclosed. If total fuel consumed is made up solely of non-renewable resources (and clearly and directly indicated as such), the total fuel was regarded as total non-renewable fuel disclosed.
26.	Disclosure of fuel consumed from renewable resources.	This is the amount of fuel an entity has consumed from renewable resources in joules or a multiple of joules. This category has a narrow scope as energy consumption is not always indicative of an entity's carbon footprint.	(GRI, 2016d)	Committed (Michelon et al., 2015)	A point was awarded only if the total renewable fuel in joules is disclosed. Also, this disclosure only measures total renewable fuelled consumed, rather than produced.
27.	Disclosure of energy reduction.	This is the amount of energy reduction as a result of energy reduction initiatives in joules or a multiple of joules from a chosen baseline year.	(GRI, 2016d)	Committed (Michelon et al., 2015)	A point was awarded only if the total energy reduction is disclosed in either joules or a percentage. Like the emissions reduction, a point is only awarded for reductions up to 2016.
G. Integration of other GHG related data.					
28.	Implementation of climate change in an entity's risk and opportunities assessment.	This is an indicator of whether the risk relating to climate change has been included in an entity's risk assessment. This would also include the description of the risk as either physical, regulatory or other. It would also include the timing of such risk	(IIRC, 2013; GRI, 2016c)	Rhetorical (Michelon et al., 2015; Borghei et al., 2016)	This would include any indicator that climate change will pose a risk or opportunity to an entity's operations. Examples include a reference to a future tax liability because of a carbon tax (must be posed as a risk), carbon reporting legislation, etc. A general

		(short, medium and long). The category would include the identification of any opportunities arising from climate change. Such risk or opportunity needs to relate clearly to an entity's operations.			climate change risk which has no clear impact on an entity's operations was not scored.
29.	Impact of risk or opportunity.	This is a description of the potential impact posed by climate change. Alongside any potential financial effects of the risk. Such impact needs to relate clearly to an entity's operations.	(GRI, 2016c)	Rhetorical (Michelon et al., 2015)	This includes the identification of the severity of the risk and repercussions of climate change (such as increased energy cost, water shortages, droughts etc).
30.	Disclosure of any potential methods to manage risk.	This is the disclosure of any methods or actions used to manage risk, relating to climate change. This can include the cost to mitigate the risk.	(IIRC, 2013; GRI, 2016c)	Rhetorical (Michelon et al., 2015)	To ensure such category remains mutually exclusive from category 23, only actions which reduce the risk posed by climate change with no reduction in GHG are classified within this category.
31.	Disclosure of how risk would prevent a company from achieving its objectives.	This is any indicator of how an entity's carbon emissions and/or climate change would prevent the entity from achieving its objectives.	(IIRC, 2013)	Rhetorical (Michelon et al., 2015)	
32.	Linkage provided between, an organisations strategy and carbon management.	This is any indicator that managing an entity's carbon footprint has been included as part of a company's strategy. This would also include the disclosure of any strategies or actions an entity plans implement to reduce	(IIRC, 2013) and interpretively developed	Rhetorical (Michelon et al., 2015)	This category includes any indicator of climate change being part of an entity's strategy. Examples include conducting business operations in a low-carbon manner, low energy management, carbon pricing in investment decisions, adherence to the Equator Principles,

		their emissions and/or impacts of climate change.			creating climate scenarios and attempts to understand the impacts of climate change and how an entity's operations contribute to climate change. Any future actions an entity plans to implement as defined per category 24 would constitute a point in this category.
33.	Disclosure of a normative statement.	This is a statement recognising the importance of an entity's carbon footprints, and/or climate change.	(Hrasky, 2011; GRI, 2016a)	Rhetorical (Michelon et al., 2015)	This includes a code of ethics, aspirational visions of a carbon neutral future and any statements recognising the importance of climate change or an entity's influence on the climate.
34.	External awards.	Disclosing any form of positive recognition for a company with regards to its carbon emissions from an external party in the current year of assessment.	(Hrasky, 2011)	Rhetorical (Cho et al., 2015a; Michelon et al., 2015)	This includes awards for a company's carbon disclosures, green building awards, recognition by the CDP (being A-listed by the CDP'S Global 500 Climate Disclosure Leadership Index) and being a Carbon Disclosure Leader in The Engaged Tracking Carbon Rankings. The award needs to be received directly by the company being assessed in the present year.
H. Target related categories					
35.	Aspirational targets.	Disclosing a company's target or objective with regards to its carbon footprint.	(Hrasky, 2011; GRI, 2016a) and interpretively developed	Committed (Michelon et al., 2015)	This includes the disclosure of *any* quantified target (targeted emissions, targeted energy use, GHG ratio, intensity ratio, etc) or *detailed* and *firm* commitments in relation to a company's

					carbon footprint. This target needs to be set in the year 2017 or later.
36.	Disclosure of targets and objectives achieved.	This is any disclosure relating to the company achieving its goals or objectives with regards to its carbon footprint in the current year of assessment. This category may overlap with categories 20, 21 and 27. If an overlap occurred, categories 20, 21 and 27 took preference over this category.	(Borghei et al., 2016)	Committed (Michelon et al., 2015; Borghei et al., 2016)	The target achieved needs to be specific and quantified. This could include meeting an emissions target, energy target or a GHG ratio. This index includes targets which are on track in being met (i.e. target to have *x* emissions by 2020, when emissions in the current year have already reached the target). The target needs to be met within the financial year of the report.

[1] Diagrams and graphs were considered in the completion of the checklist. The diagrams needed to be clearly labelled to be considered.

[2] If an item of disclosure is repeated in a slightly different manner but still communicates the same theme, this would constitute a repeated theme. For example, scope 1 emissions disclosed as cubic tons and as a percentage would constitute a repeated disclosure.

[3] For an item to constitute an action (as per categories 23 and 24) it must have been performed in the current financial year or be an ongoing process that is still occurring in the current year. More so such action needs to be performed, initiated or permitted in some way by the entity which is being assessed.

[4] If an item of disclosure is overly vague to the extent that such disclosure does not communicate any meaningful information or cannot be accurately classified, the disclosure was ignored.

[5] If an initiative is subsequently broken down into various distinct actions, the various actions of the initiative were scored whilst the initiative was not scored unless the actions and initiative are inseparable from each other.

[6] If a contradictory disclosure is found (i.e. scope 1 emissions disclosure that is different to another scope 1 disclosure), the contradictory disclosure was not scored.

[7] External assurance reports were only considered to the extent of disclosure categories 12, 13 and 22, and in this case the count was limited to 1 per category.

[8] This study would only deem a segment (be it a region or business unit) of an entity's emissions disclosures as total emissions *if* the segment contributed a minimum of 85% of the total emissions disclosed. If this requirement is met, segmented disclosures for categories 1,2,3,4,16 and 18, would be deemed appropriate disclosure items for such categories.

[9] For disclosure categories 23, 24, 32, and 33, the disclosure item needs to relate clearly to climate change, the entity's carbon footprint or energy. General environment or "green" disclosures would not constitute a point within these categories. The only "green" disclosures which were scored were those relating to the construction or award of a "green building" or adherence to principles in the construction of a green building. References to the United Nations Global Compact (UNGC) principles were not awarded any points.

[10]If a disclosure item was to overlap two or more disclosure categories; the researcher would use his discretion in categorising the disclosure item into the most relevant disclosure category.

[11] Furthermore, any disclosures relating to other air emissions were not considered for all categories except category 10.

[12]For categories 35 and 36 such targets need to be set or achieved by the company being assessed or a subsidiary of the company being assessed.

Appendix C: Validity

Figure 9: Distribution of quantity of disclosures for integrated reports

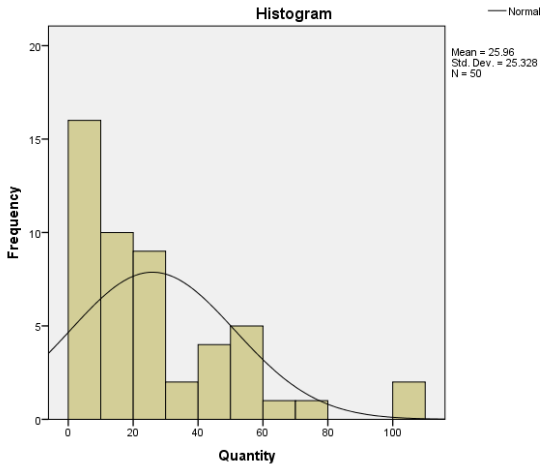


Figure 10: Distribution of quantity for combined scores

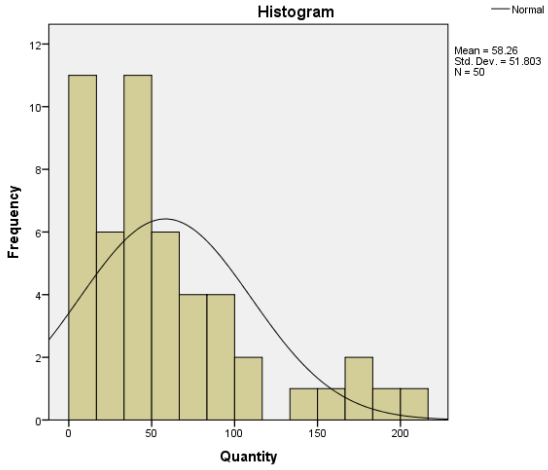


Figure 11: Distribution of density score for integrated reports

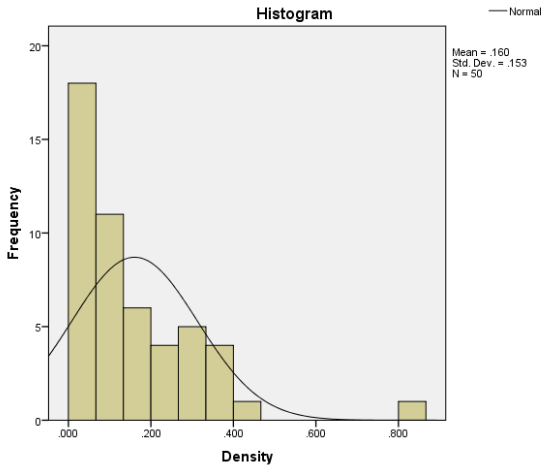


Figure 12: Distribution of attribute score for integrated reports

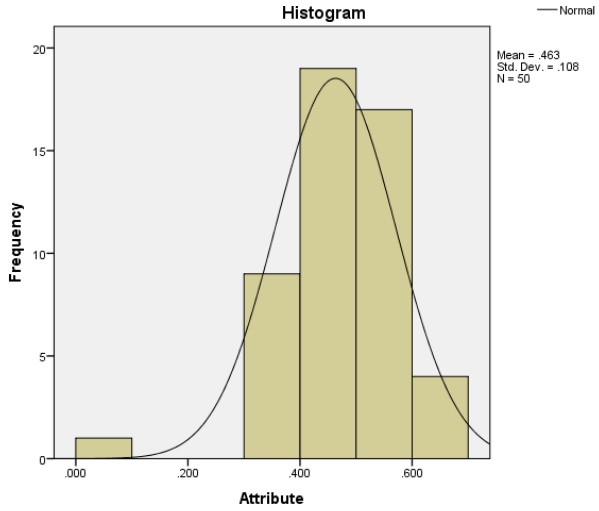


Figure 13: Distribution of management orientation score for integrated reports

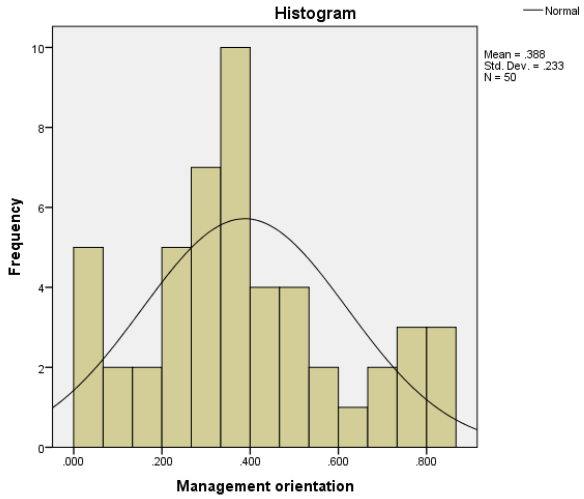


Figure 14: Distribution of integration score for integrated reports

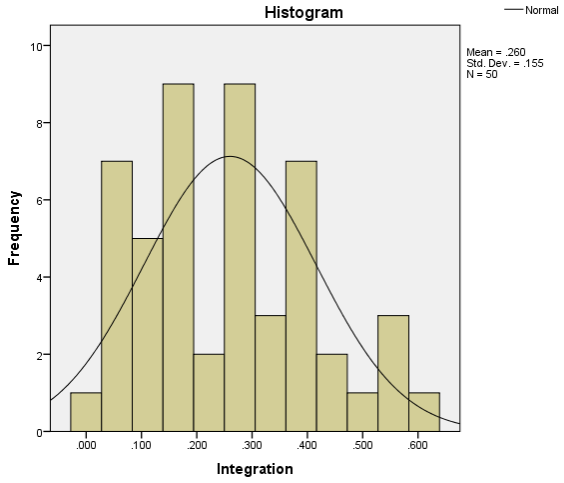


Figure 15: Distribution of assurance score for integrated reports

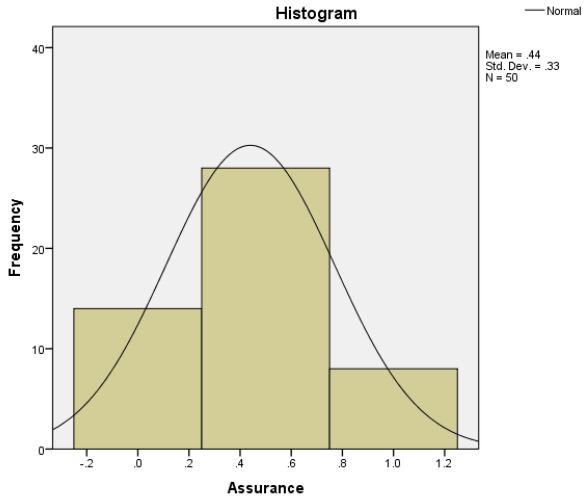


Figure 16: Distribution of repetition score for integrated reports

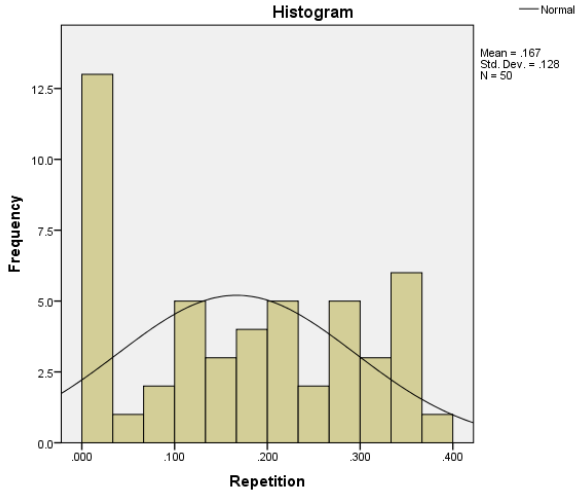


Figure 17: Distribution of overall score for integrated reports

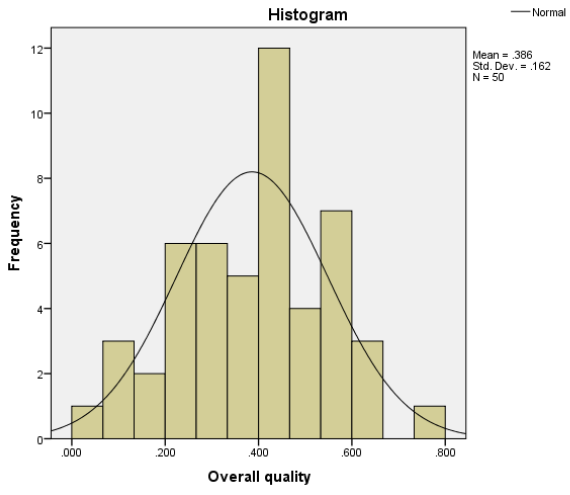


Figure 18: Distribution of density score for combined reports

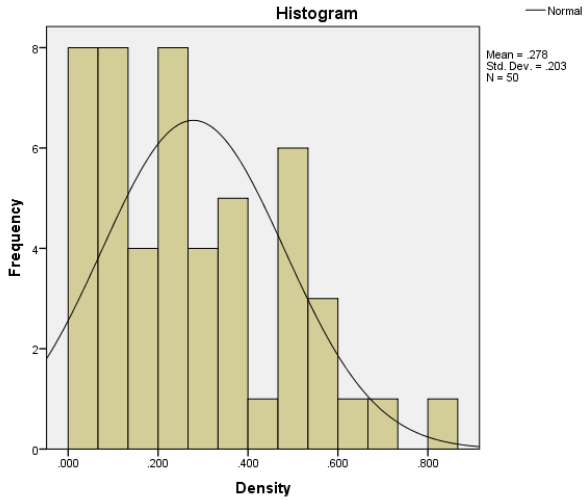


Figure 19: Distribution of attribute score for combined reports

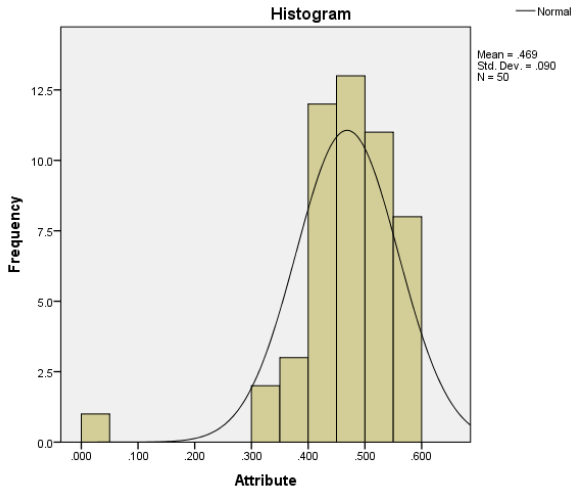


Figure 20: Distribution of management orientation score for combined reports

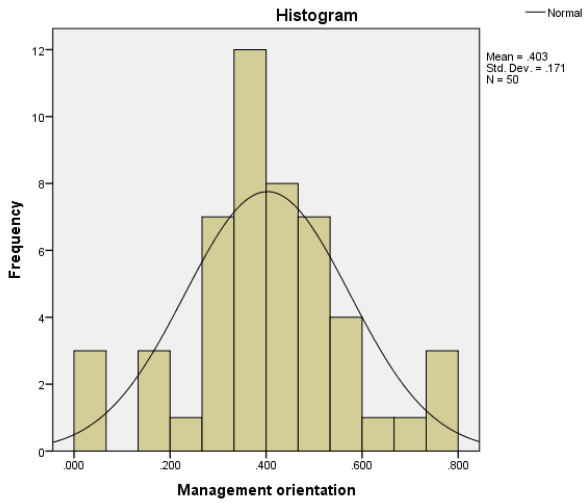


Figure 21: Distribution of integration score for combined reports

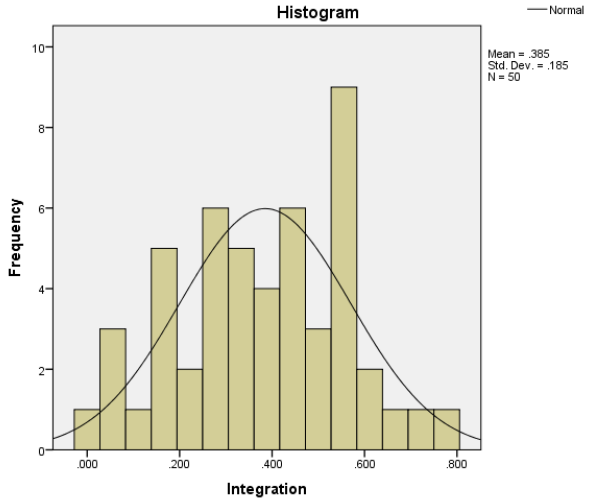


Figure 22: Distribution of repetition score for combined reports

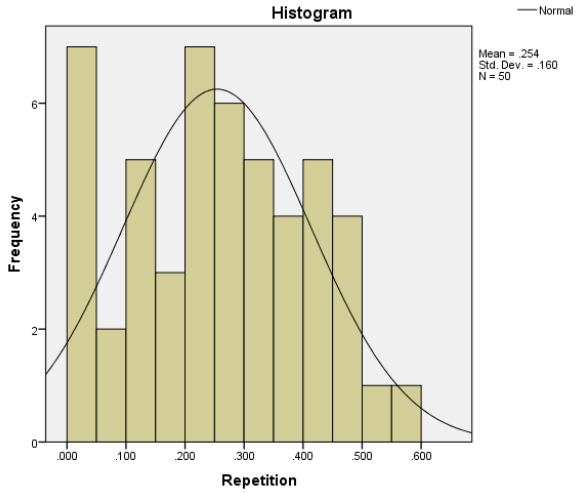
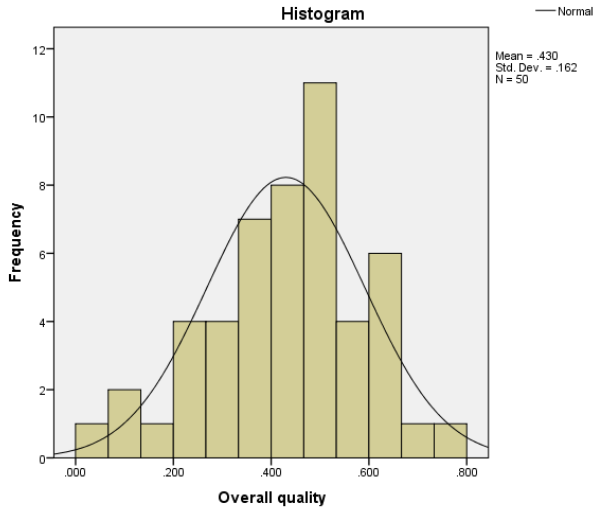


Figure 23: Distribution of overall quality score for combined reports



Appendix D: Quantity per category

The integrated reporting quantity scores per category as per the data instrument are as follows:

Integrated reporting scores		Total		Low carbon		High carbon	
	Category	**No .**	**Percentage**	**No .**	**Percentage**	**No .**	**Percentage**
1	Total emissions	68	5.2%	17	4.4%	51	5.6%
2	Scope 1 emissions	25	1.9%	7	1.8%	18	2.0%
3	Scope 2 emissions	29	2.2%	9	2.3%	20	2.2%
4	Scope 3 emissions	12	0.9%	5	1.3%	7	0.8%
5	Baseline year for total emissions	48	3.7%	12	3.1%	36	3.9%
6	Baseline year for scope 1 emissions	24	1.8%	7	1.8%	17	1.9%
7	Baseline year for scope 2 emissions	24	1.8%	6	1.6%	18	2.0%
8	Baseline year for scope 3 emissions	13	1.0%	5	1.3%	8	0.9%
9	Indicator of GHG included in emissions disclosure.	1	0.1%	0	0.0%	1	0.1%
10	Disclosure of other significant air emissions.	15	1.2%	0	0.0%	15	1.6%
11	Biogenic emissions	3	0.2%	0	0.0%	3	0.3%
12	Disclosure of global warming potential (GWP) rates used.	7	0.5%	5	1.3%	2	0.2%
13	Standards, methodologies, assumptions, and/or calculation tools used.	31	2.4%	10	2.6%	21	2.3%
14	Carbon emissions by country	6	0.5%	4	1.0%	2	0.2%
15	Carbon emissions by source, activity or business unit.	23	1.8%	9	2.3%	14	1.5%
16	GHG emission intensity	32	2.5%	12	3.1%	20	2.2%
17	Organisation specific metric	0	0.0%	0	0.0%	0	0.0%
18	Indicator of types of GHG's included in GHG intensity metric.	3	0.2%	0	0.0%	3	0.3%
19	Indicator of types of gases included in GHG intensity metric.	0	0.0%	0	0.0%	0	0.0%
20	Reduction of GHG	15	1.2%	9	2.3%	6	0.7%
21	Scopes which reductions apply to	5	0.4%	1	0.3%	4	0.4%
22	Assurance	26	2.0%	10	2.6%	16	1.8%
23	Disclosure of committed corporate actions	73	5.6%	39	10.2%	34	3.7%
24	Disclosure of symbolic corporate actions	234	18.0%	77	20.1%	157	17.2%
25	Disclosure of fuel consumed from non-renewable resources	2	0.2%	0	0.0%	2	0.2%
26	Disclosure of fuel consumed from renewable resources	3	0.2%	0	0.0%	3	0.3%
27	Disclosure of energy reduction	5	0.4%	2	0.5%	3	0.3%
28	Implementation of climate change in an entity's risk and opportunities assessment.	92	7.1%	12	3.1%	80	8.8%
29	Impact of risk or opportunity.	69	5.3%	7	1.8%	62	6.8%
30	Disclosure of any potential methods to manage risk	30	2.3%	3	0.8%	27	3.0%
31	How risk would prevent a company from achieving its objectives	1	0.1%	0	0.0%	1	0.1%
32	Linkage provided between, an organisations strategy and carbon management.	230	17.7%	69	18.0%	161	17.6%
33	Disclosure of a normative statement	82	6.3%	17	4.4%	65	7.1%
34	External awards	12	0.9%	8	2.1%	4	0.4%
35	Aspirational targets	47	3.6%	19	4.9%	28	3.1%
36	Disclosure of targets and objectives achieved	8	0.6%	3	0.8%	5	0.5%
	Total	**1298**	**100.0%**	**384**	**100.0%**	**914**	**100.0%**

The combined reporting quantity scores per category as per the data instrument are as follows:

Combined scores		High carbon		Low carbon		High carbon	
	Category	**No .** [11]	**Percentage**	**No .**	**Percentage**	**No .**	**Percentage**
1	Total emissions	126	4.3%	39	3.6%	87	4.8%
2	Scope 1 emissions	64	2.2%	25	2.3%	39	2.1%
3	Scope 2 emissions	71	2.4%	28	2.6%	43	2.4%
4	Scope 3 emissions	33	1.1%	16	1.5%	17	0.9%
5	Baseline year for total emissions	88	3.0%	25	2.3%	63	3.5%
6	Baseline year for scope 1 emissions	54	1.9%	19	1.7%	35	1.9%
7	Baseline year for scope 2 emissions	55	1.9%	18	1.6%	37	2.0%
8	Baseline year for scope 3 emissions	30	1.0%	13	1.2%	17	0.9%
9	Indicator of GHG included in emissions disclosure.	4	0.1%	0	0.0%	4	0.2%
10	Disclosure of other significant air emissions.	46	1.6%	0	0.0%	46	2.5%
11	Biogenic emissions	7	0.2%	0	0.0%	7	0.4%
12	Disclosure of global warming potential (GWP) rates used.	10	0.3%	7	0.6%	3	0.2%
13	Standards, methodologies, assumptions, and/or calculation tools used.	58	2.0%	20	1.8%	38	2.1%
14	Carbon emissions by country	15	0.5%	9	0.8%	6	0.3%
15	Carbon emissions by source, activity or business unit.	65	2.2%	29	2.6%	36	2.0%
16	GHG emission intensity	80	2.7%	40	3.7%	40	2.2%
17	Organisation specific metric	1	0.0%	1	0.1%	0	0.0%
18	Indicator of types of GHG's included in GHG intensity metric.	5	0.2%	1	0.1%	4	0.2%
20	Reduction of GHG	30	1.0%	16	1.5%	14	0.8%
21	Scopes which reductions apply to	13	0.4%	3	0.3%	10	0.6%
22	Assurance	56	1.9%	27	2.5%	29	1.6%
23	Disclosure of committed corporate actions	168	5.8%	112	10.2%	56	3.1%
24	Disclosure of symbolic corporate actions	524	18.0%	203	18.5%	321	17.7%
25	Disclosure of fuel consumed from non-renewable resources	4	0.1%	0	0.0%	4	0.2%
26	Disclosure of fuel consumed from renewable resources	8	0.3%	1	0.1%	7	0.4%
27	Disclosure of energy reduction	14	0.5%	8	0.7%	6	0.3%
28	Implementation of climate change in an entity's risk and opportunities assessment.	188	6.5%	40	3.7%	148	8.1%
29	Impact of risk or opportunity.	149	5.1%	25	2.3%	124	6.8%
30	Disclosure of any potential methods to manage risk	71	2.4%	13	1.2%	58	3.2%
31	How risk would prevent a company from achieving its objectives	2	0.1%	0	0.0%	2	0.1%
32	Linkage provided between, an organisations strategy and carbon management.	517	17.7%	204	18.6%	313	17.2%
33	Disclosure of a normative statement	184	6.3%	61	5.6%	123	6.8%
34	External awards	35	1.2%	18	1.6%	17	0.9%
35	Aspirational targets	107	3.7%	59	5.4%	48	2.6%
36	Disclosure of targets and objectives achieved	31	1.1%	15	1.4%	16	0.9%
	Total	*2913*	*100.0%*	*1095*	*100.0%*	*1818*	*100.0%*

[11] Please note No. represents the total number of counts within a category. Percentage represents the this count as a percentage of the total counts (i.e. the count divided by the total).