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DOCTORAL THESIS

An exploration of the disclosure of practices for environmental and social sustainability in sustainability reports

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February, 2018

Declaration of Authorship

I Aikaterini Papoutsi declare that this thesis titled, ‘An exploration of the disclosure of practices for environmental and social sustainability in sustainability reports’, and the work presented in it are my own. I confirm that:

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Abstract
This dissertation explores the value of disclosure in sustainability reports. Sustainability reports are part of the information provided publicly by companies and may reveal information about the type of sustainability practices adopted by the company and extent of implementation. To this end, we explore (1) developed constructs using sustainability reporting, and (2) consistency with established sustainability performance measures. Till now, limited research has been conducted pertaining to the specific operational practices that companies are reporting on for the sake of developing a new measure of social and environmental sustainability out of them. Finally, (3) using the proposed measure, we explore links to financial performance and firm size. To meet these three research objectives, we first synthesize and obtain from the literature and relevant guidelines a list of operational practices for environmental and social sustainability. Next, content analysis of 331 sustainability reports is implemented. In particular, scoring is carried out on the identified environmental and social practices to see which of those are prioritized in companies' sustainability reports. Based on the prevailing practices, we develop two constructs for social sustainability and three constructs for environmental sustainability. These constructs allow us to identify 'leader' and 'laggard' companies in four industrial sectors for comparison and provide illustrative text from their sustainability reports to demonstrate our scoring methodology. Second, we check consistency of our developed measure with existing measures of sustainability that are considered valuable. Specifically, we correlate our measure with Dow Jones Sustainability Index and Environmental Social and Governance data and find that all three measures are positively and significantly correlated with each other at the same level. Given the consistency between the three measures, we argue that our measure for sustainability performance is valuable and thus sustainability reporting appears to have some value. Finally, we explore the link between our developed measure with financial performance and firm size. Existing literature has extensively studied this relationship using established measures of sustainability performance, thus the results remain inconclusive. We revisit this relation by investigating whether our developed measure can shed light on that relationship. Structural equation modeling is performed, which indicates that there is not a significant relationship between our developed measure and financial performance, at least in the short term, as is consistent with similar research using ESG or other established measures. Thus, some aspects of sustainability but not all appear to be positively linked to financial performance. Also, to account for the industry effect, we are performing cluster analysis in four industrial sectors and identify upper and lower clusters, based on companies' total sustainability disclosure score. Our analysis indicates sector specificity as regards the relationship between sustainability disclosure and financial performance based on the proposed instrument. Also, size expressed by revenues does not affect the measure we developed, as suggested by some of the literature.

Structure and summary of the thesis

This dissertation explores the value of disclosure in sustainability reports. Chapters 1-6 explore attributes of related sustainability constructs, Chapter 7 checks consistency with other sustainability performance measures, and Chapter 8 explores the link with financial performance and company size. More specifically, the thesis is organized as follows:

Chapter 1. Introduction

Corporate reporting is a mechanism that companies deploy in order to provide an account of their activities to shareholders and other stakeholders. Corporate reporting fosters transparency and accountability and constitutes a means for engaging with stakeholders and signalling important information to them (Buhr, 2002; Adams and Frost, 2008). Financial reports constitute the most established type of corporate reporting. However the increased concern for social and environmental issues has encouraged the release of sustainability reports. The increased focus on sustainability has led firms to incorporate a range of sustainability practices in their operations and supply chains. These practices are usually difficult to observe, and as such, firms produce sustainability reports to inform their stakeholders on their social and environmental sustainability activities. On the other hand, there is concern that these reports are not accurate representations and serve only as a tool to influence public perception. As such, it is worthwhile to investigate the value of sustainability reporting in conveying companies' sustainability efforts by (1) proposing a new way of measurement of sustainability through sustainability reporting and (2) using this measure, we check its consistency with existing measures that are considered having value, and (3) linking our measure with financial performance and firm size to compare our analysis using the proposed disclosure measures with other studies in the extant literature.

Chapter 2. Literature Review

In this chapter a comprehensive literature review is carried out to explore the concept of corporate sustainability reporting through the lens of sustainability accounting. A systematic review of current operations and supply chain management literature is carried out to define social and environmental sustainability practices. This paper intends to contribute to the fields of sustainable operations management by aligning sustainability literature with accounting and operations management. We therefore review the relevant literature in both accounting and operations fields. The literature gap is that till now, limited systematic research has been conducted pertaining to the specific sustainability indicators that companies are reporting on for the sake of developing a new measure of social and environmental sustainability out of them.

This leads us to three research objectives: (1) Develop a measure for sustainability reporting and explore its attributes and (2) Check consistency of this measure with existing measures that are considered having value. Furthermore, the inconsistency in the literature as regards the link between sustainability and financial performance and firm size motivate us to investigate (3) whether the proposed measure using sustainability reports can shed light on the inconclusive results in the literature.

Chapter 3. Operational practices to capture companies' sustainability efforts

This chapter investigates the concept of sustainability within the context of reporting environmental and social sustainability. Firms' accountability for social and environmental issues has broadened the scope of reporting from financial alone to include sustainability. In this chapter, we are synthesizing from the operations management literature and existing guidelines a comprehensive list of social and environmental sustainability practices

(indicators). Next, relative indicators are grouped together under higher order thematic categories, which gives us seven conceptual constructs: (1) human rights; (2) labor practices; (3) emissions; (4) supply chain; (5) materials consumption; (6) manufacturing and operations; (7) recovery processes.

Chapter 4. Empirical exploration using sustainability reports

This chapter explores what companies are actually reporting for sustainability in their annual sustainability reports in order to explore attributes and develop a measure for sustainability performance. Based on the sustainability practices that we conceptually identified in Chapter 3, we are scoring granular reported practices for 331 sustainability reports. Next, descriptive analysis is carried out and we see that a sub-set of environmental and social practices are prioritized in companies' reports.

Chapter 5. Construct Development

Based on the prevailing practices identified in companies' sustainability reports, we develop constructs for social and environmental sustainability. Exploratory and confirmatory factors analyses are conducted for construct development and validation. Two constructs for social sustainability – human rights and labor practices - and three constructs for environmental sustainability are identified – environmental protection, materials conservation, and supply chain.

Chapter 6. Illustrations from 'leader' and 'laggard' companies

Based on companies' total disclosure score as per the measures developed in the previous chapters, we identify 'leader' and 'laggard' companies with the highest and the lowest scores respectively and compare their disclosure score on each of the constructs described in the previous chapter. For these companies, we provide examples of reported text in order to illustrate our scoring methodology.

Chapter 7. Comparison with existing measures of sustainability performance

In this chapter, we explore the consistency between our developed measure with third party provided measures. We are collecting data provided by Dow Jones Sustainability Index (DJSI) and Environment, Social and Governance (ESG) database provided by Bloomberg. This way we are investigating whether sustainability reporting, which is publicly available, is consistent with third party measures, which are using private data and require access to the company.

Chapter 8. Exploring links with financial performance

In this chapter, we identify links between our proposed measure using sustainability reports and financial performance, to shed light on the inconclusive results in the literature as regards this link. To this end, we obtain financial data for the same companies to identify the link between reported social and environmental operational practices and firm financial performance, using structural equation modelling. Finally, to account for the industry effect, we are performing cluster analysis in four selected industrial sectors and identify upper and lower clusters, based on their total sustainability disclosure score. Upper and lower clusters are compared against their financial performance and size, using ANOVA.

Chapter 9. Conclusion

In the final chapter of this study, the results are discussed, as well as the theoretical and managerial implications are drawn. Next, the limitations of this research are recognized and future directions are suggested.

Terminology

- **Sustainability disclosure or disclosure of sustainability practices:** Companies' disclosure on adoption and extent of their implementation of operational practices that would lead to desirable sustainability outcomes for the environment and society.
- **Sustainability reports**: Corporate reports that provide information about companies' social and environmental activities.
- **Third party measures**: Measures like DJSI, ESG, KLD that use various sources to provide an indication of companies' sustainability performance.
- **Extent of companies' reporting**: The degree of disclosure corresponding to disclosed operational practices.
- **Scoring methodology:** reflects the adoption and extent of implementation, using a 0-2, with an additional score of 3.

Chapter 1. Introduction

1.1 Motivation for studying sustainability reporting

The environmental and social impacts of organizations are increasingly a concern, and organizations are accountable for sustainability (Nikolaeva and Bicho, 2011; Zhu and Sarkis, 2004). The increased pressure for sustainability can be reflected into the growing number of stock market sustainability indices and standalone sustainability reports (Clarkson et al., 2007). Indeed, over the past years, a number of companies have been producing sustainability reports in response to increased requirements for transparency and accountability among stakeholders (Gray, 2001; Kolk; 2008). Regulators, rating agencies, stock exchanges, investors, consumers, and civil society organizations are asking companies to monitor and disclose their sustainability practices (Cormier and Magnan, 2007). Accounting literature has recognized that sustainability reporting helps companies enhance transparency and stakeholder accountability. The importance of sustainability reporting is also reflected in the advent of various reporting guidelines by international organizations for companies to adopt. Reporting guidelines have emerged as a response to criticism to first generation of sustainability reports.

We have identified a theoretical gap regarding two potentially contradicting theories about sustainability reporting and this study attempts to address this gap and shed light on the inconclusive literature about the value of disclosure in sustainability reports. On the one hand economic disclosure and signaling theory literature supports that sustainability reports are providing signals of companies' sustainability efforts, while institutional theory indicates that it could be greenwashing to influence stakeholder perceptions.

Economic disclosure theories and signalling theory argue that companies with superior sustainability performance will also have higher level of sustainability disclosure (Clarkson et al., 2007; Mahoney et al., 2013; Al-Tuwaijri et al., 2004). According to signalling theory the costs imposed by society on those that do not honestly report will be a sufficient deterrent so that poor sustainability companies will be less willing to report than high sustainability companies

(Clarkson et al., 2011). As such, companies will undertake sustainability disclosure (reporting) only when the benefits of providing this information outweighs the associated costs (Li et al., 1997).

Companies' sustainability practices and achievements are not easily observable to investors and other stakeholders (Connelly et al., 2011; Lyon and Maxwell, 2011). To this end, firms provide signals of their sustainability activities via the release of sustainability reports in order to communicate their social and environmental sustainability practices to their various stakeholders. A high level of sustainability disclosure can help reduce the information asymmetry between investors and managers, minimize uncertainty regarding firms' future securities returns, and reduce transaction costs for investors (Dhaliwal et al., 2011; Carnevale and Mazzuca, 2014). Higher level of disclosure means more openness extent of reporting on adoption as well as extent of implementation of practices. According to economic disclosure theories (e.g., signalling theory), companies that have superior sustainability effort by way of adopting and implementing sustainability practices will also disclose their effort by reporting many of these practices and the extent of their implementation in their sustainability reporting (Clarkson et al., 2007).

Signalling theory is an informative theoretical framework so as to understand companies' engagement with sustainability reporting (Hahn and Kuhnen, 2013). Signaling theory attempts to address this issue of information asymmetry. In particular, this theory suggests that asymmetry can be reduced by certain corporate actions and policies. Specifically, firms use costly signals to communicate their practices to those who may desire to know such information but cannot observe these practices directly (Connelly et al., 2011; Morris, 1987). Such signals help external analysts, creditors and investors form impressions and opinions about companies' ability to create value (Clark and Montgomery, 1998; Rindova and Fombrun, 1999) and make appropriate trading and investment decisions. Asymmetry in this study refers to the imbalance between the investors' information and the information that the company has on its own adoption and implementation of sustainability practices (Carnevale and Mazzuca, 2014).

It is suggested in the literature that financial accounting information is not sufficient to explain firms' market value and as such the value relevance of nonfinancial disclosure ought to be examined (Carnevale and Mazucca, 2014; Cormier and Magnan, 2007). Social and environmental activities are not always easily observable by stakeholders, and for this reason, according to signalling theory, companies are disclosing their sustainability activities to signal their actual superior position regarding sustainability activities (Healy and Palepu, 2001; Verrechia, 1983).

In this view, sustainability reports lead to greater transparency and eliminate information asymmetries between managers and investors that may prevent companies from reaping the benefits of their actions (Mahoney et al., 2013; Guthrie et al., 2004; Adams and McNicholas, 2006; Isaksson and Steimle, 2009;Golob and Barlett, 2007; Manetti, 2011; Benau et al., 2013). Therefore, removal of asymmetry aids investors in their decision making, and we could argue therefore that asymmetry hampers investor decision making (Carnevale and Mazzuca, 2014). High level of disclosure increases companies' transparency and credibility towards investors, regardless of good or bad information (Cormier and Magnan, 2007; Blacconiere and Patten, 1994). Al-Tuwaijri et al. (2004) argue that superior environmental performance reduces firms' exposure to future environmental costs and as such disclosure of this type of information should be perceived as good news by investors.

On the other hand, institutional theory supports that sustainability reporting is not an accurate representation, but an advertising tool deployed by companies. A number of studies argue that (Gray et al., 1996; Solomon and Lewis, 2002; Kolk, 2005; Bebbington et al.; 2008) sustainability reports serve as an impression management tool, provided that corporate disclosures influence the external perception of reputation. A number of studies argue that (Gray et al., 1996; Solomon and Lewis, 2002; Kolk, 2005; Bebbington et al.; 2008) sustainability reports serve as an impression management tool, provided that corporate disclosures influence the external perception of reputation. For this reason, it has been expressed in the literature that sustainability reporting purely works as a greenwashing technique, whereby companies are reporting

favorable information in order to maintain their legitimacy (Tate and Ellram, 2009; Lyon and Maxwell, 2011).

One of the most popular studies is the one conducted by Wiseman (1982), who concludes that sustainability reports is a misrepresentation of real sustainability performance. Also, there is literature that supports that sustainability reporting is not an absolute reflection of firms' social and environmental performance, as companies tend to overstate their sustainability practices so as to positively engage their stakeholders and positively influence the public perception (Brown and Deegan; 1998; Buritt and Schalteger, 2010; Hooghiemstra, 2000; Patten, 2002; Adams, 2004). Ullman (1985) also emphasizes that a common mistake is not to differentiate what companies report and what they actually do for sustainability.

We see that there exists a sustainability reporting – sustainability performance portrayal gap (Adams, 2004; Herbohn et al, 2014). Given this gap, in this study we aspire to revisit this relation by exploring what is the value of disclosure in sustainability reports. To this end, we develop a measure based on content analysis of sustainability reports in the first instance. Next, using our developed measure, we check consistency with existing measures of sustainability performance, already considered to be valid. We argue that if our measure is consistent with the third-party data, then sustainability reporting has value, since this measure is coming out of sustainability reporting only. Finally, given the inconclusive link between sustainability and financial performance, we attempt to shed some light on that link. In particular we link the measure obtained from sustainability reports to financial performance and size to explore the link between reported sustainability practices and financial performance, to explore the signalling effect of sustainability reports' content.

1.2 Methodology approach

The methodology approach that we follow in this study is as follows:

1) We are carrying out literature review and a review of acceptable practices (e.g. GRI) to conceptually develop an instrument for sustainability reports by identifying a list of 51 practices (indicators) underpinning environmental and social sustainability and organizing them into theoretical sound constructs. (Chapter 3)
2) Next step is to develop an operational measure and explore its attributes for sustainability reporting. To this end, we are implementing content analysis of sustainability reports to identify what companies are reporting by scoring the practices that we identified in the literature. A sample of 331 companies is selected and scored on the 51 operational practices. The list of sustainability practices identified in the literature is narrowed down to the 32 most relevant ones, according to what companies have disclosed. (Chapter 4)
3) Based on the prevailing 32 social and environmental practices identified in companies' sustainability reports, we develop constructs for social and environmental sustainability. Exploratory and confirmatory factor analyses are conducted for construct development. (Chapter 5)
4) To provide examples of reported content, we compare 'leader' and 'laggard' companies in four industrial sectors and provide illustrative text from their sustainability reports. (Chapter 6)
5) In order to check consistency of our proposed instrument, we correlate it with existing third party measures that are considered to have value. We collect data provided by Dow Jones Sustainability Index (DJSI) and Environment, Social and Governance (ESG) database provided by Bloomberg. This way we investigate whether the instrument built from sustainability reports content analysis is consistent with established third party measures for sustainability performance. (Chapter 7)
6) Finally, we identify links between our measure of sustainability and measures of financial performance. The purpose of this analysis is to examine whether our composite measure developed from companies'

sustainability reports can shed further light on the inclusive results in the literature as for the link between sustainability and financial performance. To this end, for the same sample of companies we obtain financial data in order to identify a link between reported social and environmental reported practices and aspects of firm financial performance, using structural equation modeling. In addition, we identify 'upper' and 'lower' clusters, based on their total disclosure score, in four industrial sectors and compare them against their financial performance and size. (Chapter 8)

1.3 Findings

In the corresponding chapters, we found:

- **Chapter 3**. A comprehensive list of 51 social and environmental sustainability practices (indicators) is synthesized from operations literature and existing guidelines. Next, relevant indicators are grouped together under higher order thematic categories, which gives us seven conceptual constructs: (1) human rights; (2) labor practices; (3) emissions; (4) supply chain; (5) materials consumption; (6) manufacturing and operations; (7) recovery processes.
- **Chapter 4:** Content analysis of 331 sustainability reports is reported, by scoring identified practices. Descriptive analysis indicates that a sub-set of 32 equally represented environmental and social sustainability practices are prioritized in companies' reports. Also, we find that the industry sector does not appear to matter as regards the specifics of what the companies are reporting.
- **Chapter 5:** Based on the prevailing practices identified in companies' sustainability reports, we obtain two constructs for social sustainability – human rights and labor practices- and three constructs for environmental sustainability – environmental protection, materials conservation and supply chain.
- **Chapter 6:** Having identified leader and laggard companies in four sectors based on the scores of companies using the total disclosure score, we find that the industry sector in no way affects the type of sustainability disclosure. All of the four industries are either reporting high on both social and environmental sustainability or reporting low on both.
- **Chapter 7:** We correlate our sustainability disclosure score derived by sustainability report with ESG disclosure score and DJSI. All three sustainability measures are positively and significantly correlated with each other at 0.33 level ($p=0.001$). The findings indicate that our developed measure based on sustainability reporting reflects an accurate proxy for companies' sustainability efforts. As such, sustainability has value, since this measure is coming out of sustainability reporting only.

- **Chapter 8:** In this chapter we identify links between our measure of sustainability and financial performance to shed light on the inconclusive results in the literature as regards this link. The structural model indicates that there is not a significant relationship between companies' social and environmental disclosed practices and their financial performance (ROA and ROS), at least in the short term. As for the 'upper' and 'lower' clusters, ANOVA indicates that upper cluster companies tend to have superior financial performance; thus this is not conclusive as the results are subject to industrial sector contingency effect. Finally, size expressed by revenues does affect the proposed instrument.

1.4 Contribution

A large part of the existing literature has studied sustainability performance by looking at existing measures provided by third parties. This data are publicly available, provided by third parties and are already considered to be valid. DJSI, ESG score provided by Bloomberg, and Council on environmental protection (CEP) are the most commonly used ones (Waddock and Graves, 1997; McGuire et al., 1998; Berman et al., 1999; Tang et al., 2012; Lopez et al., 2007; Servaes and Tamayo, 2013; Eccles et al., 2014) (Fig.1).

There is also the reporting literature, which studies the value of the various types of corporate reports. A number of studies in the accounting literature have looked at the link between the event of publishing a sustainability report and market reaction (Klassen and McLaughlin, 1996; Cormier and Magnan, 1999; Jones et al., 2007; Clarkson et al., 2008; Guidry and Patten, 2010; Flammer, 2013). More recently, Carnevale and Mazzuca (2014) examine the relationship between publishing a sustainability report and such value relevant accounting variables as book value per share and earnings per share (Fig.1).

This study positions itself into the overlap between sustainability performance and reporting literature, as we are exploring whether sustainability reports indicate companies' sustainability efforts. Till now, there has been published limited research regarding the actual adoption and extent of implementation of sustainability practices by companies (Roca and Searcy, 2012; Adams and

Frost, 2008). This study helps provide insight into sustainability reports, operational practices, and disclosure. In particular, in this study we are proposing a new multi-faceted measure of sustainability obtained from 331 distinct sustainability reports based on the social and environmental practices that companies are disclosing in their reports (Fig.1).

Figure 1 graphically illustrates the research positioning of this study.

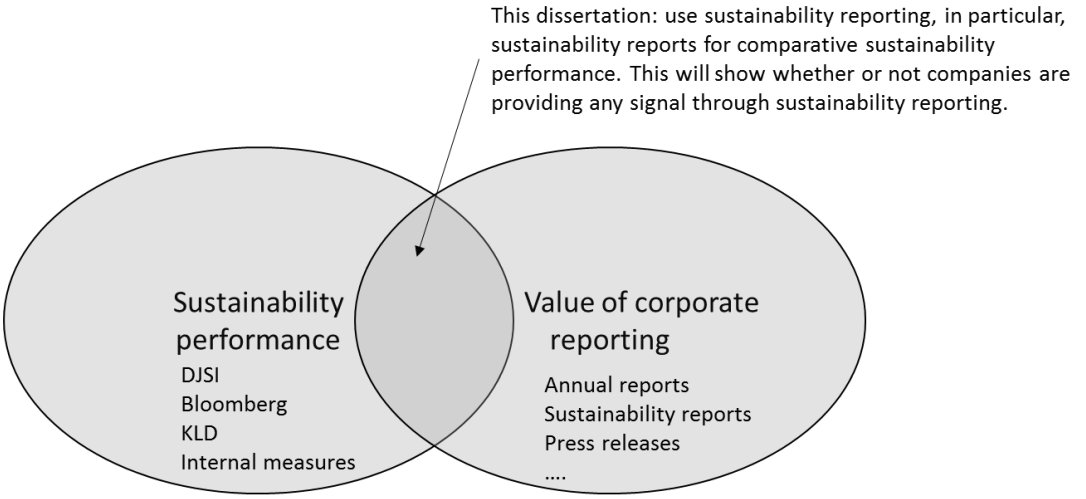


Figure 1. Positioning and context of this research which lies in the overlap of sustainability reporting for measuring sustainability performance

This research contributes to exploring what is the value of disclosure in sustainability reports by creating an instrument for sustainability based on reported operational practices. This index differs from existing indices on the grounds that (1) it is not purely based on GRI guidelines as some studies have done so (Roca and Searcy, 2012; Skouloudis et al., 2010; Clarkson et al., 2007; Morhardt et al., 2002) and (2) it is built based on the level and quality of disclosure, and not on counting words or sentences. It is important to highlight that we are extending beyond purely counting the number of words, sentences, or pages, as several studies have done so (Cowen et al., 1987; Patten, 1991; Hackston and Milne, 1996; Milne and Adler; 1999; Deegan, 2002; Guidry and Patten, 2010; Roca and Searcy, 2012). Instead, we develop a disclosure instrument based on evaluating the content and quality of information disclosed for a list of sustainability practices identified in the literature. Our methodology

is an extension of Wiseman (1982) indexing procedure, which is based on scoring disclosure of 18 environmental indicators in four categories. Wiseman's coding instrument is used by a number of studies (Patten, 2002; Cormier and Magnan, 1999, 2004). Our instrument differs from that of Wiseman on the grounds that we score standalone sustainability reports on 52 operational practices, including both social and environmental practices, from which we obtain relevant constructs.

The contribution of this dissertation is threefold. *First*, by looking at sustainability reports, we aspire to build distinct, but comparable, constructs for operational practices reported for sustainability. As authors have called for more theoretically sound constructs in this area (Seuring and Muller, 2008; Marshall, 2017), we are providing in this study the first step in developing measures and constructs using corporate sustainability reports. This is a multi-faceted measure, which can be replicated by other researchers using information available in the public domain via sustainability reports.

Second, in order to check consistency of our developed measure with third party provide measure, we correlate it with existing measures (based on internal information) already considered to be valid. In particular, we check consistency with existing measures using Dow Jones Sustainability Index (DJSI) and Environmental, Social, and Governance (ESG) data provided by Bloomberg. We show is that the measure coming out from sustainability reports based on practices is indicated to be as valuable as existing measures on "sustainability performance" that use diverse sources, both public and private.

Finally, we are able to shed further light on the currently unresolved link between sustainability and financial performance of the firm and between sustainability and firm size even though we do not resolve this link. Our analysis indicates *sector specificity* as regards the relationship between sustainability and financial performance based on the proposed instrument. Also, some aspects of sustainability but not all appear to be positively linked with financial performance. On the other hand, firm size (expressed as revenues) does not affect the measure we developed, as suggested by some of the literature.

Chapter 2. Literature review

2.1 The three dimensions of sustainability

Sustainability is a concept that extends beyond corporate boundaries and thus lacks a defined end-state (Gray, 2001). There is not an agreed upon definition for sustainability (Carter and Rogers, 2008; Moneva et al., 2006; Farneti and Guthrie, 2009). Thus, the most enduring and highly cited definition of sustainability is that of the so-called Brundtland Commission (1987) (Bens et al., 2009; Carter and Rogers, 2008), which describes sustainability as ‘’development that meets the needs of the present without compromising the ability of future generations to meet their own needs’’. Hence, this macroeconomic definition is difficult for organizations to apply, since it provides little guidance on how organizations should effectively identify present and future needs, determine the technologies to meet those needs, and understand how to balance organizational capabilities between multiple stakeholders (Gimenez et al, 2012).

A number of definitions for sustainability have been proposed in the literature, all of which have one thing in common which is that they refer to three components at a higher level: the natural environment, society, and economic performance. We refer to some of the most highly cited definitions of sustainability as captured by operations management literature.

- *To be truly sustainable, an organization would at worst do net harm to natural or human systems while still producing a profit over an extended period of time (Pagell and Gobeli, 2009)*

- *Sustainability includes environmental management, closed-loop supply chains and a broad perspective on triple-bottom-line thinking that integrates profit, people and the planet into corporate culture, strategy and operations (Kleindorfer et al., 2005)*
- *While environmental sustainability emphasizes the management of natural resources, social sustainability is concerned with the management of social resources, including peoples' skills and abilities, institutions, relationships and social values (Sarkis et al.,2010)*

- *Conduct business with a long term goal of maintaining the well-being of the economy, environment and society (Hassini et al., 2012)*
- *Meeting the needs of the firm's direct and indirect stakeholders without compromising its ability to satisfy future stakeholder needs (Dyllick and Hockerts, 2002)*
- *Demonstrating the inclusion of social and environmental concerns in business operations and in interactions with stakeholders (Van Marrewijk, 2003)*
- *Sustainability is usually operationalised through the triple bottom line, a concept developed by Elkington (1998), which simultaneously considers and balances economic, environmental and social issues from a microeconomic point-of-view (Gimenez and Tachizawa , 2010)*

Based on the existing definitions, sustainability dictates that organizations perform well on traditional measures of financial performance as well as on environmental and social performance (Pagell and Gobeli, 2009). This refers to the concept of triple bottom line, which is a holistic evaluation of firms' overall performance, measured by the integration of its environmental, social, and economic performance (Elkington, 1997).

2.2 This study

Sustainability dictates that companies are simultaneously performing well on social, environmental, and economic aspects (Linton et al., 2007; Carter and Rogers, 2008; Seuring and Muller, 2008). As such, it is wise to view sustainability as three overlapping sets of concepts in a Venn diagram rather than as standalone pillars (Sodhi, 2015). An example of an initiative in the overlapping zone is replacing coal with natural gas to produce electricity; such an action reduces the amount of gas releases in the environment, improves the living conditions of the nearby communities, as well as help firms achieve economies of scale through more efficient operations. Figure 2 illustrates the three dimensions of sustainability.

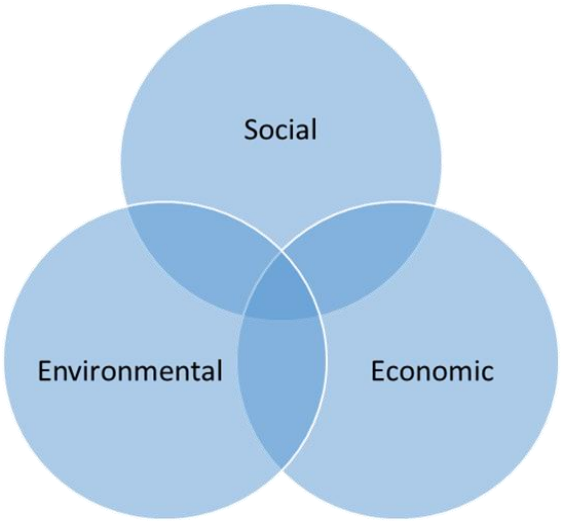


Figure 2. Visual illustration of the intersection of the three dimensions of sustainability

Sustainability reporting is about environmental and sustainability only. It is important to highlight that we do not use sustainability as a single concept (Pagell and Wu, 2009), but treat social and environmental sustainability as two separate distinct concepts that have their own antecedents, processes and outcomes (Pullman et al., 2009). For example, Wall-Mart has some of the most stringent environmental sustainability supply chain practices, but at the same time it is criticized for the treatment of people in the supply chain (Pfefer, 2010). In this study we measure sustainability through the lens of sustainability reporting. Our approach includes developing indicators and organizing them into higher order constructs corresponding to social and environmental sustainability, as illustrated in corporate sustainability reports.

2.2.1 Environmental sustainability

Shrivastava (1995) describes environmental sustainability as ‘’the potential to offer reduced long-term risks associated with resource exhaustion, fluctuations in energy costs, product liabilities, environmental pollution, and waste management issues’’. In a similar context, Moldan et al. (2012) describe environmental sustainability as ‘’ maintaining nature’s services at a suitable level’’. Dyllick and Hockerts (2002) summarize environmental sustainability as ’’consumption of natural resources at a rate below natural reproduction or no

emissions at a rate beyond the capacity of the natural ecosystem to absorb and assimilate these emissions''.

Environmental sustainability recognizes that environmental resources are limited, and thus posits that companies need to reform, redesign, and restructure their operations so as to minimize their negative environmental impact (Shrivastava, 1995). Important issues that environmental sustainability addresses are resources conservation, waste reduction, and decrease in consumption of hazardous materials (Gimenez et al., 2012; Pullman et al., 2009; Montabon et al., 2007; Shrivastava, 2007).

Corporate environmental sustainability is manifested through companies' environmental practices implementation in their daily operations and strategic planning procedures (Closs et al., 2011; Halldorsson et al., 2009; O'Brian, 1999). Environmental practices refer to the set of activities employed by firms to manage and augment their environmental responsibilities and can include any activity that contributes to advancing environmental sustainability (Tate et al., 2013). Klassen and McLaughlin (1996) support the view that environmental practices include all efforts related to minimizing the negative environmental impact of the firm's products throughout their life cycle and range from product development to final delivery and ultimate disposal of the product (Angell and Klassen, 1997; Sroufe, 2003). The need to intensify environmental sustainability practices entails companies changing their activities in their operations and supply chain.

Environmental sustainability in manufacturing

Manufacturing processes constitute a key source of environmental pollution (Shrivastava, 2007; Sarkis, 2001). Efforts to minimize the environmental impact of manufacturing processes can be classified into development of new processes or improvement of existing ones, based on environmental sustainability requirements. Waste reduction and elimination of unnecessary or toxic by-products during the manufacturing processes constitute key factors for achieving environmental sustainability (Zhu and Sarkis, 2004; Closs et al., 2011).

Environmental sustainability in operations

Environmental sustainable operations are related to product manufacturing/ remanufacture, usage, handling, logistics and waste management once the design has been finalized (Shrivastava, 2007). For example, environmental manufacturing processes, both internally and in collaboration with supply chain partners, can lead to reduced raw material consumption as a result of extending product life and/or enhancing product packaging (e.g. use of returnable containers) (Closs et al., 2011; Sarkis, 2001). This activity is known as environmental purchasing (Carter and Jennings, 2004). However, environmental purchasing goes beyond the acquisition of materials that are environmental friendly, and includes also the reconfiguration of used parts and products as well (Sarkis et al., 2001). Firms which have changed their production and distribution activities to reduce or neutralize their carbon footprint could also be included in this category.

Environmental sustainability in supply chain

Integrating environmental sustainability into supply chain management incorporates all stages from product design, material sourcing, manufacturing processes, delivery of the final product to the customers, to the end-of-life management of the product after its useful life (Shrivastava, 2007). A focus on supply chains is crucial for achieving environmental sustainability, as the supply chain considers the product from the initial processing of raw materials to the final delivery to the customer. Logistics and distribution processes are considered to be one of the main causes of environmental degradation, given the fossil fuel consumption and gas emissions. For this reason, firms have changed their distribution processes to reduce their environmental impact. Collaboration with suppliers on environmental issues as well as making sure that suppliers have environmentally certified processes considerably helps to reduce waste and emissions (Closs et al., 2011; Rao and Holt, 2005). Indeed, coffee retailers have introduced sustainability practices such as Fairtrade into their supply chains to ensure better working conditions, developers have incorporated innovative design features into new buildings to reduce

consumption of energy, water, and materials, while manufacturers have added eco-design features in their products.

2.2.2 Social sustainability

The social dimension of sustainability is codified as corporate social responsibility (CSR) (Sodhi, 2015). Social sustainability describes corporations' responsibilities to society and encompasses issues concerning alleviation of poverty and diseases, access to health care and education, and general well-being of society (Closs et al., 2011; Haugh and Talwar, 2010; Sarkis et al., 2010). It also related to the human capital of the firm and encompasses business practices that are fair and favorable to the people affected, either directly or indirectly, by the company (Govindan et al., 2014). Social sustainability requires that firms provide equitable opportunities, encourage diversity, provide training and development seminars to employees, and maintain high occupational health and safety standards (Slaper and Hall, 2015; Branco and Rorigues, 2006).

Social sustainability aims at increasing the positive impact of companies' activities on internal communities such as employees and external groups such as communities and society in general (Pullman et al., 2009; Sarkis et al., 2010). Dyllick and Hockerts (2002) define social sustainability as ''adding value to the communities within which the company operates by increasing the human capital of individual partners as well as furthering the societal capital of these communities''. As such it can be argued that social sustainability can be decomposed into two dimensions; the one is directed internally to the firm and concerns employees, suppliers, and other subcontractors and relevant labor practices, while the other direction is directed externally to the firm and relates to community and social aspects (Sharma and Henriques, 2005).

The internal focus of social sustainability concerns the company's responsibility towards its workforce and includes practices related to health and wellbeing of employees, respect for employees' diversity and provision of equal opportunities, continuous training and development, and provision of high standards of occupational health and safety to employees (Slaper and Hall,

2011; Pullman et al., 2009; Branco and Rodrigues, 2006). Another case of social sustainability internally to the firm is the recognition, value, and promotion of the capabilities of employees using appropriate human resources policies and practices for equity, well-being, and development (Pullman et al., 2009).

The external dimension of social responsibility concerns companies' responsibility towards the communities in which they operate. Involvement in community support activities relates to organizing charity fundraisers, providing donations to vulnerable populations, and undertaking voluntary activities to support local communities.

2.2.3 Economic sustainability

Economic sustainability concerns an organization's economic impact on its external and internal stakeholders in addition to that on economic systems at local, national, and global level (Azapagic et al., 2004). Companies in order to be economically sustainable need to perform well at the micro-level by minimizing costs and maximizing profits and shareholder returns (Closs et al., 2011; Haugh and Talwar, 2010). Thus, the economic dimension of sustainability does not refer only to profitability. It also concerns delivering cash flows that are sufficient enough to maintain liquidity and bring a constant, above the average return to shareholders (Halldorsson et al., 2009; Dyllick and Hockerts, 2002). As such, economic sustainability ought to deal with the bottom line and the flow of money, including such indicators as profits and shareholder returns, but also stock market performance and financial ratios (Azapagic et al., 2004; Wagner et al., 2002).

2.3 Corporate accounting and reporting

All forms of information reaching the public domain from a corporation are considered to be part of corporate accountability (Gray et al., 1995). Corporate accountability involves the responsibility to undertake certain actions and provide an account of those actions to those who desire to know this information (Gray et al., 1996; 2001). An organization is accountable to a broad group of stakeholders, and reporting is a way for organizations to provide evidence of this accountability (Guthrie et al., 2004; Lodhia and Hess, 2014; Carnevale and

Mazzuca, 2014). The consequence of corporate accounting is that firms with better disclosure or accounting quality receive financing on more favorable terms (Francis et al., 2008).

Financial accounting is a tool for the identification, measurement, and communication of financial information. Financial accounting is the product of corporate accountability that measures and regularly discloses audited, quantitative data concerning the financial position and performance of public firms (Bushman and Smith, 2003). At the heart of accounting is the notion of information provided by managers to those outside the organization, typically the owners, for the purposes of accountability and control (Gray, 2006). Financial accounting information enhances the information environment by disciplining the unaudited disclosures and supplying input into the information processing activities of outsiders.

However, traditional accounting has been criticised for focusing on monetary, quantitative measures of corporate economic activities (Burrit and Schaltegger, 2006). In particular, it is argued that financial accounting needs to broaden its scope from financial performance for shareholders to sustainability performance for all stakeholders. That is said because financial accounting has treated environmental goods as being infinite, and as such, the consumption of environmental resources is not reflected in such traditional accounting performance indicators as a cost. Similarly, financial accounting ignores the social costs that an entity may have upon the communities in which it operates (Guthrie and Parker, 1993; Farneti and Guthrie, 2009). Consequently, the concept of sustainability accounting has emerged.

Sustainability accounting involves extending the accountability of companies beyond the traditional role of providing a financial account to shareholders. It draws on the traditional financial accounting principles, but focuses on the disclosure of information about a firm’s environmental and social performance to shareholders and other stakeholders. Sustainability accounting dictates increased public scrutiny of a firm’s environmental and social sustainability

performance and public disclosure of that performance (Al-Tuwaijiri et al., 2004; Burritt and Schaltenger, 2010; Bebbington et al., 2014).

Reporting is a common mechanism deployed by companies to signal important information to shareholders and other stakeholders (O'Dwyer, 2002; Guidry and Patten, 2010; Herremans et al., 1993). It is a means for organizations to foster transparency and accountability among stakeholders (O'Dwyer, 2002; Guidry and Patten, 2010; Herremans et al., 1993).Transparency is a crucial element in building trust, maintaining or improving reputation and managing risks. Stakeholders believe in the power of transparency to better understand business and make informed decisions.

Traditionally, companies have used financial reports as their primary vehicle to inform investors about their financial performance (Gray et al., 1996; Bushman and Smith, 2003). However financial reporting is mainly targeted at shareholders, and thus there is a need to expand the width of reporting to address other stakeholders' expectations too (Carnevale and Mazzuca, 2014; Adams and Frost, 2008; Yongvanich and Guthrie, 2006; Bebbington and Gray, 2001). The acknowledgement that companies are accountable to a diverse group of stakeholders and the decision to address their requirements for information has initiated new forms of reporting.

Sustainability reporting is the response to companies' accountability for environmental and social issues to various stakeholders (Yongvanich and Guthrie, 2006). In this respect, sustainability reporting serves as a mechanism to fulfil and demonstrate accountability and create transparency by providing quantitative and qualitative social and environmental related information to a wide range of non-shareholding stakeholders extending beyond the narrow scope of shareholders, as is the case for financial reports (Hahn and Kuhnen, 2013; Yongvanich and Guthrie, 2006; Kolk, 2004; Gray et al., 1996).

2.3.1 Annual financial reports

Annual financial reports constitute the most widely produced documents by publicly owned companies to inform shareholders, investors, and creditors

about their past financial performance and outlook (Campbell, 2000; Sharma and Henriques, 2005). Financial reports are produced by all public companies at least on a yearly basis (Tilt, 2001) and constitute a communication device that allows a corporation to connect with various internal and external stakeholders (Guthrie and Petty, 2004). Investors, lenders, and other creditors use financial information provided in the annual reports in their decision making process (Aktas et al., 2013).

Annual financial reports consist partly of firms' mandatory disclosure and are controlled by accounting and securities regulators. For this reason, they are required to be audited, as the multiple users of annual reports need to be confident that they provide a true and fair view of the organization's financial performance. For this reason, a system of regulations has evolved to guide and control the content and presentation of published financial information (Guthrie et al., 2004). In particular, at the request of various stakeholders, accounting and securities markets regulators define financial reporting standards. These standards ensure relative uniformity in reporting practices and also provide for minimum disclosure requirements that voluntary disclosure alone cannot satisfy (Berthelot et al., 2003). By establishing financial reporting mechanisms that prompt firms to reveal information, accounting regulations can reduce information asymmetry problems.

In the US, the Generally Accepted Accounting Principles (GAAP) set regulations regarding the disclosure of financial information within the public domain. Some of the existing regulations are statutory and are contained in the Companies Acts. Other non-statutory guidelines are provided in a series of accounting standards which are issued by the Accounting Standards Board. Such standards are Financial Reporting Standards and Statements of Standards Accounting Practice. Financial Reporting Standards contain guidelines on matters ranging from the valuation of assets and accounting for leases to the format of cash-flow statements and accounting for VAT (Walker, 2005). Such standards ensure relative uniformity in reporting practices and provide guidance on minimum reporting requirements (Lev, 1988).

2.3.2 Sustainability reports

This dissertation focuses on sustainability reports. Although reporting can be in annual reports, press releases and other forms of disclosure. Sustainability reporting has emerged as a result of increased stakeholder requirements for transparency and accountability for environmental and social issues (Lodhia and Hess, 2014; O'Dwyer, 2002). Social and environmental sustainability information are reported to non-shareholding stakeholders either as part of the annual reports or as standalone sustainability reports (Bebbington et al., 2008; Daub et al., 2007). Till the mid-90s, it was most common to see social and environmental information incorporated in annual reports (Daub et al., 2007). However, in recent years the increased social and environmental challenges have generated pressures for companies to adopt a more systematic approach to sustainability reporting, by producing a separate sustainability report. A sustainability report is a corporate report, and provides social and environmental related information to the various stakeholders in a way comparable to annual reports (Habek, 2013; Roca and Searcy, 2012; Reddy and Gordon, 2010; Lozano and Huisingh, 2011).

Sustainability reports are public documents. Depending on the issue addressed, different stakeholders are targeted: investors, employees, customers, suppliers, regulators, nongovernmental organizations, and local communities (Donaldson and Preston, 1995; Carnevale and Mazucca, 2014; Cormier and Magnan, 2007). Table 1 visually illustrates all internal and external stakeholders that are affecting companies.

Companies with superior sustainability performance that initiate sustainability disclosure attract dedicated institutional investors and analyst coverage (Dhaliwal et al., 2011). Carnevale and Mazucca (2014) show that investors consider sustainability reports in their investment decisions, as the complementary information included in sustainability reports reduces information asymmetries and enables investors make more efficient and less risky decisions.

Sustainability reporting enables external stakeholders to understand the organization's true value and tangible and intangible assets (GRI, 2013). To begin with, suppliers are considered to be crucial partners, as they are in the position to support the social and environmental efforts of companies (Seuring and Muller, 2008). For this reason, companies present social and environmental sustainability information about their supply chain in their sustainability reports (Tate and Ellram, 2010; Russo and Fouts, 1997). Indeed, there is information asymmetry between supplier and management policies, and thus, whenever a firm invests in communication assets such as sustainability reports to share information about events that may affect the supply chain, this privileges supply chain members with private information (Wieland et al., 2013). Customers also constitute important stakeholders, as they have increasing social and environmental requirements. Companies need to understand the needs of their end customers, as this acts a crucial aspect in creating value. (Yu et al., 2014). For this reason, companies provide specific consumer- oriented information in sustainability reports (Tate and Ellram, 2010).

Table 1. Summary of internal and external stakeholders that are affected by companies' operation

Internal Stakeholders	External Stakeholders
Employees	Shareholders
Managers	Society
Owners	Government
	Creditors
	Suppliers
	Customers

Till recently, sustainability reporting was a purely voluntary release by companies. However, it has recently become a mandatory practice for large public listed European and North American companies. This legislation has already been put in practice in the Netherlands, Denmark, France, UK, and

recently in Greece for public listed companies that have more than 500 employees. Such legislation is the result of increasing investor interest in material non-financial disclosure, and stock exchanges have a key role in this transition.

Daub (2007) defines a sustainability report as ‘’a report that contains qualitative and quantitative information on the extent to which the company has managed to improve its economic, environmental, and social effectiveness and efficiency in the reporting period and integrate these aspects in a sustainability management system’’. Berthelot et al. (2003) define sustainability reporting as a platform for providing non-financial information on issues related to the natural environment, health and safety, corruption, and human rights. A similar definition is given by the World Business Council for Sustainable Development (WBCSD, 2002), according to which sustainability reports are published by companies to inform internal and external stakeholders on the corporate position and its policies, plans, and activities on economic, environmental, and social dimensions (Roca and Searcy, 2012). Soderstrom (2013) defines sustainability reporting as the communications that companies make regarding their corporate social responsibility (CSR) activities, including social and environmental impacts in addition to financial performance. Finally, Ioannou and Serafeim (2016) define a sustainability report as ‘’ a firm issued general purpose non-financial report providing information to investors, stakeholders, and the general public about the firm’s activities around social, environmental, and governance issues, either as a standalone report or as part of an integrated report.

It is quite interesting that most definitions on sustainability reporting incorporate the social, environmental, and economic dimensions of corporate performance. However, the focus of sustainability reports based on actual content is on the social and environmental dimensions only as the economic dimension is fully captured by annual reports. Maybe this has to do with the fact that companies tend, though not always, to include in their sustainability reports a summary of

their key financial performance figures, as well as information on their human and social capital, and their corporate governance structure.

2.3.3 Integrated reports

Integrated reports constitute the new type of reporting, as they combine analysis of financial and non-financial performance. Integrated reports integrate economic, environmental, and social information in a concise format, enabling a breakdown of the different silos in an organization (Lodhia and Hess, 2014). Integrated reports are part of the voluntary disclosure and they by no means replace financial reports. The rationale behind integrated reporting is to engage stakeholders in social, environmental, and governance issues. Integrated reports are increasingly being advocated as a way to ensure that firms are held accountable for their impact on environment and society (Eccles et al., 2014). The first companies that produced integrated report were the Danish enzymes company Novozymes (2002), the Brazilian cosmetics fragrances company Natura (2003), and the Danish pharmaceutical company Novo Nordisk (2004).

Integrated reporting has been developed and promoted by the International Integrated Reporting Council (IIRC), which is a global coalition of regulators, investors, companies, standard setters, accounting and non-governmental organizations. These reports include both financial and non-financial information about companies' performance and future prospects by considering the three dimensions of sustainability together (Eccles and Saltzman, 2011; GRI, 2013; Hughen et al., 2014). Typical narratives in integrated reports are the quantity of water that a company uses per unit of production compared to its competitors; the extent to which energy- efficiency programs reduce carbon emissions and lower the costs of production; or the impact of training programs on workforce productivity, lower turnover, and overall employee turnover.

2.3.4 Analogy between sustainability reports and annual reports

Based on signalling theory (Healy and Palepu, 2001; Verrechia, 1983), firms disclose information to their stakeholders including investors as well as customers and suppliers. These stakeholders could act in ways to improve

financial accounting measures that are also disclosed in annual reports and income statements. As such, there is a case for linking financial as well as sustainability disclosure. Causality could be argued in either direction but we only investigate the link.

We refer to them simultaneously as both types of disclosure (financial and sustainability) are part of corporate reporting and accountability. It is not true that that these are targeted at different stakeholders because investors also consider the information included in sustainability reports in their investment decisions, not only annual or other accounting reports (Carnevale and Mazucca, 2014). The reason we consider them together is to illustrate that accountability has broadened from focusing purely on financial performance to sustainability performance. Also, sustainability reports are publicly available just like annual reports. Semenova et al (2010) find that sustainability disclosure is value relevant and is complementary to financial information, while Carnevale and Mazzuca (2014) support that sustainability reports and financial statements provide complementary information.

Hence, a fundamental difference between sustainability reports and financial reports is that annual reports are already standardized while sustainability reports are not yet. Given though the pressure for sincerity and transparency, reporting guidelines and assurance standards such as AA1000 Assurance Standard and Global Reporting Initiative (GRI) have been developed to improve sustainability reports' credibility. Nevertheless, assurance remains voluntary thus far (Montabon et al., 2007).

Despite their differences, the two types of reports have common foundations. GRI guidelines are inspired by the principles of traditional financial reporting developed by the International Accounting Standards Committee (IASC, now known as the International Accounting Standards Board (IASB)), the main international standard–setting organization for financial reporting. The second version of GRI guidelines (2002) depicts graphically the comparison between sustainability and financial reporting. Figure 3 illustrates the hierarchy of accounting qualities developed in 1980 by the Financial Accounting Standards Board (FASB) in a statement of Financial Accounting Concepts. By comparing

the two reporting principles we see that the GRI and FASB principles share similarities.

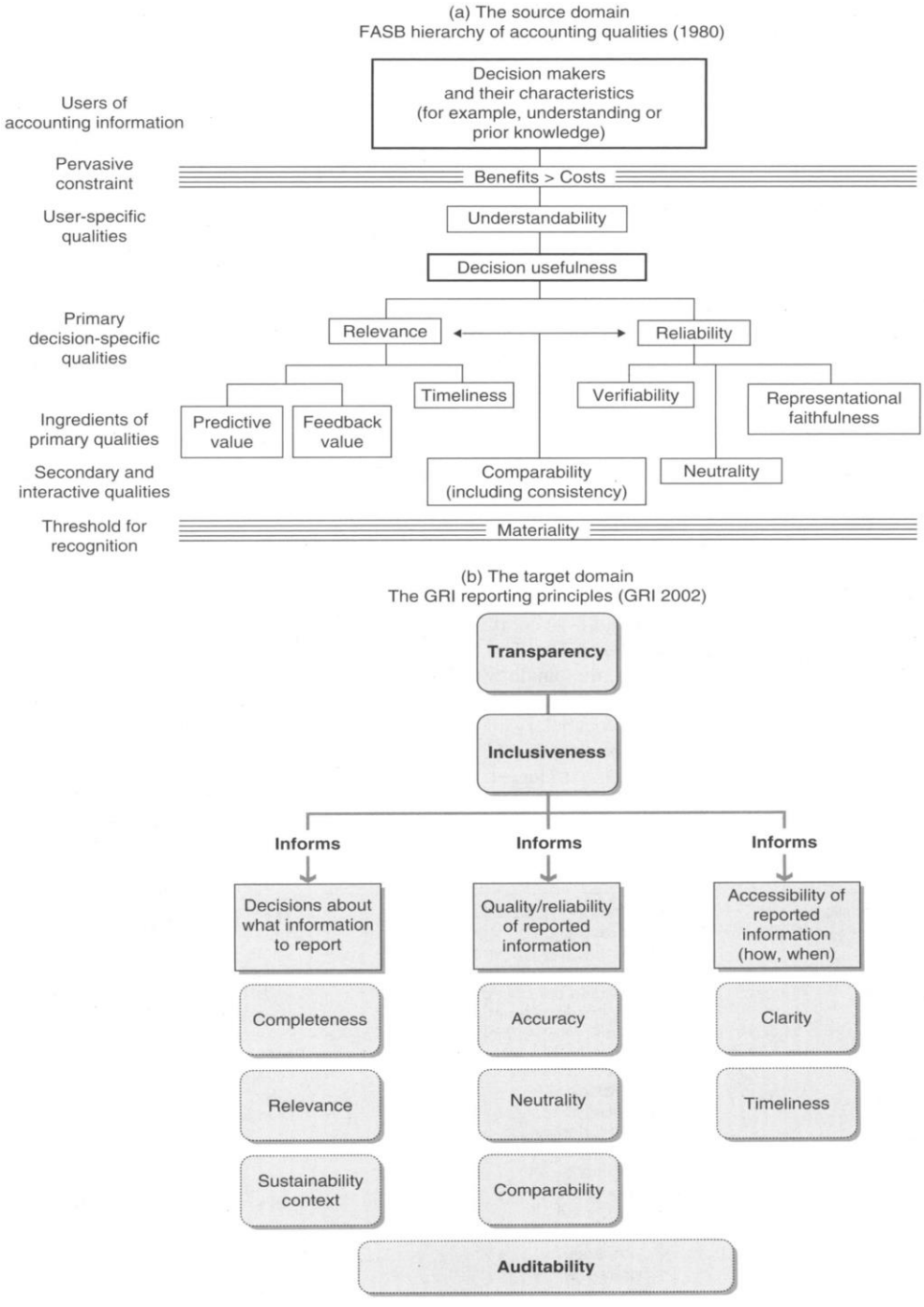


Figure 3. Analogy between between GRI and FASB Reporting Principles illustrating the common rationale behind financial and sustainability reporting (Etzion and Ferraro, 2010)

In all, financial reports have a certain degree of credibility, as they all go through the same auditing process. Sustainability reports on the other hand do not yet have definite rules concerning their content and structure. Thus they show a tendency towards standardization and are increasingly becoming similar to financial reports (Jenkins, 2006). In addition, third party verification is another means of increasing the credibility of information provided in sustainability reports.

2.4 The evolution of sustainability reporting

Social Reports

USA and European society in the 1960s and 1970s was mainly concerned for social issues, as the physical environment had not gained importance yet. The concern about social issues resulted in social reporting, which is seen as response to introduce social accounting or produce social balance sheets. In most cases, social reporting were incorporated in annual reports. In the late 1970s nearly 90% of the Fortune 500 published socially orientated information in their annual reports. Gray et al. (1995) conducted a content analysis of UK social reports for the years 1979-1991 and identified four broad categories in UK companies' disclosures; employees, community, customers, and a handful of environmental issues. The social reporting lost momentum in the 1980s (Gray et al., 1995).

Environmental Reports

By the late 1980s the focus of nonfinancial reporting shifted to environmental reporting, either as part of the annual report or as a separate document, as a response to environmental disasters. The first separate environmental report was first published in the late 1989, and this trend intensified in the 1990s, particularly in Europe and North America (Kolk, 2004; Wheeler and Elkington, 2001). Already from the late 1960s, environmental catastrophes had brought environmental issues to the forefront. The Bhopal incident in 1984 is generally credited as the catalyst for the initiation of US *Emergency Planning and Community Right-To-Know Act* in 1986, which required corporations to report

releases of more than 320 toxic substances. The resulting Toxics Release Inventory (TRI) was made available to the public on the US EPA website.

Environmental and Social reports

In late 90s companies started considering social and environmental issues simultaneously in a joint report which was published separately from financial reports. These reports were at the time were called either ‘’health and safety’’ (environmental reports’ closest relative), ‘’Corporate Citizenship’’, or ‘’corporate (social) responsibility’’ reports. Almost thirty years ago, companies switched from ‘social and environmental reporting’ to the more up to date term ‘sustainability reporting’, which is still used today (Adams and Gonzalez, 2007; Roca and Searcy, 2012; Reddy and Gordon, 2010).

2.5 Why companies are publishing sustainability reports

According to stakeholder theory, organizations are expected to take on activities to satisfy stakeholders’ expectations (Guthrie et al., 2004). Following legitimacy theory, which is closely connected to stakeholder theory, companies, in order to gain legitimacy among the different stakeholders, have to continuously demonstrate that they conform to stakeholder requirements. This is often achieved though communication via company prepared reports, as social and environmental activities are not easy to observe (Lodhia and Hess, 2014; Carnevale and Mazzuca, 2014; Guthrie et al., 2004).Organizations are depending on their stakeholders to survive; hence managers signal their sustainability initiatives to key stakeholders, via release of sustainability reports, in order to signal their sustainability practices to their stakeholders (Golob and Barlett, 2007; Asif et al., 2011; Manetti, 2011).

Sustainability reporting is also closely connected with building trust, reputation and credibility with stakeholders (Benau et al., 2013; Flammer, 2013; Adams and Frost, 2008; Branco and Rodrigues, 2006). In particular, sustainability reporting has the potential to enhance the reputational capital of the issuing company through gaining stakeholder support (Guidry and Patten, 2010; Herremans et al, 1993). In particular reputation is expected to have an impact on share price, increase in staff pride and loyalty to the company, as well as

competitive advantage in the market place (Adams and Frost, 2008; Klassen and McLaughlin, 1996).

Additionally, it is possible that investors view sustainability reporting as a means for achieving greater innovation or first move advantage though disclosure; as such sustainability reports are seen as tool that helps companies gain a competitive advantage by attracting investments, initiating new activities, entering new markets, or negotiating contracts (GRI, 2013; Berthelot et al, 2012; Morhardt et al., 2002; Branco and Rodrigues, 2006; Kolk, 2004). Finally, monitoring and reporting of environmental and social performance, prompts companies to continuously track and comply with regulatory requirements, and consequently reduce (future) compliance costs (Kolk, 2004; Waddock and Graves, 1997).

2.6 Literature gap

Till now, limited research has been conducted on the exhaustive list of operational sustainability practices that companies are disclosing in the sustainability reports (Berrone et al., 2013; Roca and Searcy, 2012; Adams and Frost, 2008; Daub, 2007; Tate et al., 2006). Although a number of voluntary guidelines on corporate sustainability reporting have been released, each emphasizes different social and environmental sustainability practices. In essence, the various reporting guidelines do not overlap with each other. As such, different interpretations may arise out of all these guidelines, resulting in a lack of consistency in the sustainability practices reported by companies. Global Reporting Initiative provides the most extensive list of reporting indicators and is the most commonly adopted one. However, GRI guidelines have a great deal of latitude, and thus a plethora of indicators can be obtained. This results in different interpretations and expectations as to sustainability reporting indicators (Moneva et al., 2006). Also, given the fact that sustainability reporting is not standardized and there are not specific rules as for the particulars that ought to be reported, companies are selective about the material they include in their reports (Jenkins and Yakovleva, 2006).

Further to that, research so far has mainly focused on studying the evolution of reports' content quality, investigating which industries or countries are most highly engaged in sustainability reporting, or evaluating the degree of reports' conformity to the GRI guidelines indicators (Skouloudis and Evangelinos, 2009; Leszczynska, 2012; Aktas et al, 2013; Roca and Searcy, 2012).

We see the vast majority of existing research has focused on the degree of reports' conformity with the GRI guidelines so far. Thus far, the majority of studies are using GRI guidelines as a basis to examine what sustainability practices companies are reporting. Only a few studies use practices extending beyond those included in GRI. This is an important issue as indicators play a critical role in communicating companies' sustainability goals (Kozlowski et al., 2015). To begin with, Tate and Ellram (2010) have looked at sustainability reports extending beyond GRI guidelines. However, they study sustainability solely in the supply chain management context, and thus focus on identifying environmental and social themes purely related to supply chain. Tate et al. (2010) also look at 100 sustainability reports using automated software in order to explore themes related to supply chain sustainability, and next, they compare the themes' disclosure according to the companies' geographic location and revenues. Rondinelli and Berry (2000) also implemented content analysis of 38 sustainability reports in order to explore what environmental practices companies are reporting. However, they do not refer to the procedure followed to implement content analysis, and no attempt is made to statistically analyse the data collected from the reports analysis. Montabon et al. (2007) also conduct content analysis by looking at 45 corporate sustainability reports to explore a set of 20 environmental management practices that have been identified from the literature. Next, they examine the relationship between the environmental practices and four measures of firm performance.

In this study, we extent our scope beyond purely analysing what operational companies disclose in their sustainability reports. Instead, we implement content analysis of sustainability reports to develop an instrument for sustainability disclosure based on content analysis of sustainability reports. Our way of measurement extends beyond counting the number of words, sentences, or pages, as several studies have done so (Cowen et al., 1987; Patten, 1991;

Roca and Searcy, 2012; Deegan, 2002; Milne and Adler; 1999; Hackston and Milne, 1996). Instead, we score sustainability reports on a list of sustainability practices identified in the literature in order to create an instrument for sustainability disclosure based on reported operational practices. Next, we check whether our developed measure is consistent with other established measures of sustainability performance, namely ESG and DJSI.

In addition, we examine the link between our developed measure and financial performance. The relationship between social and environmental sustainability and financial performance has been extensively examined in the literature. At a theoretical level, we expect that there is a positive association between social and environmental sustainability practices and financial performance. A conceptual review of existing literature is presented below.

Environmental sustainability and financial performance

The relationship between environmental sustainability and firm financial performance has been extensively studied and thus remains controversial (Russo and Fouts, 1997; Waddock and Graves, 1997; Griffin and Mahon, 1997; Orlitzky et al., 2003; Wang and Sarkis, 2013). To begin with, organizations are increasingly engaging in environmental sustainability initiatives, primarily as a result of compliance to external regulations (Sarkis, 2001). Thus, environmentally sustainable practices can bring about enhanced competitive advantage, product quality improvements, and lower manufacturing costs through reduction in the usage of raw materials, water, and energy (Tate et al., 2013; Klassen and McLaughlin, 1996; Wagner et al., 2002; Port and van der Linde, 1995; Branco and Rodrigues, 2006; Rondinelli and Berry, 2000; Yu et al., 2014). The concept referring to the relationship between environmental sustainability and firms' value added is called eco-efficiency (Dyllick and Hockerts, 2002).

To begin with, minimization of both hazardous and non-hazardous waste results in better utilization of natural resources, improved efficiency, and reduction of operating costs (Rao and Holt, 2005). Also, reduction of material and energy consumption typically lead to savings in resources and thus leads to competiveness and higher levels of financial performance (Klassen and

McLaughlin, 1996); similarly, reduction of packaging waste and the ability to design for reuse and disassembly brings about cost savings (Hart, 1995; Shrivastava, 1995).

Collaboration with suppliers also generates competitive advantage in the form of risk reduction (Porter and van der Linde, 1995). Supplier assessment allows firms to evaluate suppliers' performance and reduce the risk of suppliers' acting illegally or unethically (Gimenez and Sierra, 2012). Indeed, establishment of long-term relationships with suppliers reduces the risk of opportunism for both the purchaser and the suppliers (Port and Van der Linde, 1995; Zsidisin and Siferd, 2001). Additionally, reduced costs, shorter lead times, and better product quality are associated with implementation of ISO 14000 (Carter and Rogers, 2008).

Finally, over the last two decades a number of regulations for environmental protection have been imposed on corporations. Companies that effectively address environmental issues can proactively shape future regulations, leading to a difficult to replicate competitive advantage (Carter and Jennings, 2003). For instance, elimination of oil spillages and other environmentally damaging effects reduces liability costs. Thus, environmental sustainability can bring about lower costs in the form of charges and fines for breaking environmental regulations (Gimenez et al., 2012; Branco and Rodrigues, 2006; Shrivastava, 1995).

Social sustainability and financial performance

There have been only a limited number of studies on the link between social sustainability practices and financial performance (Pullman et al., 2009; Waddock and Graves 1997). The term that describes the relationship between social sustainability and firms' value added is called socio-efficiency (Dyllick and Hockerts, 2002).

Gimenez et al (2012) propose that firms that engage in social sustainability activities are associated with increased economies of scale. For example, an enlightened employee relations policy can result in substantial gains in labor costs and productivity through increased employee retention, thus yielding a competitive advantage compared to less responsible firms (Brown, 1996;

Pulman and Maloni, 2009). Similarly, improved working conditions and implementation of health and safety programs can increase motivation and productivity, and thus reduce the absenteeism of personnel and number of accidents, resulting in reduced labour costs (Carter and Rogers, 2008; Gimenez et al., 2012; Kleindorfer et al., 2005).

Finally, the social sustainability activities not only bring about financial benefits to the firm, but also improve the company's reputation and appeal to new customers (Gimenez et al., 2012; Lambeti and Letteri, 2009). The benefits of a strong reputation include greater access to capital, reduced operating costs, improved financial performance, and enhanced brand image. Indeed, social sustainability practices are related to achieving increased sales and customer loyalty, increased productivity and quality, an enhanced ability to attract and retain customers, and reduced control by regulatory agencies (Rondinelli and Berry, 2000; Fobrun, 2005).

Despite the expectations from the literature, empirical analysis provides mixed results as for the relationship between sustainability performance and financial performance. To begin with relationship between established third party sustainability ratings and financial performance outcomes is extensively examined in the literature providing inconclusive results (Waddock and Graves, 1997; Russo and Fouts, 1997; Orlitzky et al., 2003; Wagner et al., 2002; Soana, 2011; Wang and Sarkis, 2013). In addition, other studies have used reputational scales (Abbott and Monsen, 1978).

In this study, we measure social and environmental sustainability through sustainability reporting and explore its link with financial performance. With this analysis we aim at investigating whether sustainability reporting can shed light on the inconclusive relationship between sustainability and financial performance. To this end, we develop constructs for social and environmental sustainability and link them to financial performance outcomes. This analysis is based on the idea that the implementation of sustainability practices should be reflected in an increase in revenues (Lopez et al., 2007). Some of the literature suggests that both social and environmental sustainability practices are positively associated with higher corporate financial performance, either in the

form of cost reduction or increasing revenues (Churet and Eccles, 2014; Hughen et al., 2014; Pullman et al., 2009; Melnyk et al., 2003; Westlund, 2001; Closs et al., 2011; Orlitzky et al., 2003; Wagner et al., 2002).

Thus far, the relationship between distinct social and environmental sustainability practices and firm financial performance using empirical data remains relatively unexplored (Berrone, 2013; Pullman et al., 2009). Pullman et al. (2009) examine the link between social and environmental practices and financial performance, using cost performance as a proxy. Pagell and Gobelli (2009) work in a similar context as they examine the link between social and environmental sustainability and operations performance outcomes (lead time, quality, and innovation as proxies). This study though, does not consider any measure of financial performance. Based on the idea of Pullman et al. (2009), we investigate whether there is a link between distinct reporting social and environmental sustainability practices and financial performance.

As such the research question of this study is formulated as following:

RQ: What is the value of the disclosure in sustainability reports?

This research question is split into the following three research objectives:

- RO1: Develop a measure using sustainability reports and explore its attributes
- RO2: Check consistency of this measure with existing measures of sustainability performance that are already accepted in practice and in reserach
- RO3: Explore whether the measure developed in this study shed light on the inconsistent results in the literature on the link of sustainability performance with financial performance and firm size.

Figure 4 graphically illustrates our research question and objectives:

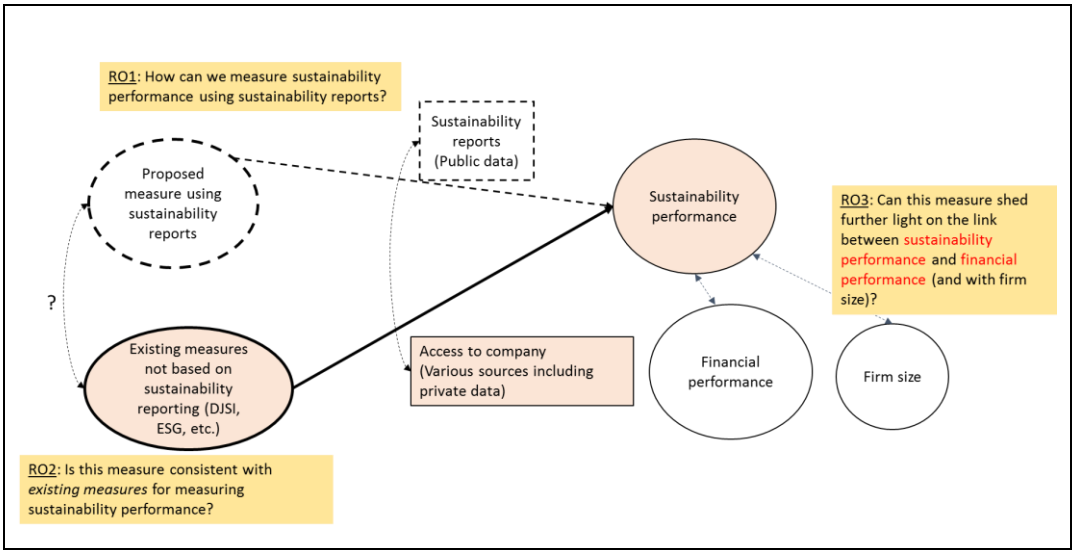


Figure 4. Graphical illustration of research question and objectives for this study showing the link between sustainability reporting and existing measures to sustainability performance

In the next chapter we review the operations management literature and conceptually identify operational practices underpinning the social and environmental dimensions of sustainability.

Chapter 3: Operational practices to capture companies' sustainability efforts

The disclosure of social and environmental activities extends the scope of accounting beyond the purely financial, as companies are urged to become accountable and transparent to a wider audience (non-financial stakeholders) than simply to shareholders (Gray et al., 1996; Eccles et al., 2014). By focusing on the relevant literature and reporting guidelines, we are looking at what are companies expected to report on sustainability, relative to existing guidelines.

A list of list social and environmental sustainability practices is identified from the existing operations management literature and reporting guidelines, including GRI. We synthesize from the literature a list of operational practices trying to make it as much wide as possible in order to be able to extract as much information as possible. In particular, we obtain from the literature the operational practices (indicators) that have been used in the academic literature and reporting guidelines thus far as performance measures of social and environmental sustainability.

3.1 Sustainability reporting guidelines

A number of voluntary guidelines and frameworks for corporate sustainability reporting have been developed to provide companies with guidance on how to report their sustainability practices and strengthen the confidence in the data provided as well as increase reporting transparency and sincerity (Jenkins and Yakovleva, 2006).

The commonly adopted guidelines are the ones produced by the Global Reporting Initiative (GRI). GRI was established in 1999 following the model of the US financial reporting system (FASBI) in response to a lack of unified system for sustainability reporting (Nikolaeva and Bicho, 2011). GRI serves as a framework for providing guidance about the disclosure of sustainability performance (Leszczynska, 2012), as it organizes sustainability reporting according to the social, environmental, and social performance. GRI is aiming to standardize sustainability reporting through the development of guidelines (Etzion and Ferarro, 2010). There are still not generally accepted accounting

or auditing standards for sustainability reporting. Thus, companies can voluntarily choose to have their sustainability reports assured or externally verified. Auditors verify indicators related to materials consumption, emissions, total energy used, fatal injuries, and environmental incidents. Social indicators fall outside the scope of auditors, as they are harder to quantify (Jenkins and Yakovleva, 2006).

The first official version of GRI guidelines was published in 2000 and the latest version (G4) was launched in 2013 and will remain valid until 30 June 2018. Indicatively, some examples of indicators for the three aspects of sustainability are:

- Financial: earnings, market presence, acquisitions, wages and benefits, expenditures on R&D, investment in training, job creation, and forms of human capital investment
- Environmental: Effect of the company's products and processes on air, water, land, biodiversity, and human health
- Social: health and safety in the workplace, employee retention, employees' wages, human rights and diversity, and working conditions

United Nations Global Compact (part of the United Nations Environment Programme) has also published a set of guidelines for reporting on sustainability. The United Nations Global Compact is a leadership platform for the development, implementation, and disclosure of responsible corporate policies and practices. United Nations global Compact aims at helping businesses align their operations and strategies to10 universally established sustainability principles in the areas of *human rights, labour, environmental protection and anti-corruption*.

AccountAbility is a non-profit network that includes businesses, civil and private organizations that work together to promote stakeholder engagement, encourage responsible competitiveness, foster collaborative governance, and set sustainability standards such as the AA1000 set of standards. The AA1000 is a series of principle-based standards to help organizations become more

accountable, responsible and sustainable. These standards address issues related to corporate governance, business models and organizational strategy, as well as provision of guidance on sustainability assurance and stakeholder engagement (Freundlieb et al, 2014). The AA1000 AccountAbility Principles Standard (AA1000APS) provides a framework for organizations to identify, prioritize and respond to their sustainability challenges. These principles have been used by leading companies since 2008 and are compatible with other sets of principles in the marketplace, such as the UN Global Compact, GRI and ISO 14031. The AA1000 Series of Standards is based on the following three principles**:**

1) **The Principle of Inclusivity:** For an organization that accepts its accountability to those on whom it has an impact and who have an impact on it, inclusivity is the participation of stakeholders in developing and achieving an accountable and strategic response to sustainability.
2) **The Principle of Materiality:** Materiality is determining the relevance and significance of an issue to an organization and its stakeholders. A material issue is an issue that will influence the decisions, actions and performance of an organization or its stakeholders. In order to make the right decisions and actions, an organization and its stakeholders need to be aware of the issues that are material to the sustainability performance of the organization.
3) **The Principle of Responsiveness:** Responsiveness is an organization's response to stakeholder issues that affect its sustainability performance and is realized through decisions, actions and performance, as well as communication with stakeholders.

Finally, the International Organization for Standardization (ISO) has released a set of standards to improve the consistency of organizational and management systems. The IS0 9000 series was introduced in 1988 as a way for organizations to implement quality management and assurance, while the ISO 14000 series was introduced in 1996 to provide practical tools for organizations to manage their environmental responsibilities. ISO 26000 was introduced in 2010 and is a concept providing guidance on how companies can operate in a

socially responsible way. ISO 26000 comprises of seven core subjects of social responsibility. These are presented in Table 2.

Table 2. The seven principles of ISO 26000 for social responsibility

1. Organizational Governance	Principles and decision -making structures of social responsibility
2. Human Rights	Discrimination and vulnerable groups, child labor, resolving grievances, civil and political rights, human development and training in the workplace
3. Employment and labor practices	Employment relationships, conditions of work, relationships, social protection, health and safety
4. Environment	Pollution prevention, sustainable resource use, environmental impact assessment, use of environmentally sound technologies and practices, sustainable procurement, biodiversity protection
5. Fair Operating Practices	Anti-corruption, responsible political involvement, social responsibility in the supply chain, fair competition
6. Consumer Issues	Fair marketing, protecting consumers' health and safety, sustainable consumption, consumer support, education and awareness
7. Community Involvement & Development	Community involvement, employment creation, wealth and income development, technology development, health, social investment

3.2 Conceptual development

In this chapter we conceptually developing measures for environmental and social sustainability concepts. To our knowledge, there is no existing study that has developed comparable constructs for social and environmental sustainability. Construct development is at the core of theory building and in this study we aim at developing sustainability constructs with an initial set of sustainability indicators. Thus far, sustainability has been treated as a one-dimensional concept using Environmental Protection Agency Toxic Release Inventory as one of the most common measures.

Sustainability is not a single overarching concept; instead, it is a multidimensional concept decomposed into the social and environmental concepts, which are further decomposed into sustainability practices (indicators) (Lamberton, 2005). Indicators are a way of measurement along specific and narrowly understood aspects of the concepts sought to be understood, in this case, environmental and social sustainability. The purpose of using social and environmental indicators is to help measure and provide information on companies' sustainability performance, by translating sustainability practices into quantifiable measures (GRI, 2013; Sodhi and Yatskovskaya, 2014).

Much of the existing literature treats sustainability as a single concept (Pagell and Wu, 2009; Pullman et al., 2009; Marshall et al., 2017). Instead, we treat environmental and social sustainability as two separate concepts, thus addressing a significant gap in the literature (Seuring and Muller, 2008; Pagell and Gobelli, 2009; Ashby et al., 2012). The gap refers to the fact that current literature has generally overlooked the social dimension of sustainability (Ashby et at al., 2012; Pagell and Gobeli, 2009; Pullman et al., 2009; Hutchins and Sutherland, 2008; Linton and Klassen, 2007), contrary to the environmental dimension of sustainability, which is substantially better represented in the existing literature. We separate the two concepts and examine the practices underpinning the two concepts. This way we create an exhaustive measurement system for social and environmental sustainability.

As such, we synthesize the literature, and together with the GRI, KLD, and UN Global Compact sustainability reporting guidelines, we create a list of distinct environmental and social sustainability indicators, to capture sustainability for the purpose of reporting to shareholders and other stakeholders.

3.2.1 Frameworks for environmental sustainability

1) Linton and Klassen (2007) discuss the incorporation of environmental sustainability into supply chains, and thus, they propose the following categories along the supply chain; production, consumption, customer service, and post-disposal disposition of products. The framework is quite comprehensive, however, it is product manufacturing and disposal centric, and thus fails to include a wide latitude of environmental practices that extend beyond the supply chain. We present Linton and Klassen framework in Table 3.

Table 3. Conceptual framework for environmental sustainability in the supply chain linking supply chain stage with environmental activities (Linton and Klassen (2007)

Stage	Activities
1.Product Design	Resource depletion and environmental impacts (LCA)
2.Manufacturing byproducts	Reduction of by-products through (clean process technologies, lean manufacturing TQM, waste recycling)
3.Byproducts during product use	Product management through extended producer involvement and responsibility

4.Product life extension	Minimize depletion for resources through activities such as remanufacture
5.Product end of life	The disposition of the product at the end of its life is largely dependent on the degree to which the initial product can be reused, recycled, remanufactured, or incinerated
6.Recovery processes at end of life	Remanufacturing, recycling, refurbishing

2) GRI (2013) uses a hierarchical framework, which consists of categories, sub-categories, and aspects. Environmental category includes 12 aspects. GRI is the most detailed framework, incorporating a wide latitude of indicators across the environmental aspects, however, not all of them are easy to evaluate (Labuschange et al., 2004) (Table 4, Appendix 1).

Table 4. Aspects on the environmental sustainability category provided by GRI guidelines (GRI, 2013)

GRI Environmental category	
Materials	Materials used by weight, percentage of recycled materials used
Energy	Energy consumption within and outside of the organization
Water	Total water withdrawal by source, volume of water recycled and reused
Biodiversity	Services provided in protected areas of high biodiversity
Emissions	GHG, ODS, NOx, and SOx emissions
Effluents and Waste	Total amount of waste disposed

Products and Services	Percentage of products sold and their packaging materials
Compliance	Monetary value of significant fines for noncompliance with environmental regulations
Transport	Environmental impact of transporting products
Total environmental protection expenditures	Total environmental protection expenditures
Supplier Environmental Assessment	Percentage of suppliers that are screened using environmental criteria
Environmental Grievance Mechanisms	Number of grievances about environmental impacts filed through formal grievance mechanisms

3) United Nations Global Compact has published, too, a set of guidelines for reporting on sustainability. It consists of 10 universally established sustainability principles in the areas of *human rights (Principles 1 and 2), labour (Principles 3-6), environmental protection (Principles 7-9) and anti-corruption* (Principle 10) (United Nations Global Compact, 2013). The ten principles of United Nations Global Compact are presented in Appendix 1.

4) Closs et al. (2011) have also conceptualized environmental sustainability using three categories. The framework provided by Closs et al. provides a good start to define environmental sustainability using specific indicators underlying the higher order constructs. However, their research is limited to only nine environmental practices. Figure 5 presents the framework developed for environmental sustainability developed by Closs et al. (2011).

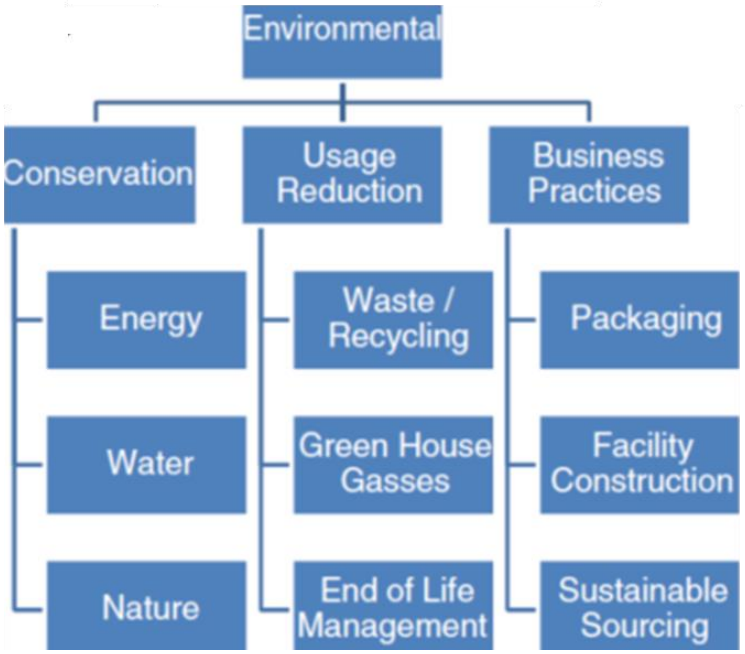


Figure 5. Categories and indicators underpinning environmental sustainability (Closs et al., 2011)

There are guidelines and literature frameworks for defining environmental sustainability categories and indicators, but they do not overlap seamlessly so we need to take them as a starting point and narrow down to those that seem to be more relevant by looking at what indicators companies are reporting. As such, as a start, we synthesize form literature the various social indicators and organize them under the following proposed constructs for social sustainability. Table 5 presents the conceptual constructs we developed for environmental sustainability for the purpose of reporting.

Table 5. Proposed constructs for environmental sustainability reporting as taken from literature

Construct	Source
Emissions	GRI (2013)
Supply chain	GRI (2013); Pagell and Wu (2009); Zhu and Sarkis (2004)
Materials conservation	Closs et al. (2011); Rondinelli and Berry (2000); GRI (2013)
Recovery processes	Pullman et al. (2009); Stroufe (2003)
Manufacturing and operations	Linton and Klassen (2007); Closs et al. (2011); Rondinelli and Berry (2000)

3.2.2 Conceptual development of environmental sustainability indicators

Similarly to the social sustainability indicators, we are organizing the list of environmental indicators into the higher order categories we identified in the previous section. As such, we are proposing the following conceptual framework as regards the expectations on environmental sustainability reporting. The list of social sustainability indicators derived from the literature are presented in Table 6.

Table 6. Summary and definitions of environmental sustainability indicators underpinning the five conceptual constructs

Emissions

Indicator	Definition	Reference
Reduce carbon footprint	• Minimize emissions of carbon dioxide (CO_2), which is the primary greenhouse gas emitted as a result of human activities	(Ageron et al., 2012)
Reduce fuel consumption	• Minimize fuel use for a particular vehicle, and is given as a ratio of distance travelled per unit of fuel consumed	(Goose, 2013)

Reduce GHG emissions	• Minimize the three scopes of greenhouse gases emissions (direct, energy indirect, other indirect) emissions over the entire lifecycle of a product	(Halldorsson et al, 2009)
Reduce other gases emissions	• Minimize the total amount of significant air emissions of gases such as NOx, SOx, PM, VOC, SO2	(GRI, 2013; Wagner et al., 2002)
Toxics Release Inventory	• Measure and participate into the Toxics Release Inventory (TRI), which tracks the management of over 650 toxic chemicals that pose a threat to human health and the environment	(Klassen and McLaughlin, 1996)
Response to oil Spills	• Eliminate Spillages, which are emergency environmental crises with social and environmental impacts, that often require assistance from local and state principles	(EPA, 2013; GRI, 2013; Klassen and McLaughlin, 1996)

Supply chain

Indicator	**Definition**	**Reference**
Assess/evaluate suppliers	• Assess suppliers' sustainability performance through formal evaluation, monitoring, and auditing using established guidelines and procedures • Supplier assessment includes offering suppliers rewards or penalties to ensure that they comply to the buying company's environmental policies • Use of suppliers' performance matrices to monitor supplier performance in areas such as ethics, environment and product development. The information collated will be used in conjunction with buying teams to encourage supplier improvements and to assess future supplier relationships	(Sancha et al., 2015; Sodhi, 2015; Gimenez and Sierra, 2013; Azapagic et al., 2004; Gimenez et al., 2012; Melnyk et al, 2010; GRI, 2013)

Collaborate with suppliers	• Partner with suppliers to jointly minimize adverse environmental and social impacts of operations (eg product design, transportation, storage, disposal of products) • Provide technical support and training to suppliers to help them set up their environmental programs • Exchange mutual information with suppliers, knowledge and techniques with suppliers for environmental activities implementation • Mutually agree on each other's responsibilities and capabilities with regards to environmental protection	(Bowen et al., 2001; Halldorsson et al, 2009; Gimenez et al., 2012; Gimenez and Sierra, 2013; Rao and Holt, 2005 Seuring and Muller, 2008; Vachon and Klassen, 2008; Ageron et al., 2012; Kruschwitz, 2013;Sancha et al., 2015)
Procure environmental sustainably (or green purchasing)	• Procure raw materials or products with environmental impacts explicitly considered. This practice ensures that suppliers and partners are taking into consideration environmental and product responsibility legislation Examples of sustainable procuremeny are: use of biologically based plastics that emit fewer greenhouse gases throughout their life cycle, use of metals that are mined in conflict-free regions, or green energy supply	(Closs et al., 2011; BSR, 2010; Hassini et al, 2012; Rao and Holt, 2005; Mahler, 2007; Sarkis, 2001; Carter and Rogers, 2008)
Source locally	• Buy from suppliers who are located closer to the point of sale. This way, the environmental impact of transporting products is reduced, while customers are satisfied since the company is supplied with agricultural and consumer products that are fresher that support their local economies	(BSR, 2010;Chopra and Sodhi, 2004; GRI, 2013)

Materials conservation

Reduce waste production	• Minimize hazardous and non-hazardous waste generation and ensure zero disposal to landfills	(Roca and Searcy, 2012; Carvalho et al., 2011; Hassini et al., 2012; Rao and Holt, 2005; Sarkis, 2003)
Reduce water consumption	• Minimize water consumption levels, through water recycling processes, or implementation of water harvesting	(Roca and Searcy, 2012; Closs et al., 2011)
Reduce packaging	• Use of lighter weight packaging materials • Reduce materials in packaging • Use environmentally friendly packaging	(Closs et al., 2011; Carter and Rogers, 2008; Shrivastava, 1995)
Reduce consumption of resources	• Reduce the volume of resources used in the design and or manufacturing process through material substitution or reconfiguration Typical resources mentioned in the reports are: Raw materials, Paper, waste, containers, batteries	(Carvalho et al., 2011; Closs et al., 2011; Halldorsson et al., 2009)
Reduce energy consumption	• Use energy more efficiently during the manufacturing processes, • conserve energy in the conduct of business operations • utilize waste materials for energy production, • conduct product recycling so as to save energy	(Roca and Searcy, 2012 Closs et al., 2011; Azapagic, 2004; Lozano and Huisingh, 2011; Montabon et al., 2007)
Plant trees	• Preserve and replant forests by planting trees to offset for the environmental degradation	(Rondinelli and Berry, 2000)
Harvest water	• Capture rainwater and translate it into water supply	(Sodhi, 2015; GRI, 2013)
Use Renewable energy	• Consume any naturally occurring source of energy, such as biomass, solar, wind, tidal. wave, and hydroelectric power that is not derived from fossil or nuclear fuel	(GRI, 2013)

Account for biodiversity	• Develop and preserve wildlife habitats near the company's operations sites • Provide financial support for broad environmental and natural resource programs • Create artificial or man-made 'natural' resources such as reefs, lakes, wetlands to offset deforestation or major land use • Encourage employee voluntary participation in remediation of natural resources degradation	(Carter and Rogers, 2008; Porter and Kramer, 2006; Closs et al., 2011; Rondinelli and Berry, 2000; World Economic Forum, 2013)

Manufacturing and operations

Co-locate the operations	• Regionalize and consolidate the supply chain and distribution processes that are closely geographically located	(Chopra and Sodhi, 2004; Goose, 2013; Halldorsson et al., 2009; Rao and Holt, 2005)
Decentralize/localize physical assets in multiple locations	• Operate separate logistics centers and use multiple suppliers to be able to deliver in the event of a disruption Decentralizing to customer locations may increase production costs (due to reduction of economies of scales) but reduce total costs by minimizing enterprise risk (Closs et al., 2011).	(Chopra and Sodhi, 2004.
Make product LCA	• Assess the environmental impacts of the products at each stage of the product's life cycle	(Hutchins and Sutherland, 2008; Linton et al., 2007; Srivastava, 2007; Azapagic et al., 2004)
Use alternative modes of transportation	• Use of alternatively fuelled vehicles	(Goose, 2013; Halldorsson et al., 2009; Rao and Holt, 2005)
Certify to ISO 14001 standard	• ISO 14000 is a series of ISO standards provide a set of formal guidelines to ensure the environmentally sound performance of a firm	(Carter and Rogers, 2008; Curkovic and Sroufe, 2010; Sarkis, 2001)

Do product stewardship	• Take a proactive approach towards raw materials and component suppliers, by integrating environmental considerations into product design and development processes	(Fiksel, 1993; Vachon and Klassen, 2008; Hart, 1995).
Use eco-friendly materials (non-toxic)	• Use of environmentally-friendly materials and substitution of environmentally questionable materials in operations along the entire supply chain	(Rao and Holt, 2005;Zhu and Sarkis, 2004; Bi, 2011; Sarkis, 2003;Zsidisin et al., 2001; Porter and Kramer, 2006)
Conduct green/ environmental conscious manufacturing	• Use cleaner technology processes so as to make savings in energy, water, and waste consumption	(Sarkis, 2001; Srivastava, 2007)
Conduct reverse logistics	. • ''Implement the cost-effective flow of raw materials, inventory, finished goods, from the point of consumption to the point of origin for the purpose of recapturing value''	(Carvalho et al, 2011; Melnyk et al, 2010; Halldorsson et al, 2009; Rao and Holt, 2005; Sarkis, 2001)
Being lean	• ''Implement an integrated approach to the management of a manufacturing organization, that encompasses a wide variety of practices, including just-in-time, quality systems, work teams, cellular manufacturing and supplier management''	(Ageron et al., 2012; Melnyk et al., 2010; Kleindorfer et al., 2005; Shah and Ward, 2007; Sarkis, 2001)
Use green transportation channels	• Use systems optimal transportation systems for vehicles' routes	(Rao and Holt, 2005)
Remanufacture	• Return products to new or better than new condition with some of the parts or components being recovered or replaced	(Linton et al., 2007; Montabon et al, 2007; Srivastava, 2007;Sarkis, 2001)

Utilize increased transportation capacity	• Reduce transportation frequency using full capacity loadings	(Halldorsson et al, 2009)
Vertically integrate operations	• Cover in–house all the supply chain activities, from green purchasing to integrating life-cycle management, through to the manufacturer and customer, and closing the loop with reverse logistics	(Carter and Rogers, 2008; Carvalho et al., 2011)
Reduce replenishment frequency	• Maintain excess capacity (redundancy) in the supply chain, particularly on the upstream side of the supply chain, so as to reduce frequent shipments	(Carvalho et al., 2011; Melnyk et al., 2010)
Adopt safer transportation	• Provide transportation systems that maximize accessibility, affordability, and safety, while minimizing environmental degradation	(Closs et al., 2011; Goose, 2013)

Recovery processes

Recycle waste	• Collect, separate, process and re-manufacture waste and organic materials	(EPA, 2013; Closs et al., 2011; Min and Galle, 2001; Kopicki et al., 1993)
Recycle water	• Reuse treated wastewater for agricultural and landscape irrigation or industrial processes; and replenish a ground water basin (referred to as ground water recharge)	(EPA, 2013; Lozano and Huisingh, 2011)
Reuse materials/resources/products	• Sort, refurbish, or repair without re-manufacturing Re-use may take place in the form of materials, assemblies, subassemblies or components	(Kopicki et al., 1993; Hassini et al., 2012; World Economic Forum, 2013; Sarkis, 2001; Kleindorfer et al., 2005; Shrivastava, 2007)
Use recyclable/ed materials	• Introduce recycled materials, components and products into the downstream production and distribution systems	(Carvalho et al., 2011; Goose, 2013;Sarkis, 2003)

Figure 6 below summarizes our conceptual definition for environmental sustainability for the purpose of reporting:

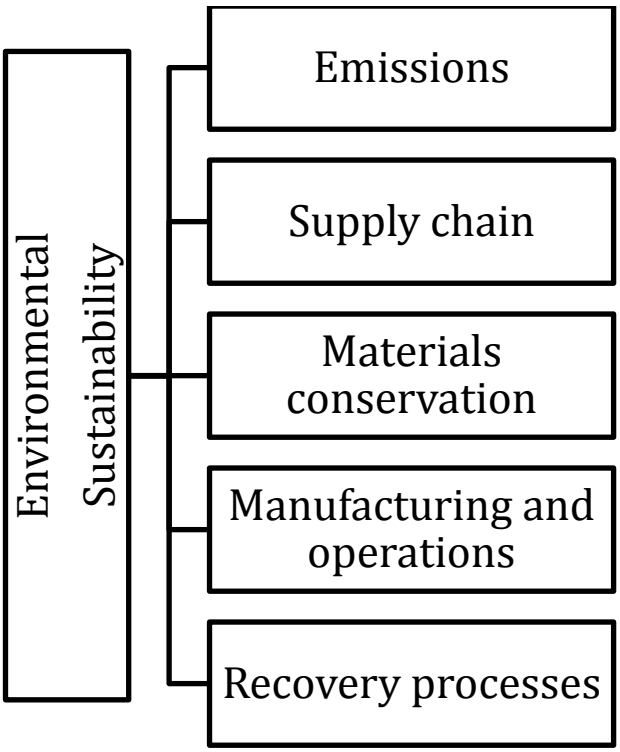


Figure 6. Conceptual development of constructs for environmental sustainability reporting

3.2.3 Frameworks for social sustainability

1) Labuschange et al. (2004) have created a conceptual framework for sustainability. According to this framework, social sustainability can be formed into the four main categories:

a) Internal human resources incorporating employment stability, employment practices, health and safety, career development, and research and development;

b) External population which encompasses human, productive, and community capital;

c) Stakeholder participation which includes information provision and stakeholder influence issues, and;

d) Macro social performance which encompasses socio-economic and socio-environmental performance (Labuschange et al., 2005). Socio-economic performance addresses the external economic impact of the company's business activities and includes economic welfare and trading opportunities. Socio–environmental performance considers the contribution of an operational initiative to the improvement of the environment or the society on a community. Extended environmental monitoring of the abilities of society, as well as enhancement and enforcement of legislation are sub-criteria.

2) In addition, GRI (2013) uses a hierarchical framework, which consists of categories, sub-aspects, and aspects. GRI is the most detailed framework, incorporating a wide latitude of practices across the social aspects, however, not all indicators are easy to evaluate (Labuschange et al., 2004). A summary of the GRI guidelines on social category are presented in Table 7.

Table 7. Aspects on the social sustainability category provided by GRI guidelines (GRI, 2013)

GRI Social category	
Labour practices and decent work	Information on employees hired, occupational H&S, diversity and equal opportunities, training and education
Human Rights	Non-discrimination, child labor, indigenous people rights, assessment of suppliers on human criteria
Society	Support to local communities, anti-competitive behavior, anti-corruption
Product Responsibility	Product and service labelling, marketing communications, customer privacy

3) KLD Research and Analytics categories

Kinder, Lydenberg, Domini (KLD) is an independent rating service that focuses on assessing corporate sustainability performance across a range of issues related to: corporate governance; community; diversity; employee relations; environment; human rights; and product. KLD excludes from the index those companies, whose records are, on balance, negative (Statman, 2006). KLD use a variety of sources to screen companies. MSCI ESG acquired KLD Research & Analytics Inc in 2010. Table 8 presents the seven categories of KLD.

Table 8. KLD's seven categories for sustainability performance (Lu et al., 2013)

Category	Indicators
Human rights	Labour rights, relations with indigenous people
Community	donations, charities, support for education
Diversity	Disabled, women, elderly,
Employee relations	Health and Safety, work/life benefits, retirement benefits
Environment	Emissions, waste, recycling, fuels
Product	Quality, safety, R & D
Corporate Governance	Ownership, transparency

4) Finally, Closs et al. (2011) decompose the social dimension of sustainability into two categories; education and ethics. For each they develop a set of indicators accordingly. Figure 7 presents the framework developed for educational sustainability and Figure 8 presents the corresponding one for ethics.

Figure 7. Categories and indicators underpinning educational sustainability (Closs et al., 2011)

Figure 8. Categories and indicators underpinning ethical sustainability categories (Closs et al., 2011)

There are all these guidelines and literature frameworks for defining social sustainability categories and indicators, but they do not overlap seamlessly. So we need to take them as a starting point and narrow down to those that seem to be the most relevant to the context of sustainability reporting by looking at what companies are disclosing in their sustainability reports. As such, as a start, we are synthesizing the different social indicators and organizing them under the following two conceptual constructs for social sustainability. Table 9 presents our conceptually developed constructs for social sustainability.

Table 9. Proposed constructs for social sustainability reporting as taken from literature

Construct	Source
Labour (Business) Practices	GRI (2013), UN Global, KLD, Labuschange et al. (2005); Carter and Rogers (2008); Dyllick and Hockerts, 2002
Human Rights - Society	GRI (2013), UN Global, KLD; Carter and Jennings, 2004; Dyllick and Hockerts, 2002

3.2.4 Conceptual development of social sustainability indicators

In this section we are developing a preliminary conceptual model based on what is expected by stakeholders to be reported on social sustainability. As such, we are conceptually organizing the list of social indicators into the higher order categories identified in the previous section. Azapagic et al. (2004) propose that aggregation of indicators into higher categories reduces the number of indicators into a smaller, more manageable number of performance measures, thus facilitating the decision-making process. The list of social sustainability indicators derived from the literature are presented in Table 10.

Table 10. Summary and definitions of social sustainability indicators underpinning the two conceptual constructs

Human rights/ society

Engage employees	• Measure employees' satisfaction rates in annual surveys Provide information on: • The company's relationships with employees in an effort to improve job satisfaction and employee motivation • The stability of workers' jobs and the company's future • Communication with employees on management programs that may directly affect employees • Awards received for effective communication with employees	(Hackston and Milne, 1996; Porter and Kramer, 2006; Carter and Rogers, 2008; Azapagic et al., 2004)
Conduct community support activities	• Donate cash, products or employee services to support community activities, events, organizations, or education • Sponsor or fund educational conferences, seminars, public health projects • Aid medical research • Conduct philanthropic and charitable activities to local societies • Employees' time and money contributing in community environmental and social activities • Develop education and training programs to eliminate negative impact on communities	(Rondinelli and Berry, 2000; Hackston and Milne, 1996; Carter and Jennings, 2003; Carter and Rogers, 2008; Norman and McDonald, 2004; Lozano and Huisingh, 2011; Roca and Searcy, 2012;Wikstrom, 2010)

Minimize (Eliminate/Eradicate) child labour	• Eradicate child labour at both the company's and suppliers' premises	(Closs et al., 2011; Carter and Rogers, 2008;GRI, 2013; Norman and McDonald, 2004; Azapagic et al., 2004)
Commit to employees	• Respect employees' human rights and provide them with the right to participate in union trades, reward them, and eradicate any form of forced or compulsory labour	

Labour practices

Item	Definition	Reference
Employ Health and Safety programs	• Reduce or eliminate pollutants, irritants, or hazards in the work environment • Promote employee safety and physical or mental health, disclose accident statistics, comply with health and safety standards and regulations, • Conduct research to improve work safety	(Hackston and Milne, 1996; Roca and Searcy, 2012; Halldorsson et al., 2012; Kleindorfer et al.,2005; Norman and McDonald, 2004)
Encourage employee diversity	• Comply with laws and regulations for hiring practices to avoid discrimination • Employ racial minorities, women, employees from diverse social profiles in the workforce and in managerial levels too • Provide information on gender, age groups, minority groups employed	(Closs et al., 2011; Hackston and Milne, 1996; Roca and Searcy, 2012; Norman and McDonald, 2004)

Establish supplier code of conducts	• Introduce formal documents between a company and its suppliers stating a series of laws and regulations that a firm's suppliers are expected to fulfill	(Gimenez et al., 2012; Closs et al., 2011; Haugh and Talwar, 2010; Halldorsson et al., 2009; Preuss, 2005 ; Preuss, 2009; Teuscher et al., 2006)
Source responsibly-ethically-	• Consider social and ethical issues in purchasing without causing a negative social impact	(Ashby et al., 2012; Bowen et al., 2001; Carter and Jennings, 2003; Rao and Holt, 2005)
Train on anti-corruption	• Provide training *to* employees on the company's anti-corruption policies and procedures as well as provision of information on total number of incidents where employees or partners were dismissed for corruption	(GRI, 2013)
Train and educate employees	• Invest in human capital through higher education and transferable skills development with prospects for personnel career development • Train employees through in-house projects • Provide financial assistance in the form of scholarship to employees for studying at educational institutions • Organize workshops for employees and suppliers to raise awareness and commitment to sustainability	(Lozano and Huisingh, 2011;Haugh and Talwar, 2010; Hackston and Milne, 1996)
Adopt Safer warehousing conditions	• Ensure safe and humane working conditions at the operations and suppliers' plants • Ensure suppliers' locations are operated in a safer manner	(Carter and Rogers, 2008; Melnyk et al., 2010)

Employ better working conditions	• Ensure a manageable workload for employees • Promote two-way communication through open office spaces and regular team meetings • Ensure that employees are entitled to a safe and hazard-free environment	(Melnyk et al., 2010; Jaffee, 2010)

Figure 9 below summarizes our conceptual definition of social sustainability for the purpose of reporting:

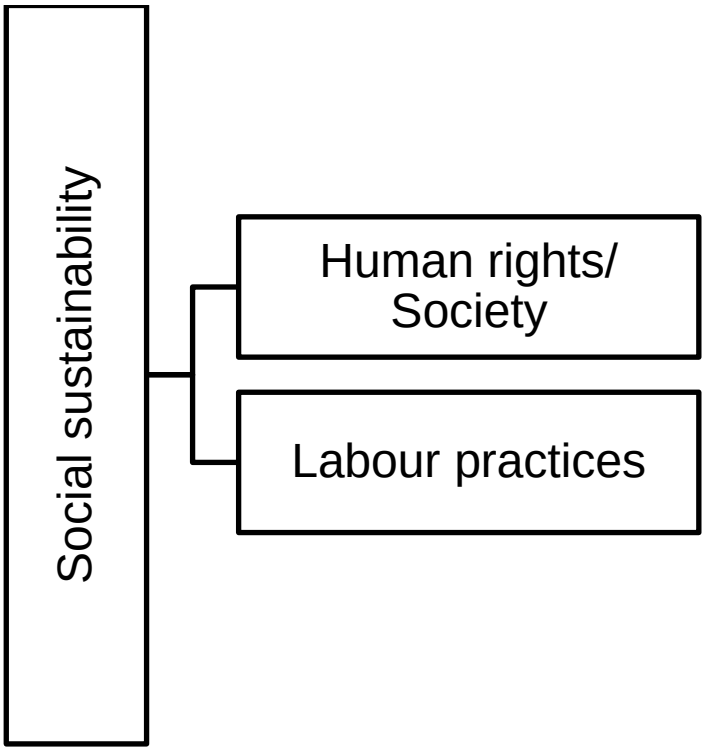


Figure 9. Conceptual development of constructs for social sustainability reporting

Chapter 4: Empirical exploration using sustainability reports

As part of the first research objective, the purpose of this chapter is to investigate what companies report for social and environmental sustainability in order to explore attributes of related constructs. By looking at companies' sustainability reports, we empirically develop measures for sustainability performance, based on the indicators that we identified in the existing operations management literature. As such, this chapter explores the first research objective, which sis formulate as follows:

RO1: Develop a measure using sustainability reports and explore its attributes

We developed measures in the previous chapters assuming sustainability reports, contrary to third party reports, reflect the signals that companies release to their investors and other stakeholders with regards to their sustainability performance. This study follows the assumption highlighted by Krippendorff (1980) and Gray et al. (1995) that the extent of disclosure (either the number of times an item is disclosed or the amount of space devoted for an item) can be taken as some indication of the importance of an issue to the reporting entity. As such report users can derive an indication of the meanings, motivations, and interactions of the communicator (Gray et al. 1995; Branco and Rodrigues, 2007).

Given that sustainability reports are not standardized, this study could provide a basis for benchmarking disclosure of environmental and social sustainability practices.

4.1 Methodology

This study utilizes a secondary data collection method - namely a *content analysis* of standalone sustainability reports, in order to investigate what companies are actually reporting as regards expectations. Content analysis is a very commonly deployed methodology in accounting research (Montabon et al., 2007), and particularly, in analysing a firm's environmental and social disclosure (Hackston and Milne, 1996; Milne and Adler, 1999; Unerman, 2000; Lodhia and Hess, 2014). Content analysis was chosen over self-reporting methods i.e. interviews with managers in

order to investigate what sustainability practices companies take into account when preparing their reports (Sharma and Henrigues, 2005).

In this study, we investigate what companies are reporting relative to what is expected from the literature. In particular, we manually code 331 sustainability reports, based on the 51 social and environmental indicators that we obtained from the literature. Even though content-analysis software exists, we decided to code manually, as this seems more appropriate for complex and sophisticated textual data. That way we will be able to identify the different terminologies used by companies.

The reason why we did not use automated computer software is that, firstly, our content analysis is not based on just counting words or sentences. Instead, we are evaluating the content and quality of the reported text; this cannot be captured by any software. In addition, much of the reported information is illustrated in graphical images and tables; again automated software would work as it only looks at text. Finally, building a pertinent dictionary of key-words was not readily apparent given the diversity in reporting styles and content.

Krippendorf (1980) also recognizes that content analysis software may be able to process big data at high speed, but it only recognizes string variables and thus it can miss out on meanings in the texts. As such, such, semantic validity cannot be satisfied when using computers, unless the text is predictable and repeated

Content analysis is a multi-purpose research method developed for investigating any kind of problem, whose content of information communication serves as the basis of inference (Holsti, 1969). Holsti (1969) describes content analysis as "any technique for making inferences by objectively and systematically identifying specified characteristics of a message." Another definition is provided by the US General Accounting Office (1996), which describes content analysis as ‘’a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding’’. In other words, content analysis can be described as a research technique that enables researchers to filter large amounts of data in a systematic manner.

Content analysis is deployed to identify the presence of certain words, concepts, themes, or phrases within a text so as to quantify their presence in a transparent manner. Content analysis encompasses strict procedures and criteria for selecting data, and the inclusion and exclusion of content is done systematically according to consistently applied rules. The first step in a content analysis methodology is to identify the constructs required for answering a particular research question. These constructs should be identified within a theoretical context. Next, consideration of why the count of associated words or phrases in a text would represent a suitable measure of the construct ought to take place. It should be taken into consideration that construct development without a theoretical rationale posits the risk of turning the content analysis into just “word crunching” (Insch & Moore, 1997).

The next step is to evaluate the text to be analysed, and consider whether the source of the information is appropriate to capture the constructs of interest and to answer the research questions. Content analysis classifies the text material, and reduces it to more relevant and manageable pieces of information-data. The results of the content analysis can be counts of occurrences, indices, or percentages, supplemented by a combination of statistical techniques’ analysis. In the context of the particular study, the lack of standardization in the structure of corporate sustainability reports would certainly fit to the description of content analysis as being a methodology that is ‘’motivated by the search for techniques to infer from data what would be too costly, no longer possible, or too obtrusive if other techniques were applied’’ (Krippendorff, 1980; Montabon et al, 2007).

Steps to ensure content analysis reliability

Stability refers to the extent to which the results of content classification are invariant over time. Given that only one person is coding, stability is the weakest form of reliability. Stability can be ascertained when the same content is coded more than once by the same coder and yields the same results. Inconsistencies in coding constitute unreliability. Inconsistencies in coding take place as a result of ambiguities in the coding rules or in the

text, cognitive changes within the coder, or simple errors such recording the wrong numeric code for a category.

Reproducibility, or intercoder reliability, refers to the extent to which content classification produces the same results when the same text is coded by more than once coder. Conflicting codings usually results from cognitive differences among the coders or ambiguous coding instructions. Reproducibility is a stronger measure of reliability than stability.

Accuracy refers to the extent to which the classification of a text corresponds to a predefined standards, set by a panel of experts or known form previous studies.

In our case, stability is ensured by coding the text of 331 reports two separate times. The coding results are consistent with each other and frequency analysis of categories produces the same results for the two codings. In addition, we used a simple coding 0, 1, 2 (plus 3) to make our methodology reproducible. Finally, there are not established standard codings in the case of sustainability reports.

4.1.1 Creating and testing a coding scheme

The investigator needs to design a coding scheme prior to implementing the coding. Weber (1990) suggests a scheme of steps for creating, testing, and implementing a coding scheme to overcome concerns about rater bias at this critical stage in content analysis. The so-called ‘’Weber Protocol’’ is widely used in the literature and thus we follow the following steps in our coding:

Step 1. Define the recording units: The first step in coding textual data is to determine the recording unit (Tangpong, 2011) of the text to be classified. According to Holsti (1969) a recoding unit is ‘’the specific segment of content that is characterized by placing it into a given category’’. There is an ongoing debate in the accounting literature with regards to the use of words, sentences, or portions of pages as the basis for the coding (Gray et al., 1995).

Words with multiple meanings can undermine the semantic validity of coding and thus can lead to wrong results. This issue can be minimized by using larger recording units such as sentences, paragraphs, or entire texts. Large recording units can preserve the original meaning of the text since words are interpreted in the context under which they originally existed, thus strengthening semantic validity. However, it has to be pointed out that it is difficult to code large recoding units as reliably and efficiently as smaller ones. There are six coding options:

- Word: once choice is to code each word. Classification of a particular word in a category is often difficult because of ambiguities or pluralities in word meaning;
- Word sense: Code the different senses of words with multiple meanings;
- Sentence: An entire sentence is often the recoding unit when the investigator is interested in words or phrases that occur together (Deegan et al., 2002; Milne and Adler, 1999);
- Theme: Theme is defined as a unit of text having no more than one each of the following elements: the perceiver, the perceived, or agent of action, the action, and the target of action;
- Paragraph; or
- Whole Text

We are carrying out coding using ‘’themes’’ as the unit of analysis (Tangpong, 2011). We have created a list of 51 questions (we later name them indicators) and search into the main text for each of those questions, which are frequently explained in multiple and tightly connected sentences in a coherent text. We need to highlight that disclosure on each theme may be located at separate spaces in the sustainability reports. Therefore, by conducting coding at the theme level we are making sure that we capture all information disclosed.

Step 2. Determine the content categories: Content categories are crucial in any text analysis as they contain the definitions of the constructs of interest (Tangpong, 2011). Most statistical procedures require distinct categories that cannot be confused. If a recoding unit can be classified simultaneously in two or more categories and if both categories are included in the same statistical analysis, then it is possible that the basic statistical assumptions of the analysis will be violated and the results put in doubt.

Our content categories development is based on the definition of construct of interest. In particular, we examine two multi-dimensional pre-established constructs named social and environmental sustainability constructs. The two constructs comprise of 51 individual content categories in total. The content categories are taken from literature, are clearly developed, and are mutually exclusive so as to ensure the clarity of the coding scheme.

Step 3. Test of coding on a sample of text: The development of the coding rules needs to be based on the definition and observable attributes of the constructs in the literature and be consistent with the descriptions of the pre-established content categories. In any other case, the validity of the eventual measure is undermined.

In order to ensure that the categories are clear, it is recommended to test the clarity of category definitions, by coding a small sample of the text. Such a testing reveals ambiguities in the coding rules. If the reliability is low or if errors in the coding process are discovered, the coding rules must be revised and re-tested. When high coder reliability has been achieved, the coding rules can then be applied to the entire text.

Step 4. Assess reliability: When human coders are used, accuracy of the coding process needs to be ensured. It is important that the coders are trained to learn the coding rules and have become familiar with the coding rules so as to minimize the potential individual bias inherent in human coders and strengthen coder reliability. The use of multiple coders can

increase the objectivity of the results when a high degree of agreement exists between the coders.

The reliability of human coders should also be assessed after the text is classified. We should not assume that if samples of text were reliably coded, then the whole corpus of text will also be reliably coded. Human coders are more likely to make mistakes as the coding continues. Their understanding of the coding rules may change in subtle ways as the text is coded.

In order to ensure reliability in our coding, and considering that human coders are used, we coded the same text two times so as to compensate for possible errors in the coding. This process is called verification.

4.1.2 Sampling frame

A sample of 331 stand-alone sustainability reports published by European, American (US) and Canadian companies is selected and textually analyzed.

The unit of observation in the data collection process is the firm. Our sampling frame is purposive; firms from different industries, sizes, products, and processes are selected, given that these firms are likely to implement a wider variety of different sustainability practices. The objective of the particular sampling approach is to come up with a sample that will be diverse enough to incorporate a diversified portfolio of corporate sustainability practices, something that may be overlooked if a single industry or a single product sample is selected. All companies' sustainability reports are standalone, web-based and obtainable through the Sustainability Disclosure Database, which is a publicly available database.

Our approach is *stratified sampling* with industry sectors as strata. Sampling focuses on European, American, and Canadian companies because of their common understanding in policies and practices. Beside, these countries are commonly used in studies of this type (Soana, 2011) to allow us comparison with the literature. We realize that, in this way, we exclude all countries belonging to the southern hemisphere including

English-speaking countries, but sustainability could be perceived differently in Eastern countries, taking into consideration the different economies of scale, environmental, climate, living, taxation or regulation conditions. Thus it could be the case that contextual differences between the two hemispheres have a moderating effect on sustainability reporting (Reddy and Gordon, 2010; Jose and Lee, 2007). Nevertheless, this particular research approach could be criticized on the grounds of our target population not being representative, and consequently, the results not being generalizable globally. Also, reports for the years 2012-2014 were only considered, as data collection took place within the years 2013 - 2014. We used *Sustainability Disclosure Database* as the source of data collection. There are 3487 companies available in this database that fulfil this nationality criteria.

However, not all of these organizations had sustainability reports we could use in our sample. Some of these companies incorporate their sustainability report into their annual report. In addition, European countries' sustainability reports are quite commonly written in their corresponding non-English native language, thus these reports are excluded from the sample. For consistency reasons, we only focus on reports written in English language so that the same terminology of social and environmental practices is used. Finally, some reports were extremely short and we considered them unusable.

The final sample contains a mixture of 331 different companies, among which 117 are American or Canadian, and the rest 214 are European companies. Our sample comprises 193 large companies and 14 small-medium enterprises; 124 are multinational enterprises. The report publication years range from 2014 to 2012, with the vast majority of the most recent reports having been published in year 2013. Again, we study reports written only in English language so as to be consistent with the terminology of the practices.

Particular attention has been paid to include a diversified portfolio of industries in the sample using industry sectors. This enables us to investigate whether and how the level of sustainability disclosure is

differentiated among the different industrial sectors. It has been suggested that there are interaction effects between companies' degree of sustainability disclosure and their industry backgrounds in such a way that industrial sectors with high environmental impact tend to have higher levels of sustainability practices' disclosure (Jose and Lee, 2007). To this end, we conduct stratified sampling in the sustainability reports selection. Stratified sampling recognizes distinct sub-populations (strata) within a population.

The database classifies companies in 38 industrial sectors. As such, it can be said that the population is divided into 38 subpopulation groups (strata). For the purpose of this analysis we aggregate these sectors further to reduce our industrial sectors into smaller, more manageable numbers. Indicatively, we are considering together mining and metals; computers and technology; consumer products and household products; energy and energy utilities. Finally, industries with minor representation such as waste, textiles, tourism, and railroad are grouped together as ''other''. Consequently, we come up with 18 industrial sectors.

As such, it can be said that the population is divided into 18 subpopulation groups (strata). In other words, we have divided our population into 18 strata, and we carry out random sampling for each stratum separately. Finally, we combine the results from the separate simple random samples. When choosing a stratified random sample, each member of each sub-class of the population has an equal opportunity of being included in the sample. This way it is ensured that all 18 industry sub-classes are represented across the population. The homogeneity of items within each stratum provides precision in the estimates of underlying population parameters. Our goal was to represent each industrial sector with 20 sustainability reports. We were not able to retrieve 360 sustainability reports owing to the small fraction of usable reports, and thus our sample finally comprises of 331 companies.

Therefore, the 331 companies form a stratified sample of an identified (or defined target) population belonging to the Sustainability Disclosure database. Consequently, the sample can be said to be representative of the population, and thus the results of this study can be generalizable. The

industry classification of our sample is illustrated in Appendix 1. The reason why we do not use multiple reports for the same company is that at this stage of research we do not examine improvement over the years for a particular company. The goals for this research was to explore measurement of extent of adoption of operational practices as inferred only from sustainability reports, and tie this measure to financial as well as third party performance measures. This is the reason why we only look what a company is reporting on a single year.

4.1.3 Data collection

The next step is to score sustainability reports on the 51 environmental and social indicators that are conceptually identified to investigate which of those indicators are prioritized. In particular, scoring of each of the sustainability practices/indicators of the list is initially captured on a 0-2 rating scale, which is then extended to 0-3 scale, as some companies have exceptional performance.

Scoring is organized as follows: 0 score is given provided that an item of the list is not mentioned in the report, a score of 1 is given when an item is briefly mentioned or qualitative statements are provided in the report, a score of 2 is given when a numerical clue or an analytical description is provided in the report for a sustainability item and a score of 3 is given when extensive numerical coverage is provided by giving information on improvements that have taken place, or when full coverage is provided for an item, or when a goal is accomplished, and no further improvements or investments in the specific element are expected to take place. This is a simple and straightforward methodology to score distinct practices, corresponding to the following idea: Score of 1 refers to the adoption of a certain practice, score of 2 refers to the achievement of something specific for a certain practice, and score of 3 refers to exceeding specific goals/ expectations for a certain practice.

The reason why we did not make use of Likert scales is that it was clear from initial coding analysis that the variable distributions would be highly

skewed towards zero. As such, it would not make sense to use a 1-5 or 1-7 Likert scale that implicitly assumes an underlying normal distribution. A baseline is not needed for the level of granularity 0-2, with a score of 3 assigned only when the company reports its expectations are exceeded for a particular practice in terms of implementation.

A similar scoring system has been implemented in numerous past studies that conduct content analysis methodology; to begin with, Wiseman (1982) rates disclosure of 18 environmentally related items in annual reports. In particular, Wiseman gives a score of 3, which is the highest possible score, when an item is described in quantitative or monetary terms. A score of 2 is given when an item is disclosed based on company-specific information, and no quantitative measures are provided for that item. A score of 1 is given when an item is described in general terms, and finally a score of 0 is assigned when an item is not disclosed. Morhardt et al. (2002) and Guidry and Patten (2010) also conduct content analysis by scoring each GRI and ISO 14031 topic on 0-3 scale; 0 is assigned when a topic is not mentioned; 1, when a topic is briefly mentioned; 2, when more detailed description is provided or only self-comparison metrics are used; 3, when company-wide metrics are used that could be compared to other companies. Al-Tuwaijiri et al. (2004) assign a 0-3 weight to four environmental indicators. The greatest weight of 3 is assigned when quantitative disclosure is provided, a weight of 2 is assigned when non-quantitative but specific information is provided, and finally the weight of 1 is given when general qualitative disclosure is given for a particular indicator.

A similar scoring approach is followed by Montabon et al. (2007), who score environmental practices on a five - point scale; a score of 1 represents a low intensity and a score of 5 represents a high intensity of involvement. Additionally, Leszczynska (2012) scores sustainability reports on particular GRI topics based on a 0-4 scale (SustainAbility and the united nations environment progam (UNEP) which also 0-4 score); 0 points are assigned when a specific topic is not mentioned in the report, 1 point is given when a topic is briefly or generically mentioned, 2 points are

given when a more detailed coverage takes place, 3 points are assigned when extensive coverage is provided, and finally, 4 points are given when there is full coverage of the topic in the report. The same procedure is followed by Skouloudis et al. (2010), who score indicators on a 0-4 scale, where 0 indicates no coverage on a specific GRI topic, 1 refers to generic or brief statements on a topic, 2 includes the provision of valuable information, but nevertheless leaves issues in need of being further addressed, 3 refers to adequate and clear information provision, and finally 4 is given when the coverage of a specific GRI topic can be characterized as full in the report.

The application of scoring system is illustrated with the following examples:

Score 0-No mention

Close cooperation with our suppliers leads to innovative solutions that improve the sustainability of the entire value chain (Henkel, 2013).
The company strives to inform the market in a transparent way about the carbon footprint related to the production of its products and services by labelling their CO2 emissions.
Our ISO 14001 certification, which has been translated into clear and practical guidelines, shows that the application and improvement of our environmental performance is a ongoing focus of attention (Boskalis, 2013).
The CO2 emissions from the Dockwise fleet amounted to 534,000 tons in 2013. This includes emissions for the entire calendar year but not the emissions for the Dockwise Yacht Transport activities, which were sold in 2013 (Boskalis, 2013).

Score 1- Generic Statements

We work to reduce our use of water throughout our operations, while maintaining the highest quality and safety standards — and we recycle it whenever possible. Our teams throughout the world have been identifying unique and strategic ways to make sure we use water as

efficiently as possible. In 2013, these combined efforts helped us reduce our water intensity by 66% compared with our 2006 baseline (Biogen, 2013).
Relative water consumption down 1% by 2014, compared with 2011 (Atria, 2013).
By 2020, 100 percent of our paper packaging will contain either recycled or third-party certified virgin content (P&G, 2013).

Score 2- More detailed/ numeric information

The percentage of recyclable Barilla packs has increased from 85% in 2008 to 96% in 2012 (Barilla, 2013).
In 2012, 41% of our packages are made rom recycled materials. By 2014, 98% of our packaging will be recyclable (Barilla, 2013).
One way to reduce overall water consumption is to recycle water within our operations. In 2012, we used 0.59 million cubic meters of recycled water, meeting approximately 5 percent of our total water demand (Johnson and Johnson, 2013).
Colgate's 2015 goal is to reduce the water consumed per unit of production in the manufacture of our products by 40 percent vs. 2005. We are on track, with a 32.4 percent reduction as of 2013 (Colgate, 2013).
In 2012, our plants consumed about 2.4 million cubic meters of water, saving more than 700,000m^3 compared to 2008, and corresponding to approximately 23%. (Barilla, 2013).

Score 3- Full and systematic coverage

In 2013, UPS employees and retirees contributed US$51.3 million to a community-based organization. The respective totals in 2012 were US$48.3 million from employees (UPS, 2013).
In 2013, provided more than 161 million doses to affected children in 16 countries, an increase from 116 million doses to affected children in 14 countries in 2012 (Johnson and Johnson, 2013).

In 2013, Abengoa Solar invested a total of €280,000 euros in social action, 18 % more than in 2012 (Abengoa, 2014).
Employees volunteer to become peer educators and assist in implementing the HIV/Aids workplace programme. Currently, there are 408 peer educators, above the target of 325 (Lonmin, 2013).

4.2 Descriptive statistics

Descriptive statistics analysis is implemented to investigate which of the sustainability indicators identified in the literature are prioritized in companies' sustainability reports. An initial list of 51 sustainability indicators was compiled by the relevant literature and reporting guidelines. This list will be narrowed down to include only those indicators that are incorporated in the sustainability reports.

We observe that the main bulk of the scores distribution is concentrated around the zero score. Namely, on average, 77% of the total bulk of the distribution corresponds to 0 score, 9% corresponds to 1 score, and 9% and 5% of the total mass corresponds to 2 and 3 scores respectively. However there are certain practices that have a relatively even distribution across the scores. These indicators are presented in Table 11.

Table 11. Social and environmental indicators that are reported by the majority of the companies and are equally balanced across the 0-3 scores

Sustainability Indicators	***0***	***1***	***2***	***3***
Conduct community support activities	17%	15%	37%	31%
Employ Health and Safety programs	23%	15%	42%	20%
Encourage employee diversity	21%	26%	50%	3%
Recycle waste	53%	19%	16%	13%
Reduce carbon footprint	44%	15%	24%	17%
Reduce energy consumption	11%	15%	45%	29%
Reduce GHG emissions	37%	9%	32%	21%
Reduce waste production	28%	21%	27%	24%

Reduce water consumption	26%	20%	28%	26%
Train employees	27%	31%	34%	8%
Use renewable energy	57%	21%	17%	5%

Looking at the indicators above, it seems that they belong to the first generation practices as the particular indicators cover the most prominent and basic sustainability issues related to recycling, emissions reduction, reduction in resources consumption, employees' rights protection and health and safety at the workplace. Furthermore, those indicators are easy to describe in quantitative terms. Other practices that are not so evident in corporate sustainability reports cover more recently developed practices, related to supplier management, safe product packaging and transportation, and employee training and development. These practices are not easy to quantify, they require high utilization of human and financial resources, and their impact is not immediate. Companies refer to such practices in more qualitative terms in their sustainability reports, and this is the reason why they are skewed towards zero. Practices that are reported by almost none of the companies are presented in Table 12.

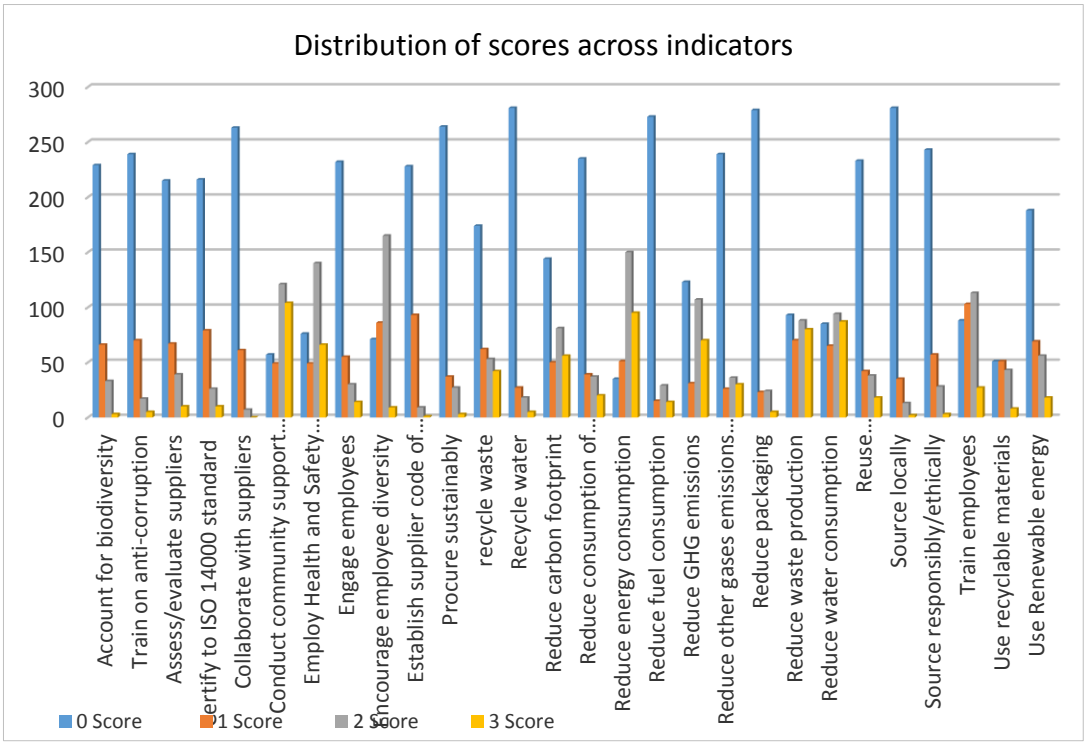
Table 12. Social and environmental indicators that are reported by almost none of the companies and are concentrated at 0 score

Sustainability Indicators	***# companies***
Harvest green water	2
Adopt safer transportation	1
Adopt Safer warehousing conditions	1
Co-locate the operations	1
Conduct Lean management	1
Employ better working conditions	1

Reduce replenishment frequency	1
Conduct green/ environmental conscious manufacturing	0
Conduct reverse logistics	0
Decentralize/localize physical assets in multiple locations	0
Do product stewardship	0
Use green transportation channels	0
Utilize increased transportation capacity	0
Vertically integrate operations	0

For the purpose of descriptive statistics, the indicators that are reported by fewer than 50 companies are excluded from the descriptive analysis. We will come back to those indicators in the next chapter where sustainability constructs development takes place. Our decision to exclude the under-reported indicators from the descriptive analysis makes sense on the basis that in this section we explore what companies are reporting, and thus it reasonable to narrow down our analysis to the sub-set of indicators that prevail in companies' sustainability reports.

Figure 10 summarizes the distribution of scores for each sustainability item. We see that most of the indicators reflect scoring values of 1 or 2, while 3 is less salient across the dispersion of scores under each item. Score 4 is hardly allocated to any of the indicators. This fact indicates that sustainability indicators either are not reported at all or the rest are reported at a moderate level, as scores rarely achieve the value of 3.



**Indicators that are reported by less than 50 companies are not presented

Figure 10. Distribution of 0-3 scores across the social and environmental indicators

Next, a frequency analysis is conducted; a frequency analysis counts how many companies are reporting each sustainability practice. Frequency analysis is not about the appearance of words related to a particular practice but the overall context in which the text is used. This is because we are trying to infer to what extent they have actually implemented this practice. Thus, for us, the appearance of a practice in the report has to indicate the effort that the company is putting on that particular practice. Figure 11 presents the frequency analysis of the social and environmental indicators following content analysis.

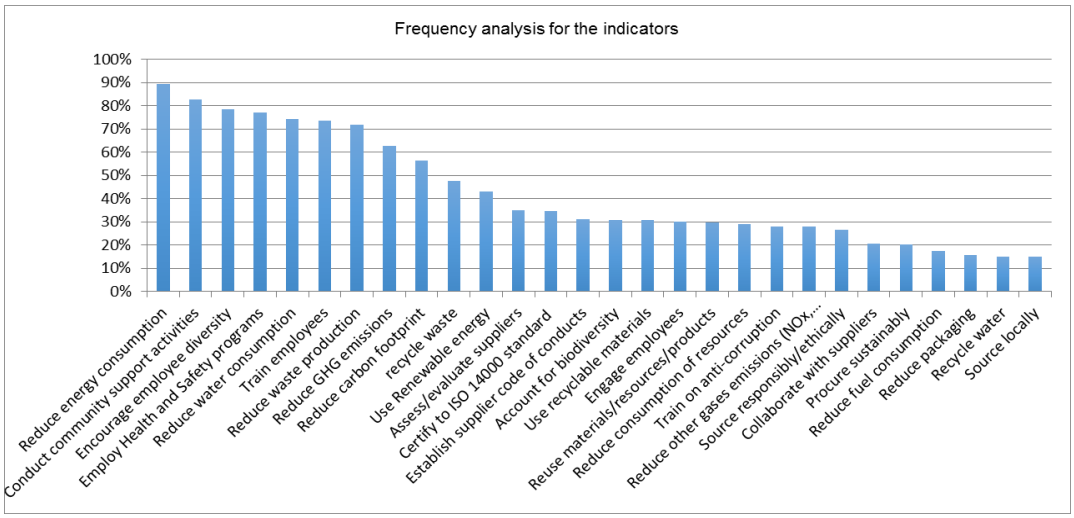


Figure 11. Percentage of companies reporting each social and environmental indicator

As seen in Figure 11, the most highly cited elements, disclosed by more than 200 companies, are the following: *reduction of energy consumption* (cited by 296 companies), *community support activities* (274 companies), *encouragement of employee diversity* (260 companies), *health and safety* (255 companies), and *reduction of water consumption* (246 companies). As expected, these practices are the ones having the most even distributions across the scores. Conversely, practices like sourcing locally (50 companies have mentioned it), water recycling (50 companies), packaging reduction (52 companies), reduction of fuel consumption (58 companies), and sustainable procurement (67) are reported by less than 70 companies Table 13 presents the top five and bottom five sustainability indicators.

Table 13. Top five and bottom five indicators based on percentage of companies reporting that measure

Top Five	**%**	**Top Bottom Five**	**%**
Reduce energy consumption	89	Source locally	15
Conduct community support activities	83	Recycle water	15
Encourage employee diversity	79	Reduce packaging	16
Employ Health and Safety	77	Reduce fuel consumption	18
Reduce water consumption	74	Procure sustainably	20

It is worth highlighting at this point that the most highly cited indicators are the ones that are mentioned by multiple guidelines. Indeed, *reduction of energy consumption* is recommend by GRI and the literature, *community support activities* and *health and safety* are recommended by GRI, the literature, and KLD, and finally, *employee diversity* is mentioned by UN Global Compact, GRI, KLD, and the literature. An exception to the rule is *reduction of water consumption*, which despite being recommended by 74% of the companies, is only recommended in published guidelines by the GRI.

Next, the mean values for each item are calculated. Figure 12 summarizes the mean values of the social and environmental sustainability indicators.

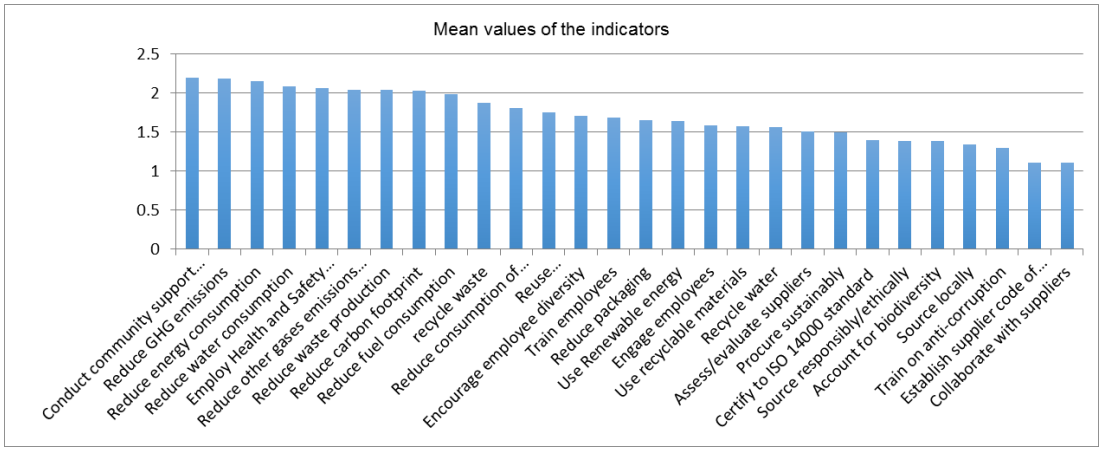


Figure 12. Mean values of responses for social and environmental indicators

The item with the highest mean value is community support activities with a mean value of 2.20, while reduction of GHG has the second highest mean value of 2.19. On the other hand, the item with the lowest mean value is collaboration with suppliers and establishing supplier codes of conducts (mean value 1.10), while training on anti-corruption has a similarly low means value (1.29). It is noteworthy that certain indicators have high mean values, but they are reported by a limited number of companies. For example, reduction of emissions of other gases is only reported by 28% of companies, but its mean score equals 2.04, which is the sixth highest mean value.

At a next stage, disclosure scores for each item are calculated using an equal-weighted index, which assigns one point to each disclosed indicator. Despite the fact that some studies have placed a weighting on disclosure (Al –Tuwaijri et al., 2004; Wiseman, 1982), we argue that weighting implies some kind of bias of a financial kind towards social responsibility (Branco and Rodrigues, 2007). Figure 13 summarizes the total summated score for each sustainability indicator.

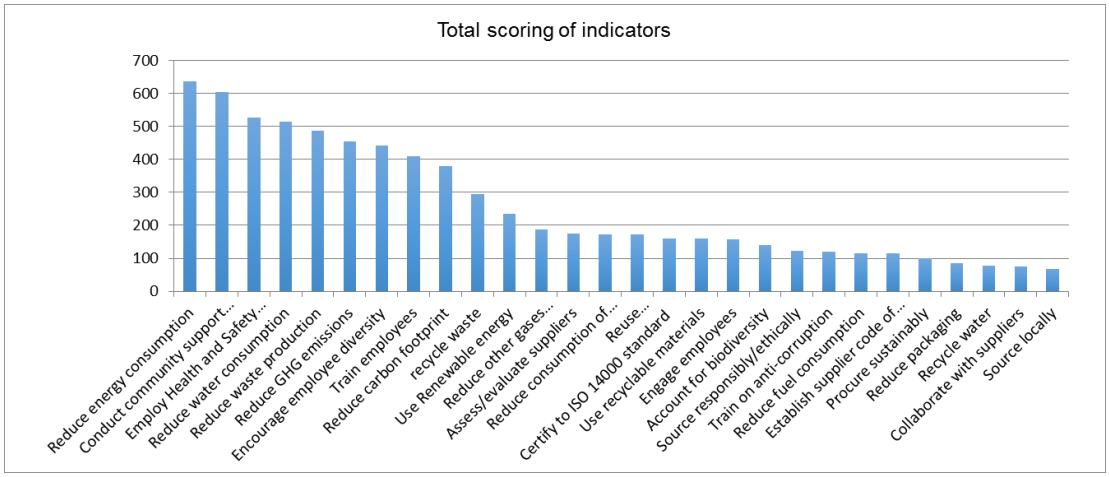


Figure 13. Total summative scoring for each social and environmental indicator

Figure 13 illustrates that energy reduction and community support activities achieve the highest sum score, reaching a score of 636 and 603 respectively. Health and safety comes third, while water and waste

reduction also have, high scores. A quite similar picture is to be found in Figure 12, where community support activities and energy reduction come first, while the rest of the elements – although with some minor diversions - seem to follow the same position in the two figures. It follows from this that the particular indicators are not only reported by the majority of the companies, but also achieve high scores, implying that companies are implementing the particular indicators at a high level.

Finally, an analysis of sustainability disclosure per industry sector is implemented to explore the industry effect on the extent of disclosure. For the industry analysis, we separate the social and environmental indicators in order to generate two new variables, referring to the total social and environmental sustainability correspondingly. Again, equal weights are used when summing up the scores of the individual social and environmental sustainability indicators. Figure 14 and Figure 15 present the average environmental and social disclosure for each industry.

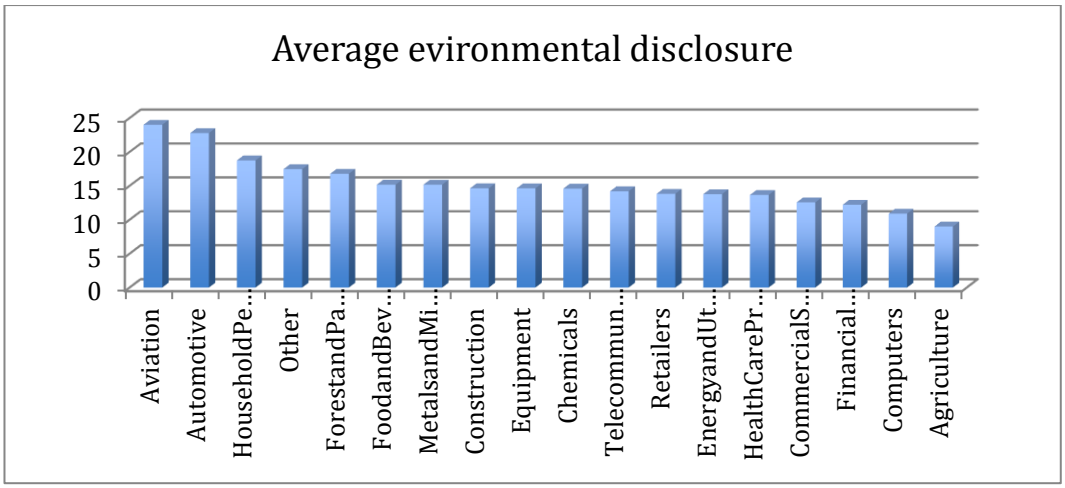


Figure 14. Average scoring on environmental disclosure for each company in each sector

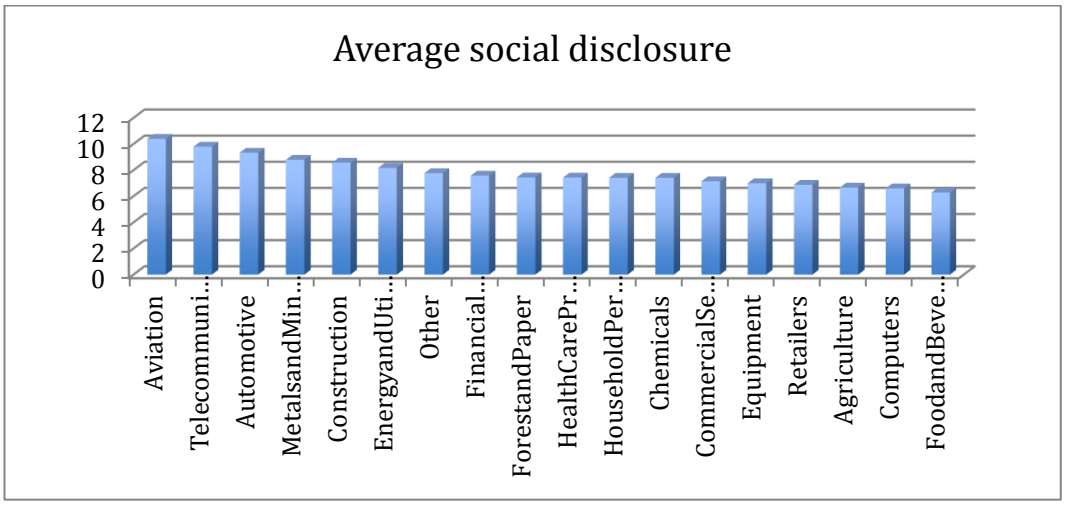


Figure 15. Average scoring on social disclosure for each company in each sector

Aviation, automotive, household, and forest and paper products achieve the highest average in environmental disclosure. This finding is in line with Cowen et al. (1987) and Berthelot et al. (2012). At first glance this might sound surprising, but all the above are environmentally intense industries, and thus they engage in environmental practices so as to compensate for the environmental degradation that their activities cause. One possible explanation for this behavior is that highly extractive industries are subject to environmental and safety scrutiny. Roberts (1992) also raises the argument that high profile industries are expected to have higher levels of sustainability disclosure. In particular, the automobile, airline, and oil industries have the most intuitive appeal, given that the particular industries have high levels of consumer visibility, political risk, and intense competition.

The automotive industry for example may have a detrimental environmental impact as a consequence of its operations, but this can be offset through implementation of environmentally friendly activities (tree planting to offset carbon footprint, engagement into green purchasing, and monitoring suppliers on their environmental performance). Furthermore, GE has been focusing on reducing its environmental impact, by working with its suppliers to redesign the production processes of their gas turbines to make them efficient. Also, GE has redesigned their jet engine products

to exceed the requirements of emission directives in Europe, and additionally, GE's product portfolio includes 32 clean technology products (Marshall et al., 2015).

As for social disclosure ranking, we see that aviation, telecommunications, automotive, metals, construction, and energy are achieving the highest scores. This is in line with Deegan (2002), who highlight the fact that industries with high environmental impact may disclose more information on social issues than other industries. Given that the environmental and social sustainability dimensions are distinct from one another, the one can compensate for the other. In banks and financial services industries for instance, environmental regulatory pressure is minimal. As such, these industries are not implementing much on environmental sustainability, but they are engaged into social sustainability activities. In Canada for instance, banks, insurance companies, trust and loan companies are required to report on their charitable donations, thus partly explaining financial services' high scoring in sustainability disclosure (Roca and Searcy, 2012).

4.3 Discussion

In this section we analyzed the content of companies' sustainability reports to examine what sustainability practices companies are disclosing. Descriptive analysis shows that a sub-set of the initial list of practices is more salient in companies' disclosure. In addition, we need to point out that there is equal level of disclosure among social and environmental practices. In all probability companies wish to reflect particular signals by reporting specific practices, taking into consideration the fact that the prevailing indicators are not only highly cited by the majority of firms, but also achieve high mean scores.

Indeed, the most highly reported indicators are the most prominent and established ones. In other words, it is apparent that the first generation indicators are the ones that prevailing. Indicatively, practices related to natural resources consumption, emissions, and heath and safety belong to

the first generation sustainability practices implemented by companies. In addition, these practices are the easiest to measure and quantify.

To begin with, reduction of energy consumption is not only an environmentally friendly initiative, but can also help lower cost. The same is the case for water consumption; reduction in water utilization protects the natural environment, but can also lead to financial savings. Therefore, it can be the case that certain sustainability practices are not only related to environmental sustainability, but also to cost reductions associated with minimized pollution costs in the form of fines, licenses, and breaking regulations (Churet and Eccles, 2014; Hughen et al., 2014; Branco and Rodriques, 2006). Indeed, reduction in resources consumption can offer the potential to reduce emissions and hence reduce liability costs (Molina et al., 2009). Cost-efficiency is critical for shareholders, who aspire to see that investments in sustainability bring about cost reductions. In this case, companies are implementing sustainability practices that are related to cost reductions, and consequently, it is reasonable that these practices are also highly reported.

Implementation of community support activities is an indicator that prevails among the 331 firms' disclosures. This is in line with the findings of Holcomb et al. (2007) and Gray et al. (1995). Companies are expected to respect and support the communities in which they operate, via implementation of such activities as educating local people, offering work to people from local communities, donating, and organizing philanthropic activities. Unless companies take into consideration the needs and living conditions of the public and nearby communities, then business operations may be prohibited by indigenous people. Apart from gaining communities' support and satisfaction, companies improve their public image, attract new customers, and gain access to new markets through implementation of such activities (Branco and Rodriques, 2006). As such, investors will consider the company's image, and perhaps in particular its sustainability records, before deciding to invest (Westlund, 2010). Besides, as Branco and Rodrigues (2006) advocate, firms that implement charity contributions

can reduce their taxable income as well as gain grants and incentives, achieving cost savings this way.

Employment of health and safety programs and encouragement of employee diversity also achieve high disclosure scores. This is consistent with Gray et al. (1995) who highlight the high rate of employee related disclosure by companies. Examples of these are internally oriented social practices associated with employee protection, support, and satisfaction. It is very important for employees that they work in a safe and healthy environment, which is respectful to their rights and diversities. Employee satisfaction is a crucial factor for corporate reputation and success and companies consequently highlight their actions on internal social sustainability activities in their reports. Employee diversity is another area that is also heavily reported. The underlying idea behind encouraging diversity among employees, suppliers, and business partners is a good virtue to practice. Indeed, people prefer to work for an organization with an environmental and social conscience with respect for its employees while customers are increasingly looking for evidence of a social responsibility among their suppliers. Besides, investments in sustainability activities can attract more engaged employees, and foster current employees' motivation, engagement and loyalty to the firm. In turn, this leads to reduced turnover, recruitment, and training costs (Branco and Rodrigues, 2006).

To sum up, in this study chapter we analyzed 331 sustainability reports to explore what practices companies are disclosing. We are summarizing below the list of our findings:

- A sub-set of the initial list of practices are prioritized in companies' sustainability reports. This is in line with Roca and Searcy (2012), who also propose that the plethora of sustainability indicators can be consolidated to a smaller set of indicators to measure similar issues.
- Sustainability indicators are either not reported at all (score 0) or are reported at a moderate level (score 1-2), as scores rarely achieve the highest value of 3 for most indicators.

- The most highly reported indicators belong to the first generation practices that are easy to quantify and are the most prominent and established ones.
- Companies are equally reporting on social and environmental practices.
- The industrial sector does not appear to matter as regards the specifics of what the companies are reporting.
- Later in chapter 8, we will see that size also does not matter.

Chapter 5. Construct development

In this chapter we develop constructs, based on the data derived from the sustainability reports' content analysis. Constructs represent cohesive distinct buckets for sustainability, corresponding to social and environmental sustainability separately. These constructs comprise of social and environmental disclosed practices.

Following Zhao et al (2011) methodology, we first carry out exploratory factor analysis (EFA), which is a data driven process used to understand the structure of a set of variables. EFA reduces the number of variables into a smaller number of initial (original) factors based on the chosen statistical criterion. Although we can expect which practices are grouped together based on their definition, we implement EFA as this is an exploration study and we wish to explore how variables are formulated. Besides, EFA is a way is to test our data and scoring methodology. We implement EFA using principal component analysis (PCA) as the extraction method for data reduction and for determining the main constructs measured by the items taken from different sources (Zhao et al., 2011). PCA assumes that the total variance of the variables can be accounted for by means of its components (or factors), and hence there is no error variance.

We next carry out confirmatory factor analysis (CFA) to test the model indicated by the EFA. The objective of CFA is to ensure unidimensionality, convergent validity, and reliability of the measurement scales (Narasimhan et al., 2006). In CFA the relationships of the variables to the factors are set at the onset and then we test how these relationships fit the data. Unidimensionality is established by assessing the overall fit of the model (Chen and Paulraj, 2004; Bollen, 1989). In order to evaluate the tenability of the measurement model, we are looking at the following fit criteria:

(a) The chi-square ($\chi 2$) which is the absolute fit index and tests whether the model fits in the population; ideally the chi square value should not be significant in order to indicate a good model fit

(b) The root mean squared error of approximation (RMSEA) and standardized root mean squared residual (SRMR) which ought to be less than 0.08;

(c) The competitive fit index (CFI) and the Tucker Lewis index (TLI) which ought to be greater than 0.9 to indicate a good fit;

(d) The Coefficient of determination (CD), which is similar to the R-squared value and represents the proportion of each dependent variable's variance explained by the model;

(e) The ratio of chi-square statistic to the degrees of freedom. Kline (2005) suggests that the ratio should fall within the recommended levels of 1.0-2.0 to indicate a good model fit; this criterion is also met in the two factor correlated model.

Before proceeding to the factor analyses, we note that we do not include all 51 variables in our analysis. We estimate the ratio of scores range (which is formulated at 0-3) to standard deviation for the 51 indicator variables. Figure 16 illustrates the concentration for the sustainability indicators (we have excluded seven indicators that are not reported by any of the companies thus their mean and standard deviation equal to zero).

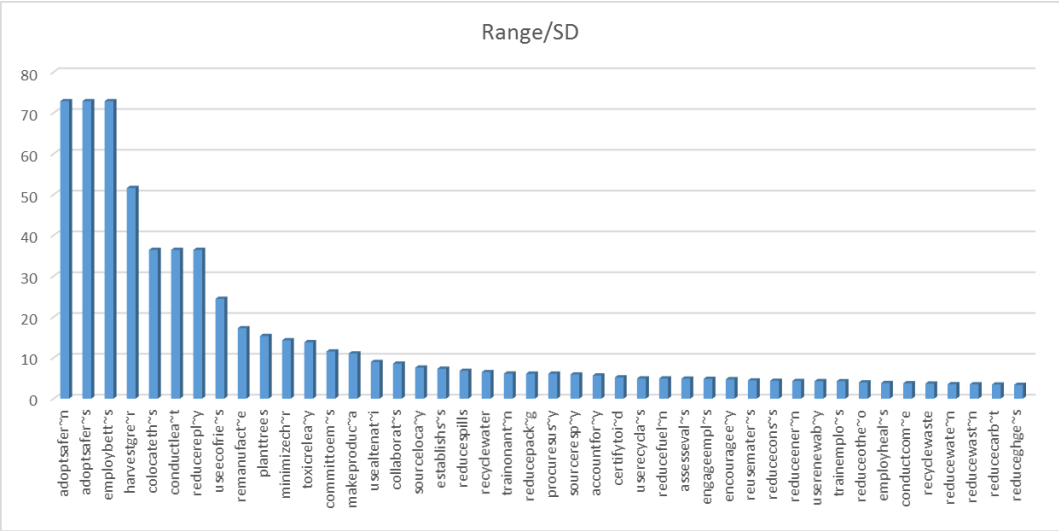


Figure 16. Graphical illustration of concentration for the sustainability indicators (excluding seven indicators with no response)

Looking at Figure 16, we see that there is a clear bend formulated at 10 in our variables. As such, we remove from our analyses 12 indicators whose range divided by standard deviation exceeds the value of ten. These indicators have a large range and a small standard deviation, and as such there is not enough variance for those indicators to explain anything. As such, these 12 indicators, together with the seven indicators with zero response, are not considered any more in this study. We carry out our factor analyses using the remaining 32 social and environmental indicators. In particular Table 14 presents the list of finally retained social sustainability indicators and Table 15 presents the final list of retained environmental sustainability indicators.

Table 14. Final list of social sustainability indicators retained for exploratory factor analysis

	Construct	**Item**
1	Labour practices	Employ Health and Safety programs
2	Labour practices	Encourage employee diversity
3	Labour practices	Establish supplier code of conducts
4	Labour practices	Source responsibly - ethically
5	Labour practices	Train on anti-corruption
6	Labour practices	Train and educate employees
7	Human rights /society	Engage employees
8	Human rights /society	Conduct community support activities
9	Human rights /society	Commit to employees

Table 15. Final list of environmental sustainability indicators retained for exploratory factor analysis

	Construct	**Item**
1	Emissions	Reduce carbon footprint
2	Emissions	Reduce fuel consumption
3	Emissions	Reduce GHG emissions
4	Emissions	Reduce other gases emissions
5	Emissions	Response to oil Spills
6	Supply Chain	Assess/evaluate suppliers
7	Supply Chain	Collaborate with suppliers
8	Supply Chain	Procure sustainably (environmental purchasing)
9	Supply Chain	Source locally
10	Materials Consumption	Reduce waste production
11	Materials Consumption	Reduce water consumption
12	Materials Consumption	Reduce packaging
13	Materials Consumption	Reduce consumption of resources
14	Materials Consumption	Reduce energy consumption
15	Materials Consumption	Use Renewable energy
16	Materials Consumption	Account for biodiversity
17	Recovery Processes	Recycle waste
18	Recovery Processes	Recycle water
19	Recovery Processes	Reuse materials/resources/products
20	Recovery Processes	Use recyclable/ed materials
21	Manufacturing and Operations Practices	Make product LCA
22	Manufacturing and Operations Practice	Use alternative modes of transportation (fuel)
23	Manufacturing and Operations Practice	Certify to ISO 14001 standard

Table 16 and Table 17 present the descriptive statistics for social and environmental sustainability indicators correspondingly. According to Kline (2005) every variable with skewness absolute value greater than 3 and kyrtosis absolute value greater than 10 are of concern. We see that the majority of variables are within the acceptable ranges. At the same time certain indicators such as ‘make LCA’, ‘use alternative modes of transportation’, ‘reduce spills’, and ‘commit to employees’ exceed the threshold values. Thus, we do not exclude them from the analysis at this stage, as the Exploratory Factor Analysis that follows, will provide greater insight into the number of indicators that will be excluded from the finalized scale.

Table 16. Descriptive statistics for final list of social sustainability indicators

Indicators	Mean	SD	Skewness	Kurtosis
Employ health and Safety programs	1.59	1.05	-0.32	-1.10
Encourage employee diversity	1.34	0.84	-0.43	-1.01
Establish supplier code of conducts	0.34	0.55	1.42	1.72
Source responsibly ethically	0.37	0.68	1.76	2.21
Train on anticorruption	0.36	0.65	1.92	3.50
Train employees	1.24	0.94	0.11	-1.01
Engage employees	0.47	0.83	1.69	1.87
Commit to employees	0.06	0.35	6.24	41.90
Conduct community support activities	1.82	1.06	-0.51	-0.94

Table 17. Descriptive statistics for final list of environmental sustainability indicators

	Mean	SD	Skewness	Kurtosis
Reduce carbon footprint	1.15	1.16	0.37	-1.39
Reduce fuel consumption	0.35	0.81	2.20	3.51
Reduce GHG emissions	1.37	1.19	0.01	-1.55
Reduce other gases emissions	0.57	1.01	1.49	0.69
Reduce spills	0.19	0.59	3.34	10.69
Assess/ evaluate suppliers	0.53	0.82	1.40	0.95
Collaborate with suppliers	0.23	0.47	1.92	2.92
Procure sustainably	0.30	0.66	2.13	3.56
Source locally	0.20	0.53	2.82	7.94
Reduce waste production	1.47	1.14	0.00	-1.41
Reduce water consumption	1.55	1.14	-0.12	-1.39
Reduce packaging	0.26	0.66	2.53	5.52
Reduce consumption of resources	0.52	0.92	1.57	1.14
Reduce energy consumption	1.92	0.93	-0.65	-0.35
Use renewable energy	0.71	0.93	1.01	-0.20
Account for biodiversity	0.43	0.71	1.51	1.28
Recycle waste	0.89	1.09	0.82	-0.77
Recycle water	0.24	0.62	2.76	7.12
Reuse materials/resources products	0.52	0.90	1.55	1.15
Use recyclable materials	0.49	0.81	1.47	0.99
Make product LCA	0.11	0.36	3.65	13.46
Use alternative modes of transportation	0.11	0.45	4.22	18.21
Certify to ISO 14000 standard	0.49	0.77	1.58	1.88

Common Method Variance Test

Common method variance (CMV) can be a threat to the validity of the results when data for the independent and dependent variables are collected from the same informants. Common method variance is the variance that is attributable to the measurement model (Gimenez and Sierra, 2012). Common method variance test is an exploratory technique to rule out the possibility of one factor emergence due to, say, some companies disclosing nearly all practices and others disclosing almost none. Given that both sustainability and financial data are obtained from companies' reports, we carried out this test to eliminate the possibility. Hence, we realize that different persons have written the various sections of the sustainability reports.

Harman's single (one) factor test is a common technique to assess common method variance (Narasimhan et al., 2006). Harman's test is used to ensure that not a single general factor accounts for the majority of covariance between the predictor and criterion variables. This test examines whether CMV exists in a dataset by loading all variables of the study into an exploratory factor analysis and examining the unrotated factor solution (Shah and Ward, 2007). If a single factor emerges, then this is an indication of CMV. The basic assumption is that if a substantial amount of CMV is present either (a) a single factor will emerge from the EFA or (b) one general factor will account for the majority of the covariance among the variables. Discriminant validity is supported if the original, unconstrained measurement model fits significantly better than a constrained single factor model (Vachon and Klassen, 2008; Pullman et al., 2009).

As such, we check for the existence of common method variance for the social and environmental indicators, as they are collected from the same source at the same time from the same respondent. Harman's one-factor test is employed, whereby we apply an EFA with no rotation including the 32 indicators. Eight factors with eigenvalues greater than 1 have emerged, with the first factor accounting for 15.10 % of the total variance explained. The results indicate that CMV is not a threat for this study, as no single factor has emerged nor any single factor accounts for the majority of the variance. Hence,

we recognize that Harman's one-factor test has some weaknesses. To begin with, it does not statistically control for this type of variance. Also, this method is sensitive to the number of variables inserted. As the number of variables increases, there are higher chances of CMV (Eichhorn, 2014).

For this reason, we also apply a confirmatory factor-analytic approach to Herman's one factor test the hypothesis that a single factor can account for all the variance (Flynn et al., 2010; Podsakoff et al., 2003). As such, we are loading all 32 variables into one CFA. Chi-square test is statistically significant, while the model fit indices of x^2/df (604.51/252) =2.39, CFI =0.593, TLI=0.554, SRMR= 0.071 and RMSEA=0.065. The fit for the unidimensional concept is not good. This suggests that a single factor model is not acceptable and thus CMV is not a threat for this study.

Validation analysis

There are five types of validity that need to be examined in order to ensure the validity of constructs. Construct validity assesses the extent to which the measurements properly represent the underlying theoretical constructs (Venkataraman, 1989). Construct validity refers to the extent to which the items in a scale measure the theoretical construct (Chen and Paulraj, 2004). Testing of construct validity concentrates on finding out a) whether an item loads significantly on the factor it is measuring - convergent validity- and b) ensuring that an item measures no other factors –discriminant validity. Construct validity steps include examining content validity, convergent validity, discriminant validity, and reliability (Anderson and Gerbing, 1988).

1. **Content Validity**

Content validity of an instrument is the extent to which it provides adequate coverage for the construct domain (DeVellis, 2016). Kerlinger and Lee (2000) define content validity as the representativeness or sampling adequacy of the content of a measuring instrument. Content validity assessment is a non-statistical assessment of validity, and is supported by an extensive literature review and making sure that there is linkage between the construct and theory.

2. Convergent Validity

Convergent validity measures the similarity or convergence between the individual items measuring the same construct. In this study, convergent validity is assessed using both EFA and CFA (Chen and Paulraj, 2004). In EFA, a component is considered to have convergent validity if its eigenvalue exceeds the value if 1 (Hair et al., 1995) and its factor loadings exceed the minimum value of 0.30 (Chen and Pulraj, 2004). Convergent validity is further assessed by the CFA solution, which reveals that the standardized coefficients for all items are two times greater than their standardized errors and all t values are all larger than 2 (Anderson and Gerbing, 1988; Zhao et al., 2011; Flynn et al., 2010). Bollen (1989) states that the larger the t-values, the stronger the evidence that the individual items represent the underlying factors. Furthermore, the proportion of variance (R^2) in the observed variables, accounted for by the theoretical constructs influencing them, can be used to estimate the reliability of an indicator. In previous studies, R^2 value above 0.3 are considered acceptable (Chen and Paulraj, 2004)

3. Discriminant Validity

Discriminant validity measures the extent to which the individual items of a construct are unique and do not load on any other constructs (Chen and Paulraj, 2004). In this study, discriminant validity is established using CFA. Models were constructed for all possible pairs of latent constructs. These models were run one each selected pair by (a) allowing for correlation between the constructs, and (b) fixing the correlation between the constructs at 1.0. Constraining the covariance between two latent variables is similar to stating that they are not distinct (Shah and Ward, 2007). A statistically significant difference in chi-square values between the fixed and free models indicates the distinctiveness of the two constructs (Flynn et al., 2010)

4. Reliability

Reliability or internal consistency ensures that a measure consistently reflects the construct that it measures. Reliability, taken overall, can be said to be an assessment of the degree of consistency and homogeneity between the items within a scale (Hair et al., 2006). Cronbach's coefficient alpha is the most commonly used measure for scale reliability. Internal reliability assesses the

extent to which items in a scale are correlated with each other. It is expressed as alpha (α) also called Cronbach's alpha. Alpha is an indication of the proportion of variance in the scale scores that is attributable to the true score. Typically, Cronbach's alpha should equal to 0.70 or higher (DeVellis, 2016), but for newly developed scales an alpha value of 0.60 can be used as a cut-off value (Chen and Paulraj, 2004). Fornell and Larcker (1981) also give an even lower threshold Cronbach's value of 0.5 for exploratory research.

Social sustainability and environmental sustainability

The social concept of sustainability remains relatively unexplored. Further to that, the joint synergistic contribution between environmental and social sustainability practices has been investigated to a very limited degree. Thus certain environmental sustainability practices are associated with improved social sustainability. Practices that are related to improved environmental and social performance are called eco-justice practices (Moneva, 2006).

Indicatively, reduction of resources consumption, waste recycling and product re-use and recycling do not only protect the environment and help maintain natural resources, but also help solve waste disposal and treatment problems for customers and communities (Rondinelli and Berry, 2000). As such, these practices extend beyond pure environmental protection, as they also improve employees' working conditions and communities' quality of life (Gimenez et al., 2012; Rondinelli and Berry, 2000; Shrivatsava, 1995).

Similarly, educating employees on social issues is positively related to environmental sustainability improvement through employee participation in voluntary activities such as local communities' support, tree planting for carbon offsetting and protecting wildlife (Johnson, 2006). In addition, Marshall et al. (2005) found that a concern for vineyard employee health and safety is linked to the reduction of environmental hazardous practices (toxic spray applications) in the workplace.

In order to explore the degree of integration between social and environmental practices, we implement an EFA using PCA including both environmental and social practices together. This way we explore the structure of social and environmental practices in order to decide whether we should treat social and

environmental sustainability practices separate to each other. Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO) value equals to 0.73 ($p<0.01$), while there are six components with eigenvalues above 1, explaining 46.05 % of the total variance. The social and environmental indicators are clearly separated from each other across the six components. This analysis confirms that the two concepts are distinct from each other and as such we treat social and environmental sustainability separate from each other and develop separate constructs for social and environmental sustainability.

5.1 Steps for construct development

We follow the framework proposed by DeVellis (2016) for scale development to validate our constructs. As such, we follow an eight step procedure which helps ensure that the measures and constructs that we are following in this section are valid and reliable.

Step 1. Clear determination of what needs to be included in a measure: It is important for scale developers to ensure that the construct being measured is distinct from other constructs. Scales can be developed to be either broad or narrow, varying according to the situations to which they apply. This is also the case for the constructs they cover. It is often observed that similar items may tap quite different constructs.
In this study we aim at developing a scale for sustainability, by creating constructs for the social and environmental nodes of sustainability, each comprising of a set of distinct and unique indicators.

Step 2. Generation of an item pool: Once the purpose of a scale has been clearly defined, we should start constructing the instrument. The first step is to generate a large pool of items that will potentially be eventually included in the scale.

An initial pool of 51 environmental and social was initially generated from the literature, which underwent a ‘’trimming process’’ due to their low variance. The final pool comprises of 31 indicators.

Choice of those constructs that reflect the scale’s purpose: The items ought to be selected taking into consideration the specific measurement goal. The description of what exactly the scale is intended to do should guide the process. It is important that items are making up a homogenous scale that reflects the latent variable underlying them. As such, the content of each item should primarily reflect the construct of interest. The use of multiple items constitutes a more reliable test than individual items, but still each must be sensitive to the true score of the latent variable.

In theory, a good set of items is chosen randomly from the universe of items relating to the construct of interest. Although the items should not extend beyond the bounds of the defining construct, they should exhaust the possibilities for the types of items within those bounds. The properties of the scale are determined by the items that comprise it. As such, if items constitute a poor reflection of the construct and they are hard to articulate, then the scale will not capture the essence of the construct.

Redundancy: Redundancy entails distinguishing between item features that strengthen a scale through repetition and those that do not. Redundancy is of minor concern during the early stages of item development.

In this study we removed 19 social and environmental indicators that had very low variance and as such do not contribute to the analysis.

Number of Items: It is not possible to specify the number of items that should be included in an initial pool. As a general rule, the larger the item pool, the better it is. However, it is very common for the initial pool to be three or four times as large as the final scale. If items are not relevant to the content of interest, or empirical data indicate that certain items are not essential for attaining good internal consistency, then the initial pool can be two times as large as the final scale. In our study, the initial pool of items comprised of 51 indicators, among which, only 32 indicators are included in the empirical analysis construct development.

Step 3. Determination of the measurement's format: Our scale consists of equally weighted items. The social and environmental sustainability indicators are equally disclosed in companies' sustainability reports and can be combined by simple summation into an acceptably reliable scale. In equally weighted scales, individual items can have a variety of response-option formats. This gives the scale developer a wide latitude in constructing a measure optimally fit for a particular purpose.

Step 4. Have initial item pool reviewed by experts: This step is concerned with having a group of people who are familiar with the construct to review the item pool and rate how relevant they think each item is to what we intent to measure. In this study we did not have the items reviewed by a pool of experts. We believe some of the items that are reported by very few companies have filtered out questionable or less useful items.

Step 5. Inclusion of additional items: It might be useful to include some additional items that will help determine the validity of the final scale. In this study we did not implement this step because our work used items obtained from GRI guidelines and other frameworks rather than inductively from sustainability reports themselves.

Step 6. Administer items to a development scale: An important issue to consider is the sample size. An indicators that appears to increase internal consistency may not have the same effect when it is used in a separate sample. Another risk of a small sample size is that it might be not representative of the population the scale is intended for. Nunally (1978) suggests that 300 cases is an adequate number so as to eliminate subject variance as a significant concern. Our sample consists of 331 firms; hence it meets this requirement.

Step 7. Evaluation of items: The inter-item correlation item is utilized to determine the items that contribute the least. First of all, items are negatively correlated to other items within a scale are the first that need to be discarded. Looking at our items' correlation matrix, we see that the level of correlation

among the items is modest to low, as the correlation coefficient values are not exceeding the value of 0.3. However, this is expected, as the items are skewed towards the value of zero. In addition, there any not any negative correlations taking place.

Reverse Scoring: If there are items that are negatively correlated with other items, then the option of reverse coding those items should be considered. There is no negative correlation taking place between any of our items, as such there is no need to proceed to reverse coding in this analysis.

5.2 Social sustainability construct development

Exploratory factor analysis for social sustainability

EFA, which is consistent with our conceptual definition for social sustainability, indicates two components underpinning social sustainability; the first component is related to companies' labour practices as it incorporates those activities conducted at the workplace so as to support employees and ensure a secure and fair working environment. The second component, on the other hand, is related to respecting human rights and offering assistance to local communities. The only exception to the rule is 'source responsibly', which does not load onto the labour practices component, as expected, but loads on the third component on its own. Source responsibly is reported by only 20% of the companies and since CFA requires at least two indicators for each construct, we do not consider it further in our analysis; however, we believe it should be investigated further for more items in future research using reports for later years as responsible sourcing is a big topic of great importance that we investigate in the future.

As Ashby et al (2012) and Sodhi (2015) point out, the identification of social practices for sustainable supply chain management is an area that is gaining momentum, especially concerning suppliers' ethics, working conditions, health and safety. The EFA results for social sustainability practices are presented in Table 18.

Table 18. EFA results for social sustainability practices

	1	2	3
Employ health and safety programs	.689		
Encourage employee diversity	.634		
Establish supplier code of conducts	.438		
Source responsibly ethically			.899
Train on anticorruption	.569		
Train employees	.732		
Engage employees		.675	
Commit to employees		.671	
Conduct community support activitie		.661	

*We impose a relaxed but indicative threshold of 0.4 for indicator loadings

Cronbach's alpha value equals to 0.344 for the human rights component, which is quite low, perhaps because it comprises only three indicators, and 0.606 for the labour practices component, which is within the acceptable levels.

Discriminant validity is assessed via examining the component correlation matrix. We see that the two factors correlate at a very low level (r=0.20), which is far less than the cut-off point. As such, discriminant validity is ensured in our analysis.

Finally, all indicators load significantly on their respective constructs; all loadings (except the one for supplier codes of conduct) are greater than 0.6, providing evidence of convergent validity of the theoretical constructs.

KMO test: The Kaiser–Meyer–Olkin Measure of Sampling Adequacy value is 0.67, thus exceeding, even marginally, the recommended value of 0.6, while Barlett's Test of Sphericity reaches statistical significance ($p<0.001$), supporting the factorability of the correlation matrix. Barlett's Test of Sphericity tests the hypothesis that the correlation matrix is an identity matrix (diagonal elements are equal to 1, while off-diagonal elements are equal to 0), which implies that the variables of the analysis are not correlated, and therefore they are not suitable for factor analysis. In our case, the significance value is less than 0.05,

therefore we reject the null hypothesis that the population matrix is an identity matrix. There are some significant correlations at p<0.01 level, but the degree of correlation among the indicator variables is quite modest (r=0. 20-0. 35).

Eigenvalue test: We use the Kaiser criterion, according to which total variance is explained by those components that have an eigenvalue of one or more. The number of factors is determined by retaining only the factors with an eigenvalue of 1 or higher (following Kaiser's criterion). The eigenvalue of a factor represents the amount of variance explained by that factor. PCA reveals that there are three components with eigenvalues above 1, explaining 49% of the total variance.

Rotation: To aid in the interpretation of these components, varimax rotation is performed, following Zhu and Sarkis (2004) and Cormier et al. (2004). A rotated factor is simply a linear combination of the initial factors. The rotated factors will explain exactly the same total variance as the initial factors, even though the variables relate to the rotated factors differently than they relate to the initial factors. Rotated factors divide up the variance more usefully. The rotated solution reveals the presence of a simple structure, with the components showing a number of strong loadings and all items loading substantially on only one component. The three components are weakly correlated with each other (<0.20).

Pattern matrix presents the factors which have emerged and the corresponding loadings of the variables. All indicators load on separate components, providing evidence of a lack of common method variance (Podsakoff et al., 2003). The cut-off value for the factor loadings is 0.4, and as such items with loadings less than 0.4 are removed (Shah and Ward, 2007).

Confirmatory factor analysis for social sustainability

Following the approach executed by Zhu and Sarkis (2004) and Marshall et al (2015), we conduct CFA for social sustainability based on four alternative measurement model configurations:

a) An independent two factor model, in which we hypothesize that each item loads on its respective factor, based on the EFA results;

b) A two-factor correlated model, in which each item loads on its respective factor, while the correlations among the factors are free to vary;
c) A hypothesized higher order factor, representing a general latent 'social sustainability' practices construct, allowing each of the two factors to load significantly onto the higher order factor; and
d) A one factor constrained model, in which the eight indicators load on a single factor.

The results of the alternative model configurations for the social sustainability scale are presented in Table 19.

Table 19. Alternative CFA model configurations for social sustainability

	X^2 (df)	X^2/df	RMSEA	SRMR	CFI	TLI	CD
One factor model	51.01 (20)***	2.55	0.068	0.056	0.83	0.76	0.64
Two factor model	**26.47 (20)**	**1.32**	**0.031**	**0.044**	**0.96**	**0.95**	**0.79**
Two factor correlated model	22.93 (19)	1.20	0.025	0.036	0.97	0.96	0.80
Higher-order factor	22.93 (18)	1.27	0.029	0.036	0.97	0.95	0.46

Model statistics indicates that the two-factor correlated model adequately fits the data, as evidenced by the chi-square statistic and comparison indices. Chi-square test is not statistically significant, which indicates that the model has a good fit. Also, the ratio of chi-square to the degrees of freedom falls within the recommended range of 1.0 -2.0, which is another indication of acceptable fit (Chen and Paulraj, 2004). All indicate that the model fits the data well.
Table 20 presents the factor loadings for the social sustainability practices. We see that all the indicators load positively and significantly on their respective constructs ($p<0.01$) and exceed the value of 0.3, manifesting existence of

convergent validity. Hence the factor loadings are not ideally high, particularly for the supplier codes of conduct; however, we do not drop any of the indicators for two reasons. First, removing indicators may threaten the content validity of scale (Narasimhan et al., 2006); second, this is an exploratory study and the results are indicative to signal how the variables are formulated. Convergent validity is further ensured by the fact that CFA results also reveal that the standardized coefficients for all items are greater than twice their standardized errors and that the t values are all larger than 2 (Zhao et al., 2011; Flynn et al., 2010). Finally, reliability is assessed using composite reliability (CR), which is a measure equivalent to Cronbach's alpha (Nunnally, 1978). CR values are presented in Table 20, and we see that they equal to Cronbach's alpha values. This implies that the variance captured by the factor is significantly higher than the variance indicated by the error components.

An additional test for discriminant validity is also implemented. We verified that the squared root of average variance extracted (AVE) for each of the two constructs is greater than the correlation between any pair of them (Fornell and Larcker, 1981; Shah and Ward, 2006). Both labor practices and human rights constructs have AVE equaling less than the cut-off value of 0.5, thus several studies have accepted AVE values below 0.5 (Zhao et al., 2011; Sarkis et al., 2010; Flynn et al., 2010).

Table 20. CFA results for social sustainability

Construct	Indicator	Loading
Labour practices (AVE=0.25, CR=0.61)	Employ health and safety	0.54***
	Establish supplier codes of conduct	0.33***
	Train employees	0.64***
	Train on anti-corruption	0.43***
	Encourage employee diversity	0.50***
Human rights (AVE=0.20, CR=0.41)	Conduct community support activities	0.35***
	Engage employees	0.59**
	Commit to employees	0.36***
Labour practices* Human rights		0.20*

The fact that the two-factor measurement model fits significantly better than the constrained one factor model further supports discriminant validity (Vachon and Klassen, 2008). The inadequate fit of the one factor model is consistent with our expectations that social sustainability is a multidimensional concept - that is, there is more than one factor driving the pattern of co-variation among the social indicators. For the case of social sustainability, it comprises two constructs – human rights and labour practices - which are decomposed into a number of indicators. The finalized scale for social sustainability is illustrated in Figure 17.

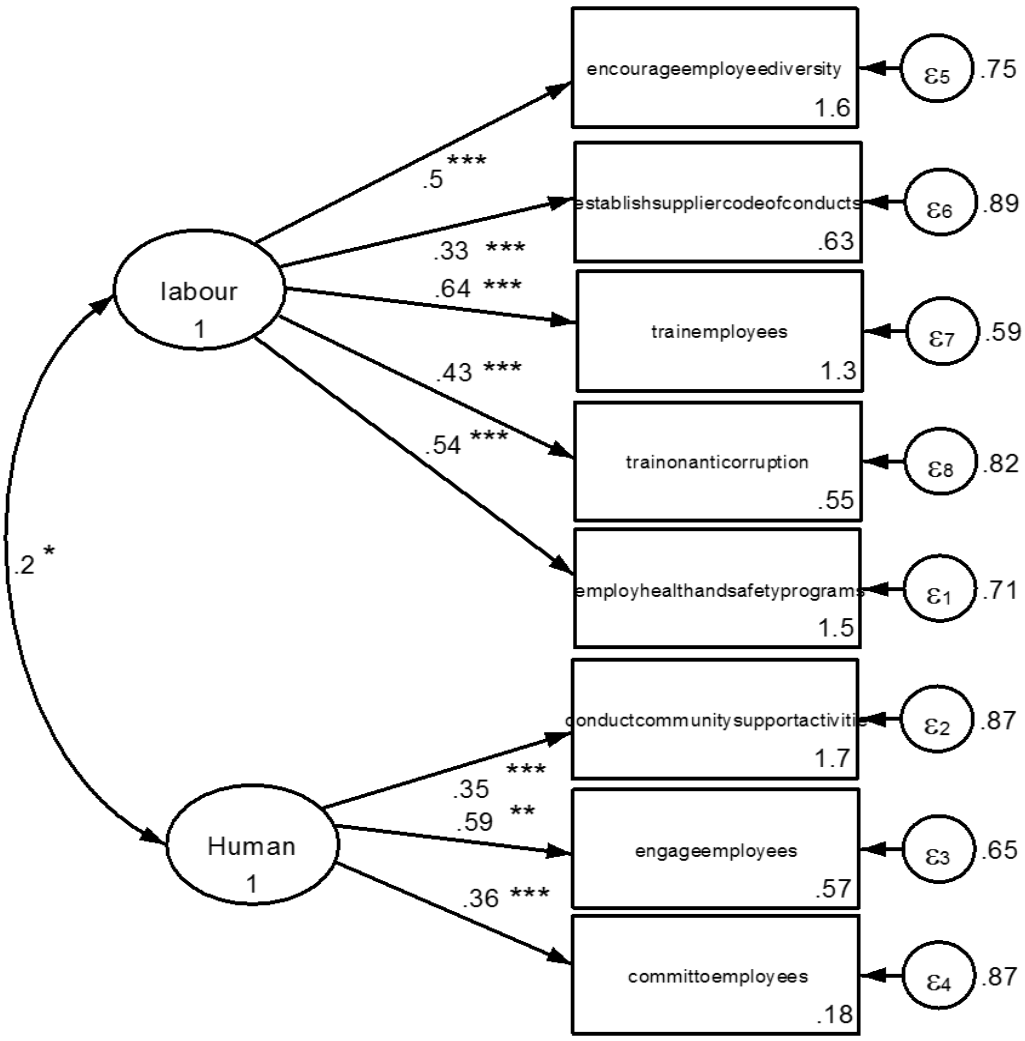


Figure 17. Social sustainability measurement model (obtained by CFA)

5.3 Environmental sustainability construct development

Exploratory factor analysis for environmental sustainability

EFA for environmental sustainability gives three components. In particular, the first factor is related to environmental protection practices. The second component is related to materials consumption reduction, while the third component concerns supply chain management. The EFA results for environmental sustainability practices are presented in Table 21.

Table 21. EFA results for environmental sustainability practices

	1	2	3
Reduce_carbon_footprint			
Reduce_fuel_consumption			
Reduce_GHG_emissions		.707	
Reduce_other_gases	.543		
Reduce_ Spills	.585		
Assess_suppliers			.603
Collaborate_with_suppliers			.501
Procure_sustainably			.432
Source_locally	.445		
Reduce_waste_production		.661	
Reduce_water_consumption		.621	
Reduce_packaging			.510
Reduce_consumption_of_resources			
Reduce_energy_consumption		.560	
Use_renewable_energy			
Account_for_biodiversity	.665		
Recycle_water	.471		
recycle_waste			
Reuse_materials			

Use_recyclable_materials		.498
Make_product_LCA		.411
Alernative_transportation		
Certify_to_ISO	.445	

*We impose a relaxed but indicative threshold of 0.4 for indicator loadings

Cronbach's alpha equals to 0.551 for environmental protection, 0.636 for materials conservation, and 0.516 for supply chain components respectively. The constructs give values below 0.7, but they are still above 0.5 for exploratory research. Thus, we accept these values, as we do not validate the constructs. This is an exploratory research and we are not validating the constructs; instead, these constructs are indicative to signal how variables are formulated. The three components correlate at a very low level (below 0.2), which is far less than the cut-off point. As such, discriminant validity is not an issue for this analysis.

Observing the EFA results, we see that all three components show a number of strong loadings and most of the variables load substantially on only one component. All indicators load on separate components, providing evidence of a lack of common method variance (Podsakoff et al., 2003).

KMO test: EFA for environmental sustainability is implemented using Principal Component Analysis as the Extraction Method. The Kaiser–Meyer–Olkin value is 0.66, thus exceeding, though marginally, the recommended value of 0.6, while Barlett's Test of Sphericity reaches statistical significance ($p<0.001$), supporting the factorability of the correlation matrix. The degree of correlation among the indicator variables is modest (r=0, 20-0, 35).

Eigenvalue test: Eigenvalue being greater than one is the statistical criterion that EFA utilizes to determine the number of factors. Initial PCA reveals that there are eight components with eigenvalues above 1, explaining 59 % of the variance. Looking at the screeplot though, there is a clear break at the third component. Therefore, it was decided to rerun the analysis by forcing a three-factor solution.

Rotation: To aid in the interpretation of these components, varimax rotation is performed. The three-component solution explains 27.7% of the variance, while the three components are correlated at a very low level.

The importance of the materials consumption reduction component is reflected in increasing regulations on this category (such as the registration, evaluation, authorization, and restriction of chemicals directed by EU) that require companies to commit to non-environmental hazardous processes.

We see that EFA revealed a component related to supply chain management, which includes the environmental practices that are implemented within the supply network. Shrivastava (2007) defines sustainable supply chain management as'' integrating environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the customers as well as end-of-life management of the product after its useful life''. Indeed, sustainable supply chain management, integrating both upstream and downstream supply chain, has the capability to minimize the environmental impact of forward and reverse flows (Yu et al., 2014; Zhu and Sarkis, 2004). Sustainable supply chain management addresses issues related to waste reduction, environmental sourcing of raw materials, inbound logistics processes, and collaboration with suppliers on environmental issues.

The fact a supply chain related construct emerged from EFA is a very interesting finding, highlighting the important role of supply chain in improving environmental sustainability as number of studies argue (Carter and Rogers, 2008; Gimenez and Sierra, 2013). Firms' operations are outsourced to suppliers, a fact that implies that firms' environmental impact depends to a large extent on the environmental impacts of their supply chain network. Thus, firms need to manage their supply chains to ensure that suppliers abide by environmental regulations and health standards. To this end, Tate and Ellram (2010), recognize in their study that suppliers, materials, technologies, manufacturing, and modes of transportation are key factors to consider for environmental sustainability. Indeed, companies are increasingly managing

their suppliers' environmental performance to ensure that sourcing of environmental friendly materials is taking place (Rao and Holt, 2005).

It is worth mentioning that ''local sourcing'' would be expected to load onto the supply chain related component. Instead it loads onto the environmental protection practices. This makes sense on the grounds that local sourcing has multiple effects. On the one hand it enables companies to keep better control of the quality of purchased materials as they can keep track of suppliers, and on the other hand transportation distance is reduced. This way gas emissions and fuel consumption are reduced. As such, this practice extends beyond purely supply chain management as it substantially contributes to environmental impact minimization.

Contrary to social sustainability, which is totally consistent with our conceptual definition, EFA indicates different components for environmental sustainability from what we expected from our literature review. In particular a number of environmental indicators do not load above the threshold value of 0.4 and as such are not presented in the EFA, as they do not contribute to any of the components. Probably this has to do with the fact that the environmental indicators far outnumber the social ones. Environmental sustainability is substantially explored in the literature and consequently the environmental indicators that we derived from the various sources are very specific and analyzed in detail. Also, as sustainability reporting is a relatively recent phenomenon its content is not yet standardized.

Confirmatory factor analysis for environmental sustainability

After eliminating items that had low loadings, we proceed to CFA for environmental sustainability, based on four alternative measurement models configurations:

a) A three factor unconstrained model, in which each item loads on its respective factor, corresponding to the EFA solution;

b) A three -factor correlated model, in which each item loads on its respective factor, while the correlations among the factors are free to vary;

c) A hypothesized higher order factor, representing a general latent environmental sustainability' practices construct allowing each of the two factors to load significantly onto the higher order factor; and

d) A one factor constrained model, in which the eight indicators load on a single factor.

The results of the alternative model configurations for environmental sustainability scale are presented in Table 22.

Table 22. Alternative CFA model configurations for environmental sustainability

	X^2 (df)	X^2/df	RMSEA	SRMR	CFI	TLI	CD
One factor model	325.07 (104)***	3.12	0.080	0.076	0.554	0.486	0.69
Three factor model	**241.10 (104)*** **	**2.31**	**0.063**	**0.081**	**0.724**	**0.681**	**0.938**
Three factor correlated model	196.66 (101)***	1.94	0.053	0.058	0.807	0.771	0.928
Higher-order factor	208.60 (101)***	2.06	0.057	0.063	0.783	0.742	0.64

Model statistics indicates that the three-factor correlated model adequately fits the data, as evidenced by the chi-square statistic and comparison indices. The ratio of chi-square to the degrees of freedom falls within the recommended range of 1.0 -2.0 (Chen and Paularj, 2004). All indications are that the model fits the data well.

Table 23 presents the factor loadings for the social sustainability practices. We see that all the indicators load positively and significantly on their respective constructs ($p<0.01$) and exceed the value of 0.3, providing evidence of convergent validity. Hence the factor loadings are not ideally high; however we do not reject any of the indicators. Convergent validity is further ensured by the fact that CFA results also reveal that the standardized coefficients for all items

are greater than twice their standardized errors and that the t values are all larger than 2 (Zhao et al., 2011; Flynn et al., 2010). Finally, reliability is assessed using composite reliability (CR), which is a measure equivalent to Cronbach's alpha. CR values are presented in Table 20, and we see that they equal to Cronbach's alpha values.

An additional test for discriminant validity is also implemented. We verified that the squared root of average variance extracted (AVE) for all constructs is greater than the correlation between any pair of them (Fornell and Larcker, 1981; Shah and Ward, 2006). All three constructs have AVE less than the cut-off value of 0.5, thus several studies have accepted AVE values below 0.5 (Zhao et al., 2011; Sarkis et al., 2010; Flynn et al., 2010).

Table 23. CFA results for environmental sustainability

Construct	Indicator	Loading
Environmental protection (AVE=0.20, CR=0.57)	Reduce other gases emissions	0.47***
	Reduce spills	0.40***
	Source locally	0.32***
	Account for biodiversity	0.61***
	Recycle water	0.30***
	Certify to ISO14000 standard	0.43***
Materials conservation (AVE=0.31, CR=0.64)	Reduce GHG emissions	0.48***
	Reduce water consumption	0.58***
	Reduce energy consumption	0.60***
	Reduce waste production	0.57***
Supply chain (AVE= 0.16, CR=0.53)	Assess/ evaluate suppliers	0.53***

	Collaborate with suppliers	0.36***
	Procure sustainably	0.29***
	Reduce packaging	0.52***
	Use recyclable materials	0.37***
	Make product LCA	0.30***
Protection * Materials		0.43***
Protection * Supply chain		0.20*
Materials* Supply chain		0.40***

The fact that the three-factor measurement model fits significantly better than the constrained one factor model further supports discriminant validity (Vachon and Klassen, 2008). The inadequate fit of the one factor model is consistent with our expectations that environmental sustainability is a multidimensional concept - that is, there is more than one factor driving the pattern of co-variation among the environmental indicators. Environmental sustainability comprises three constructs - environmental protection, materials consumption reduction, and supply chain - which are decomposed into a number of indicators. The finalized scale for environmental sustainability is illustrated in Figure 18.

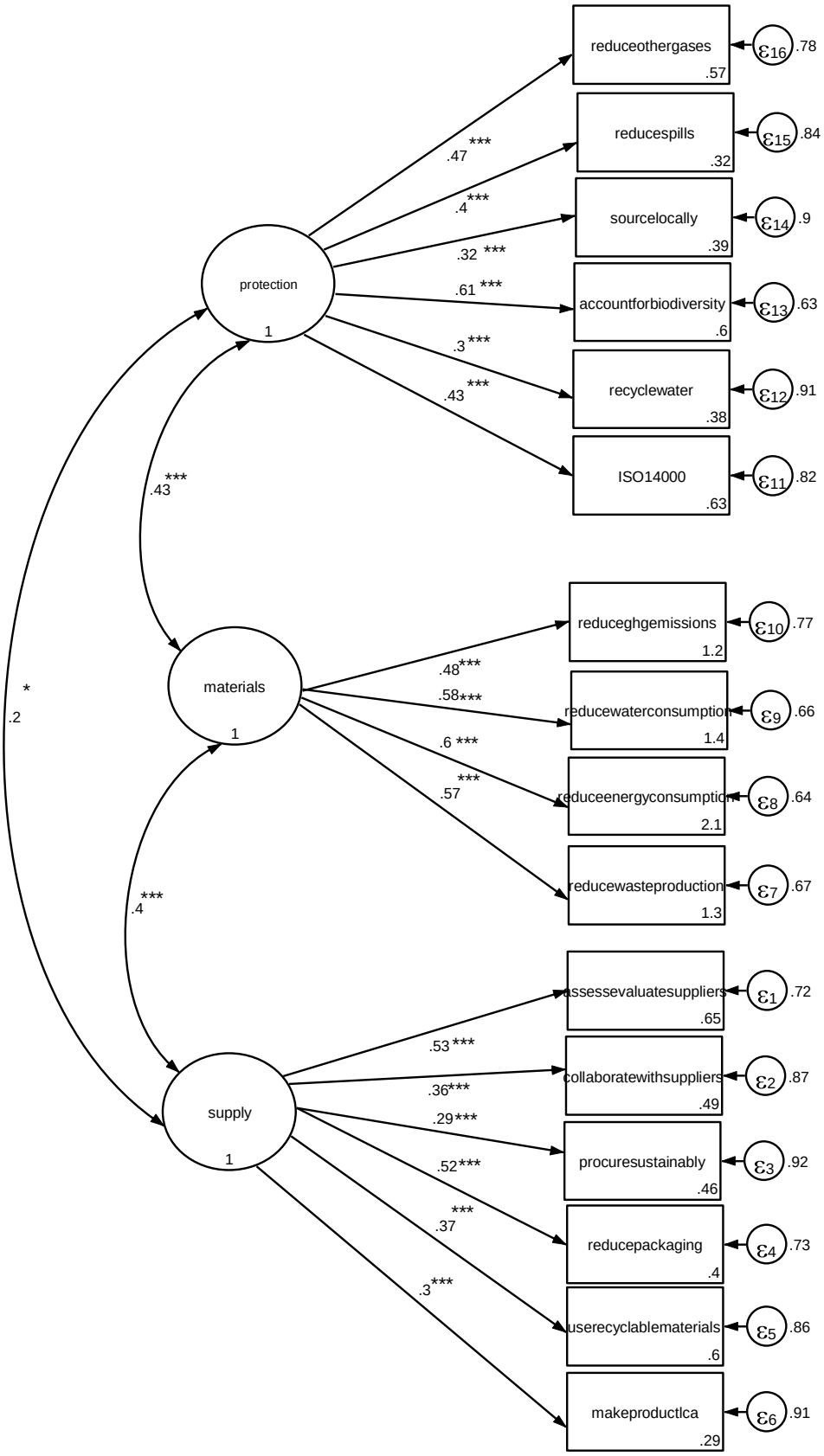


Figure 18. Environmental sustainability measurement model (obtained by CFA)

Table 24 presents the factor scores for the two social and three environmental constructs derived by EFA and Table 25 presents the Spearman rank order correlation between the five constructs. Factor scores are composite variables defined as sums of the variables' standardized values, weighted by their factor loading coefficients. The five constructs are positively and significantly correlated with each other ($p < 0.05$), providing support for the multi-dimensional and integrated nature of sustainability. Exception to this rule is human rights, which is the weakest construct, as it comprises of only three indicators.

It is worth mentioning that the effect of multicollinearity is not present, as bivariate correlations do not exceed the value of 0.47. An exception to the rule is human rights, which is not correlated with the rest of the factors. This is not surprising if we take into account that it's Cronbach's alpha value equals 0.344, which is considerably less than that of the other constructs. Thus the remaining four constructs are reliable and meet established criteria for assessing validity. As such, we can safely conclude that sustainability comprises a broad set of items that can be distilled into five distinct constructs, each representing a unique facet.

Table 24. Standardized statistics for the two social and three environmental constructs

Variable	Mean	SD	Min	Max	alpha (α)
Human rights	0	1	-1.062	6.006	0.344
Labour practices	0	1	-1.871	2.179	0.606
Environ. protection	0	1	-0.854	3.706	0.551
Materials conservation	0	1	-2.142	1.831	0.636
Supply chain	0	1	-0.87	4.01	0.516

Table 25. Correlation analysis for the two social and three environmental constructs

	Human rights	Labour practices	Materials consumption	Supply Chain	Environ. protection
Human rights	1				
Labour practices	0.1305**	1			
Materials conservation	0.0892	0.3076***	1		
Supply Chain	-0.0197	0.2209***	0.1994***	1	
Environ. protection	-0.0602	0.4740***	0.2920***	0.1148**	1

**$p \leq 0.05$; ***$p \leq 0.01$.

We have also tried CFA based on the conceptual developed constructs for social and environmental sustainability. The social construct is not an issue as EFA determines the same two constructs expected from theory, except that it eradicates ‘’source responsibly’’ indicator. Hence the CFA for environmental sustainability based on theory is not robust enough, and thus we do not consider it further in our analysis. In any case, the CFA for both social and environmental sustainability based on theory are presented in Appendix 2.

Chapter 6. Illustrations from ‘leader’ and ‘laggard’ companies

The purpose of this chapter is to provide illustrative text form sustainability reports to provide support for the scoring methodology. We are identifying leader and laggard companies based on their total sustainability disclosure score (summing up all practices’ scores for each company). Relevant quotes from reports are used to compare against leader and laggard companies’ disclosure and provide some support for the scoring methodology applied.

A comparative case study analysis is implemented, in order to explore the pattern of disclosure in four industries using a multi-case approach. Within case analysis is used in order to reduce the amount of data and present it in a meaningful way (Eisenhardt, 1989). Data reduction is primarily done through categorization and pattern matching (Pagell and Wu, 2009). To this end, we have selected 16 companies as exemplary cases so as to summarize the relevant information derived from the content analysis. The sample of 16 companies is in agreement with Eisenhardt (1989) conclusion that the use of less than four cases is not recommended.

The sixteen companies have been selected as follows: We focus on 1) energy and utilities; 2) metals and mining; 3) commercial services; and 4) household product manufacturers and select the companies with the two highest and the two lowest disclosures within each of the four industrial sectors. We are profiling these companies as ‘leaders’ and ‘laggards’ correspondingly within these sectors. The use of multi-industry data is considered a strength for this study as it reduces the possibility of contingency effects. A similar classification clustering scheme comparing leader and laggard companies, based on their disclosure, is used by Patten (1991), Jenkins and Yakovleva (2006) and Formentini and Taticchi (2016).

The reason we select the particular industries is that they are all different from each other and as such we maximize variance across companies. Also, metals, energy, and commercial services have a high propensity for pollution, while household products are consumer oriented with high advertising intensity. Advertising expenditure increases public awareness about the company and informs customers and other stakeholders about corporate sustainability

activities (Servaes and Tamayo, 2013). In addition, we chose household and personal products industrial sector, which has consumer visibility and according to Roberts (1992) this industry characteristic has a systematic relationship with sustainability activities. Energy and commercial services have high representation in our sample, while metals and mining is a controversial sector as regards its sustainability operations activities. Also, these four industries have the largest number of companies' representation in the sample (34 companies are representing logistics services, 35 companies are representing energy and utilities, 24 companies belong to metals and mining). Other researchers, for instance, Patten et al. (2002) consider four sectors as well -- chemical, energy, metals, and petroleum -- as critical industries. In Table 26 we exhibit companies' distribution within the four selected industrial sectors.

Table 26. Number of companies in the four selected industrial sectors

Industry	Number of companies in overall sample	Number of leader companies	Number of laggard companies
Energy and utilities	35	2	2
Metals and mining	24	2	2
Commercial services	34	2	2
Household services	12	2	2

Looking at the four selected industries we see that although the exact sustainability indicators vary across the industries, particular indicators are disclosed in all four industries. The following graphs present the indicators that are reported by more than 50% of the companies of each industry. Figure 19 presents the frequency analysis of sustainability indicators disclosed in the four industry sectors.

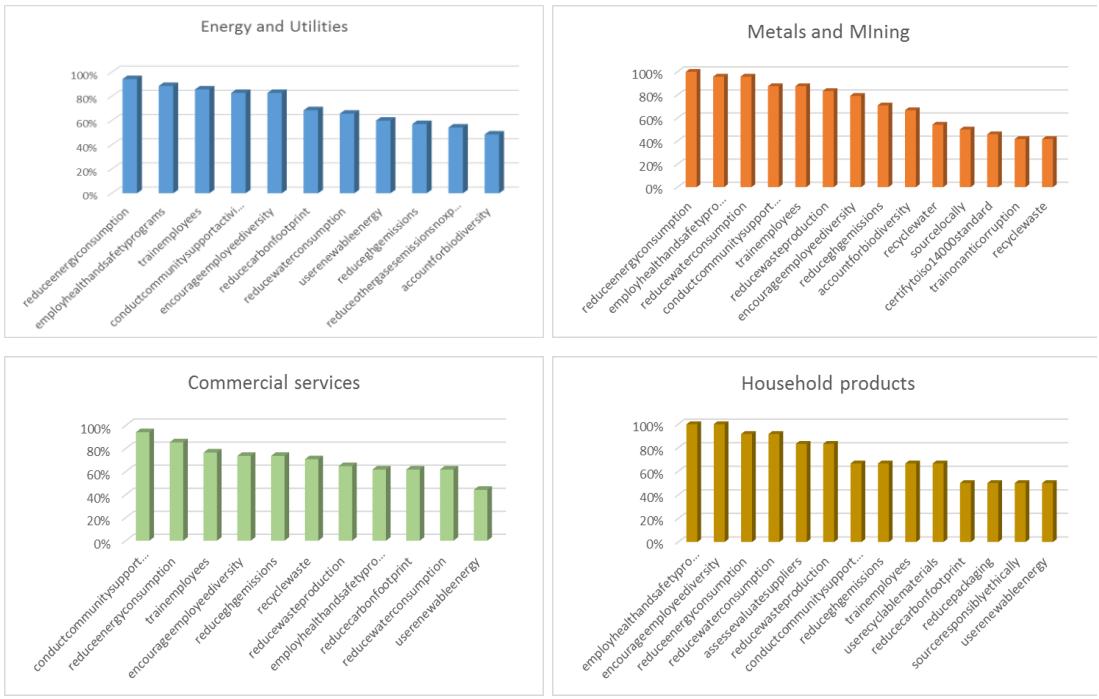


Figure 19. Frequency analysis of social and environmental indicators across the four selected industrials sectors

To begin with, reduction of energy consumption is reported by 33 energy, 24 metal, 29 commercial, and 11 household companies. Along similar lines is reduction of water consumption and GHG gases, health and safety, employee training, community support activities, and employee diversity. It is illustrated from the analysis that all four industries report both social and environmental indicators. Thus, it is worth getting into greater detail and observing the differences in disclosure within each industrial sector individually.

6.1 Leader and laggard companies

Leader companies have the highest sustainability performance as per their disclosure, while laggard companies disclose some social and environmental sustainability information, but the degree of their disclosure is relatively low. The identified leader and laggard companies are presented in Table 27.

Table 27. The eight leader and eight laggard companies in the four selected industrial sectors

Industry	Company	Country	Revenues (m. $)
Leader companies			
Household and Personal products	Bic	France	2,539
	Johnson & Johnson	USA	71,312
Energy and Utilities	Abengoa	Spain	10,752
	Hellenic Petroleum	Greece	10,469
Metals and Mining	Teck Resources	Canada	9,382
	Lonmin PLC	UK	1,520
Commercial services	UPS	USA	55,438
	Ansaldo	Italy	1,303
Laggard companies			
Household and Personal products	Kruger	Canada	
	Groupe SEB	France	32
Energy and Utilities	Koncar	Croatia	646
	Solar Century	UK	182
Metals and Mining	Alcoa	USA	23,032
	IMI PLC	UK	2,190
Commercial services	Panalpina	Switzerland	6,758

	DFDS	Denmark	12,779

Both leader and laggard companies are nearly all European, thus reducing another differentiation inside sectors. Turning to the report content quality, there is a general perception that two factors determine reports quality: a) conformity with GRI guidelines; b) external assurance/ verification (Moneva et al., 2006). In addition, some scholars have used number of pages or words as measures of sustainability (Wiseman, 1982; Cowen et al., 1987; Jenkins and Yakovleva, 2006).

All leader companies (except from BIC) report in accordance with GRI guidelines. We see that UN Global Compact principles are not very well established, as only three of the leader companies refer to them in their sustainability reports. Finally, all leader companies except for Johnson and Johnson have sought external assurance verification of their reports (Table 28). On the other hand, laggard companies are latecomers to the disclosure of social and environmental information. To begin with, laggard companies' sustainability reports consist of a considerably smaller number of pages compared to those of the leader companies. Also, laggard companies are relatively slow in providing more sophisticated information; only three companies adhere to the GRI guidelines, while only two of them refer to the UN Global Compact principles. Finally, laggard companies have clearly been slower in externally verifying their social and environmental information, as only two of them have sought third party assurance. Table 28 analyzes the characteristics of the leader and laggard sustainability reports.

Table 28. The content of leader and laggard companies' sustainability reports

Leader Company	Year	GRI –G4 Guidelines	UN Global Compact principles	Assurance	Pages
Johnson & Johnson	2013	✓	✓	x	118
BIC	2012	x	x	✓	72
Kruger	2015	✓	x	x	88
Groupe SEB	2014	✓	✓	✓	35
Abengoa	2013	✓	x	✓	130
Hellenic Petroleum	2012	✓	✓	✓	134
Koncar	2013	✓	✓	x	38
Solar Century	2013	x	x	x	16
Teck Resources	2013	✓	x	✓	133
Lonmin PLC	2013	✓	x	✓	197
Alcoa	2013	x	x	x	8
IMI PLC	2012	x	x	✓	9
UPS	2013	✓	x	✓	116
Ansaldo	2014	✓	✓	✓	91
Panalpina	2013	x	x	x	32
DFDS	2014	x	x	x	18

Finally, Figure 20 and Figure 21 illustrate the total disclosure scores for leader and laggard companies in the four industrial sectors. We see that all leader companies are outperforming laggard ones, and in some cases, by more than 3 times.

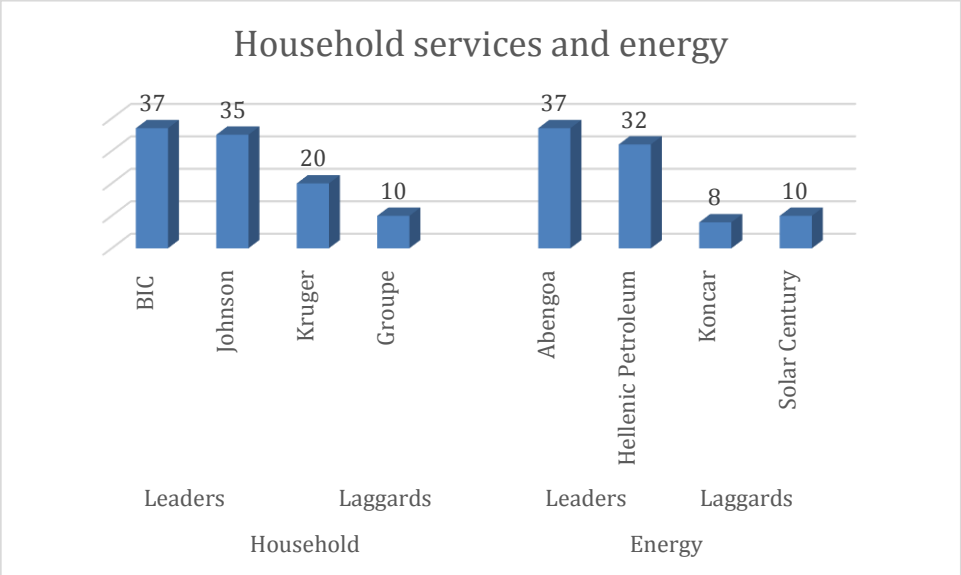


Figure 20. Total disclosure for leader and laggard companies in household services and energy and utilities

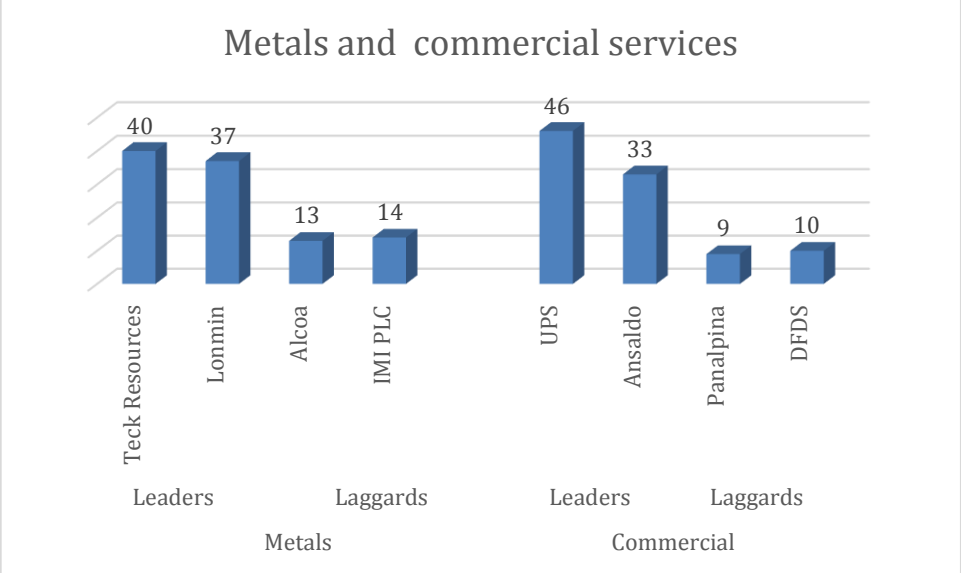


Figure 21. Total disclosure for leader and laggard companies in metals and mining and commercial services

6.2 Reported text

In order to distinguish which practices differentiate leader from laggard companies, we calculate the average score of the leader and laggard firms within each of the four industries in the five sustainability variables obtained by

the EFA. Table 29 presents the scores of the leader and laggard companies in each of the five sustainability variables.

Table 29. Magnitude of differences in disclosure in the five sustainability variables between leader and laggard companies

	Labour practices	Human rights	Protection	Materials	Supply chain	Total
Household and personal products						
Leaders	8	1.5	6.5	10.5	5.5	26.5
Laggards	4.5	2	1	3.5	3	11
Energy and utilities						
Leaders	9	3	8.5	6.5	**0**	27
Laggards	2	1	1	1.5	**0**	5.5
Metals and mining						
Leaders	8	5	9	9.5	**0**	31.5
Laggards	3	0	0.5	6	**2**	9.5
Commercial services						
Leaders	8.5	**1**	5	10.5	3.5	25
Laggards	4	**1**	0	1.5	0	6.5

In all, Table 29 confirms the argument that leader companies are outperforming laggard ones at least double in all five sustainability variables. An exception to the rule is supply chain, which equals zero for leader firms in both energy and mining industries. This fact is illustrated by the fact that Teck Resources,

Lonmin, Abengoa, and Hellenic Petroleum, are not disclosing extensive and quantitative supply chain related information in their reports. In addition, leader and laggard companies in the commercial services score equally on human rights.

To provide support to our content analysis methodology and companies’ resulting sustainability score, we provide relevant reported text from leader and laggard companies’ sustainability reports. This analysis aims at providing support to our scoring methodology. To begin with, Table 30 provides relevant texts from metals and mining sustainability reports.

Table 30. Text retrieved from metals and mining' sustainability reports

	Metals and Mining Leaders (Teck Resources, Lonmin)	**Metals and Mining Laggards (Alcoa, IMI)**
Human rights indicators	*Lonmin, 2013:* • *Employees volunteer to become peer educators and assist in implementing the HIV/Aids workplace programme. Currently, there are 408 peer educators, above the target of 325*	*IMI, 2012:* • *In 2012, the business in Bangalore launched a new responsible business action group for employees called 'Reach Out'. 25 employees volunteered to decorate a school for students with difficulties*
Labour practices indicators	*Teck Resources, 2013:* • *The number of women in operational or technical roles was 439, or 4.5% of the total workforce population in 2010 and 691, or 6.2% of the total workforce population in 2013* • *Employee anti-corruption training is conducted every two years* • *The safest year thus far, attaining a 26% lower lost-time injury frequency over 2012 and reducing our total reportable injury frequency by 5.6%* *Lonmin, 2013:* • *100% of business units are analysed for corruption risks through internal auditing process* • *In 2013, there was an absenteeism rate of 10.7% compared to 13.8% in 2012* • *Lost time injury frequency rate (LTIFR) declined by 15.86% in*	*IMI, 2012:* • *All businesses are now required to track and report on hazards and near misses, which has resulted in the increase in reporting of such incidents from 9,500 in 2011 to 14,800 in 2012*

	2013, from 4.16 per million man hours worked in 2012, to 3.50 per million man hours	
Environ. protection indicators	*Teck Resources, 2013:* • *Purchased approximately 7,150 hectares of private lands for wildlife and habitat conservation purposes* • *Received the British Columbia Jake McDonald Annual Mine Reclamation Award for excellence in the reclamation of the Pinchi Lake Mine in British Columbia* • *Only 13% of the water used is from fresh water, while the remaining 87% is recycled or reused water* • *To date, 10 of the 13 operations have attained and maintained certification* *Lonmin, 2013:* • *100% ISO 14001 certification across all operations*	*Alcoa, 2013:* • *Recycle or reuse 15% of residue generated by 2020; 30% by 2030. Achieved 0%* • *In 2013, a 24% reduction in landfilled waste from 2005 was achieved.* • *In 2012, global biodiversity team surveyed 40 select Alcoa locations around the world to acquire information on their ecological values*

	• *Approximately 270 million spent on environmental management in 2013 (2012:197 million)*	
Materials conservation indicators	*Teck Resources, 2013:* • *In 2013, a total of 45,556 terajoules of energy was consumed, as compared to 46,993 TJ in 2012* • *In 2013, total GHG emissions as carbon dioxideequivalent (CO2e) were 3,089 kilotonnes, compared to 3,1gt83 kt in 2012.* • *Of those totals, our direct GHG emissions5 were 2,722 kt in 2013, compared to 2,889 kt in 2012*	*Alcoa, 2013:* • *Between 2005 and 2013, the GHG emission intensity of the Global Primary Products business was reduced by 25.5%* • *The freshwater-use intensity (consumption per unit of production) increased by 3% in 2013 compared to 2012* *IMI, 2012:* • *Energy use is a significant cost to the business (circa £20m in 2012) and it is our aim to reduce that cost as far as possible and further capitalise on the £700k savings made to gross costs in 2012*
Supply chain indicators	*Lonmin, 2013:* • *A pre-qualification safety assessment for all new vendors to ensure they meet our safety requirements before awarding them contracts* *Teck resources, 2013:* • *In 2013, spent approximately $127 m. on suppliers; this represents an increase of 9% or nearly $10 million over the prior year and amounts to 3% of the total spend*	*IMI, 2012:* • *In 2012 a new process to the supplier risk management systems was added. This is designed to ensure that our suppliers remove 'conflict minerals' from supply chain* • *Suppliers are subject to rigorous and on-going audits by the group supply chain teams as part of the supplier evaluation process*

		Alcoa, 2013: • *The Global Supplier Sustainability Program focuses on key suppliers and has four components—communicating expectations, assessing, developing and educating, and monitoring*

Table 31 provides relevant quotes for energy and utilities. Based on the five sustainability variables, we are differentiating leader from laggard companies using text taken from the companies' sustainability reports.

Table 31. Text retrieved from energy and utilities' sustainability reports

	Energy Utilities Leaders (Abengoa, HELPE)	**Energy Utilities Laggards (Solar Century, Koncar)**
Human rights indicators	*Abengoa, 2014:* • *In 2013, Abengoa Solar invested a total of €280,000 euros in social action, 18 % more than in 2012* *HELPE, 2012:* • *HELPE invests more than € 3.2 m. in social and environmental responsible actions annually*	*Koncar, 2013:* • *Koncar co-finances activities of those sport clubs, which are less commercial but gather amateur athletes of all ages*
Labour practices indicators	*Abengoa, 2014:* • *In 2013 the percentage of women in the workforce increased to 22 % compared to 2012. The number of women in*	*Konca, 2013:* • *A total of 170 new workers were employed in the reporting period. The*

	senior and middle management positions also rose 1 % on 2012 • *A total of 151,490 hours of training were given in 2013, up 5 % on 2012. Average training per employee was 70.4 hours. Some 17,786 employees attended training sessions, an increase of 26 % compared to 2012* • *In 2013, a total of 58 managers were evaluated, 9% more than the previous year, which involved 320 appraisers* *HELPE, 2012:* • *The accident severity index was 50% lower compared to the average European rate in the sector* • *The group employs 148 permanent employees with disabilities*	*youngest employed was 19 and the oldest 63* • *Courses in technical knowledge, foreign languages, sales and presentation skills, computer skills, learning about new regulations, and work safety are organized*
Environ. protection indicators	*Abengoa, 2014:* • *Awarded the Industry Choice Award in the latest edition of the CSP Today Awards USA 2013, associated with the solar-thermal sector* • *In 2013, some 90 % of Abengoa's companies were certified according to the ISO 9001 standard* *HELPE, 2012:* • *All industrial facilities, storage facilities and service stations are certified in accordance with*	*Koncar, 2013:* • *Koncar implements ISO 9001:2000 Quality Management System, ISO14001:2004 Environmental Management System and OHSAS 18001 Occupational Health and Safety Management System* • *Koncar does not operate near protected or highly biodiverse areas outside protected zones.*

	internationally recognized standards	
Materials conservation indicators	*Abengoa, 2014:* • *In 2013, Abengoa Solar implemented numerous initiatives to help reduce the use of river water, which fell by 33 % compared to 2012* • *Abengoa Solar in 2013 successfully reduced atmospheric emissions by more than 13,000 tons of CO2, an increase of 58% compared to 2012* *HELPE, 2012:* • *Part of the refinery production process is the pre-treatment of the polluted wastewater streams and their reuse within processes* • *100,993 m^3 biodiesel was used in 2013 in comparison to 78,623 m^3 in 2012*	*No mention*
Supply chain indicators	*Abengoa, 2014:* • *The number of locally-hired managers grew in 2013, with an average of 95 %* • *In 2013 some 90 % of purchases were made from local suppliers* *HELPE, 2013:* • *Vessels are certified by the French Bureau Veritas to travel even under extreme weather conditions, ensuring for the continuous and uninterrupted supply of fuel to the Greek islands*	*No mention*

Table 32 provides relevant quotes for household services. Based on the five sustainability variables, we are differentiating leader from laggard companies using text obtained from the companies' sustainability reports.

Table 32. Text retrieved from household services' sustainability reports

	Household services Leaders (BIC, Johnson and Johnson)	**Household services Laggards (Kruger, Groupe SEB)**
Human rights indicators	*Johnson and Johnson, 2013:* • *In 2013, provided more than 161 million doses to affected children in 16 countries, an increase from 116 million doses to affected children in 14 countries in 2012* • *In Asia-Pacific region, 25 percent of the employees participated in 2013, impacting more than 16,700 lives*	*Groupe, 2014:* • *The Group allocated €2.15 million to corporate philanthropic activities in 2014, down €700,000 compared to 2013* • *In 2012, 645 labour practice grievances were filed, addressed or resolved through formal grievance mechanisms. In 2013 this number was 926. In 2012 and 2013, there were 4 and 6 incidences, respectively, of discrimination and corrective action taken*
Labour practices indicators	*Johnson and Johnson , 2013:* • *Serious Injury and Illness Case (SIIC) rate was 0.020 compared to our goal of 0.035; it improved from 0.027 last year and 0.028 the year before, and is at the lowest rate since 2007* *BIC, 2013:* • *In 2012, the median age of employees is 40 years and median seniority is seven years*	*Kruger, 2014:* • *In 2012, 284 new employees were hired. 35 per cent of these were over the age of 40. In 2013, 179 new employees were hired with 28 percent of these aged 40 or older*

Environ. protection indicators	*Johnson and Johnson, 2013:* • *Reduced bottle weight by 23 percent and reduced carbon material by 32 percent* • *Improved shipping efficiency 58 percent by increasing the number of units per pallet from 2604 to 4416* *BIC, 2012:* • *In 2012, BIC continued its partnership with TerraCycle, a pioneer in the collection and reuse of non-recyclable wastes* • *90% of the Group's employees work in ISO 9001 certified factories* • *Mexico has totally eliminated the use of PVC in its packaging, and the United States and Brazil are actively making progress toward that same goal*	*Groupe, 2014:* • *The Is-sur-Tille plant has created a flower meadow and installed a nesting tower for swallows to promote biodiversity* *Kruger, 2014:* • *In 2012, 30 per cent of fibre was from reclaimed sources while 70 per cent was virgin materials. In 2013, recycled fibre accounted for 27 percent while virgin material represented 73 per cent of our mix* • *In 2012, environmental protection expenditures was $10.4 million and in 2013 $11.5 million*
Materials conservation indicators	*Johnson and Johnson, 2013:* • *At the end of 2013, the water use volume was down slightly over 2012, to slightly less than 11.2 million cubic meters, a reduction of approximately 2.5 percent compared to our 2010 baseline volume* *BIC, 2012:* • *Water consumption per ton of production decreased by 6.7% between 2011 and 2012. Total water consumption fell by 11.1%*	*Kruger, 2014:* • *In 2013, Kruger consumed 23,449,819 m3 of water in absolute terms, an increase of 0.9 per cent (209,445 m3) versus 2012* • *In 2013, Kruger increased packaging material to 1.86 pounds per quota case produced, a 3.9 per cent increase versus 2012* *Groupe, 2014:* • *In 2014, Groupe SEB emitted 261,825 tonnes of CO2 equivalent, up 3.6% from 2013*

	during a period when production decreased by only 4.7% • *In 2012, the BIC Group achieved a 1.5% decrease in the amount of waste generated per tonne of production compared with 2011* • *The total amount of indirect GHG emissions in 2012 was estimated to 82,910 tons of CO2 equivalent, i.e. a 3.4% decrease compared to 2011*	• *In 2013 the Group set four targets to be met by 2020: 20% less energy consumption by electrical goods; 20% less energy consumption by production plants; at least 20% recycled materials in new products; 20% less greenhouse gas emissions from transporting products*
Supply chain indicators	*Johnson and Johnson, 2013:* • *In 2013, 129 of the 156 suppliers we approached chose to participate in Carbon Disclosure Project's Supply Chain program* • *Approximately 190 suppliers were evaluated and scored by a third party vector in 2013* *BIC, 2012:* • *Since 2011, 158 suppliers were evaluated by Ecovadis according to sustainable development criteria* • *50% of BIC's plastics suppliers have been working with the Group for more than ten years* • *Collaborative research with suppliers to identify new materials(plant-based or recycled), new concepts or hybrid materials*	*Kruger, 2014:* • *Many of the packaging materials are FSC certified and we continue to work with suppliers with the objective for all materials supplied to be certified" (Kruger, 2014)* *Groupe, 2014:* • *CSR criteria account for 25% of the score given to new suppliers of raw materials/components and finished products*

Table 33 provides relevant quotes for commercial services' corresponding sustainability reports. Based on the five sustainability variables, we are differentiating leader from laggard companies using text taken from the companies' sustainability reports.

Table 33. Text retrieved from commercial services' sustainability reports

	Commercial services Leaders (UPS, Ansaldo)	**Commercial services Laggards (Panalpina, DFDS)**
Human rights indicators	*Ansaldo, 2014:* • *In 2014, total donations and sponsorships amounted to roughly €270 thousand* *UPS, 2013:* • *In 2013, UPS employees and retirees contributed US$51.3 million a community based organization. The respective totals in 2012 were US$48.3 million from employees*	*Panalpina, 2013:* • *Panalpina's Boeing 747-8 freighter flew to Africa carrying 100 tons of UNICEF's aid to a country in crisis*
Labour practices indicators	*Ansaldo, 2014:* • *Overall, at the sites specified in this analysis, 34,502 training hours were provided in 2014 (+30% on 2013), accounting for 39% of total training hours* • *The percentage of women blue collars and managers went from 11.3% to 19.0% and from 8% to 9.2%, respectively* *UPS, 2013:* • *In 2013, UPS spent approximately US$565 million on training. Females received an average of*	*Panalpina, 2013:* • *Four new learning and development programs covering communications, empowerment, performance management and skills were attended by over 500 employees* • *Zero fatal accidents and 119 nonfatal accidents that required some sort of medical treatment were reported*

	17.1 hours of training and males received 21.1 • *In 2013, 29.1 percent of management employees were women, compared to 29.0 percent in 2012* • *In 2013, 96.8 percent of management employees received training on the Code of Business Conduct*	*DFDS,2014:* • *Injury severity represented by lost working days significantly increased in 2014 compared to 2013; the average number of lost days per LTA more than doubled from 12 in 2013 to 26 in 2014* • *A Training and Development department was established in 2012* • *28% of DFDS' workforce are women, but only 10% of all employees on higher management levels from Directors and above are women*
Environ. protection indicators	*UPS, 2013:* • *For the third year in a row, UPS earned a 99 out of 100 for voluntary carbon disclosure and achieved a top position in CDP's Global 500 Climate Disclosure Leadership Index (CDLI)* • *UPS reduced aviation gallons burned per 100 available ton miles to 6.52 in 2013, the lowest level in the last five years*	*DFDS, 2014:* • *Sulphur emissions from ships was the main environmental challenge for DFDS in 2014*
Materials conservation indicators	*Ansaldo, 2014:* • *The office sites have seen a decrease in energy consumption (-4.0%), due to less use of electrical energy (-5.5%), natural gas (-32.6%) and petrol and other fuels (-7.5%)*	*Panalpina, 2013:* • *In 2013, heating energy increased significantly by 46% and vehicle fuel consumption increased slightly by 6%*

	• *There was a reduction in the quantities of packaging produced again in 2014 (-17%)* • *The 10.4 tonnes of mixed material packaging produced in 2014 were all recycled* *UPS, 2013:* • *Succeeded in reducing fuel consumption and increasing efficiency resulted in a value for the KPI of 8.72 packages per gallon in 2013, up from 8.64 in 2012. UPS has now improved this KPI for five consecutive years*	• *CO2 emissions increased by 6%, with most of that increase attributable to increased heating energy and the corresponding 13% increase in direct CO2 emissions* • *Other environmental indicators collected include paper consumption, which remained level between 2012 and 2013, and water consumption, which increased significantly*
Supply chain indicators	*Ansaldo, 2014:* • *Suppliers are constantly monitored through contacts between them and the Ansaldo STS functions with which they operate* *UPS, 2013:* • *In 2013, UPS directed 53 percent of all procurement spending to local suppliers. Excluding fuel, the portion of procurement with local suppliers rises to 68 percent*	*Panalpina, 2013:* • *Panalpina does not currently screen new suppliers using labor practices criteria, environmental performance, or for their impacts on society* *DFDS, 2014:* • *DFDS has developed a code of conduct, which is available from DFDS' website*

Text obtained from sustainability reports illustrates that leader firms are reporting at a much higher level compared to laggards along all five dimensions. Leader companies provide in their text quantitative information for the practices

they implement, while they explicitly refer to detailed progress in terms of extent of practices implementation relative to the previous year.

Accordingly, laggard companies are referring to practices implementation in qualitative terms in most cases. In cases where quantitative information is provided, we see that they refer to the adoption and extent of implementation of a specific practice over an extended time frame. E.g. In 2013, a 24% reduction in landfilled waste from 2005 was achieved (Alcoa, 2013). More importantly, laggard companies refer to declined implementation of a specific practice in their disclosure. E.g. increase of hazards and near misses from 9,500 in 2011 to 14,800 in 2012 has been noted (IMI, 2012). Similarly, the freshwater-use intensity (consumption per unit of production) increased by 3% in 2013 compared to 2012 (Alcoa, 2013).

The relative text obtained from companies' disclosure for the five sustainability variables is consistent with the numbers obtained for the particular variables as a result of the scoring methodology in Table 29.

The quantitative analysis shows that leader companies are outperforming laggard ones at least double in all sustainability variables. An exception to the rule is supply chain, which equals zero for leader firms in both energy and mining industries. This finding is also apparent in Table 30 (text retrieved from report), where we see that leader mining companies do not provide quantitative information for their supply chain practices. Disclosure for supply chain is also not differentiated between leader and laggard energy companies (Table 31) - the extent of reporting is quite limited. Maybe this has to do with the fact that both industries' supply chains have a strong environmental impact and thus companies do not score high on supply chain sustainability.

Similarly, leader and laggard companies' average disclosure score in the commercial sector score equally in the human rights variable. Looking at Table 33, we see that companies' disclosure is quite limited. Leader commercial companies do not provide quantitative information for their human right practices implementation. These companies are mainly logistics companies and it seems that they do not emphasize on practices related to child labour elimination, employee engagement, or community activities.

Chapter 7. Comparison with existing measures of sustainability performance

The second research objective of this study is to explore whether our ccomposite measure obtained from sustainability reports is consistent with existing third party measures that are not based on sustainability reporting. To this end, we are exploring in this chapter the link between our proposed measure and other existing measures for sustainability performance. The second research objective is formulated as follows:

RO2: Check consistency of our measure with existing measures that are considered useful for measuring sustainability performance.

7.1 Socially responsible investing

The idea behind sustainability indices is that sustainability practices can help create long-term value from which shareholders can benefit. This is reflected in investors' preferences for equities of environmentally responsible firms. To this end, financial institutions create stock portfolios according to social and ethical criteria enabling investors to invest in these companies (Lopez et al., 2007). In particular financial institutions like Dow Jones, Morgan Stanley and Stoxx have created portfolios of socially responsible investment stocks. These indices identify the most sustainable companies to encourage investing in these companies (Lopez et al., 2007). Figure 22 shows the market growth of responsible investing from 2007 to 2015 in Europe, US, and Africa. It is apparent that there is an increasing trend towards investing in responsible stocks.

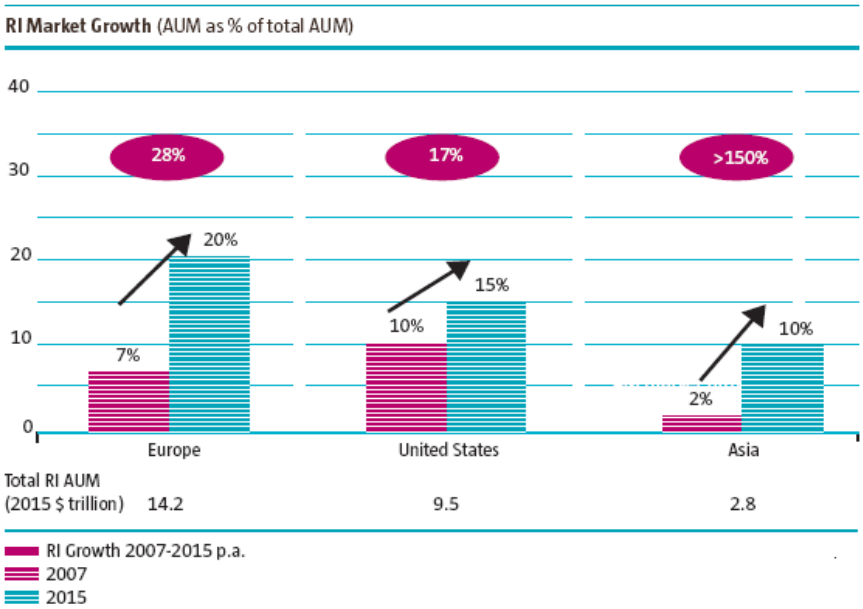


Figure 22. Increased market trends in responsible investing (Robeco/Booz, 2015)

Investors and other decision makers in capital markets, are increasingly interested in investigating the social, environmental, and ethical dimensions of a company before investing in it, exerting this way greater pressure for accountability in social and environmental issues (Ioannou and Serafeim, 2016). The process taking personal values and social concerns into account when making investment decisions is known as socially responsible investing (Jenkins, 2006). Indeed, socially responsible investing movement is part of the field of sustainability accounting (Waddock, 2003). Investors' interest in sustainability accounting as a criterion to be considered in the configuration of their investment portfolios, has led to the emergence of sustainability indices linked to financial markets (Lopez et al, 2007).

Dow Jones Sustainability Index (DJSI) includes the most sustainable companies covered on a yearly basis. Established in 1999, DJSI constitutes the first global sustainability benchmark. DJSI is based on the cooperation of Dow Jones Index, STOXX limited and Sustainability Asset Management. DJSI identifies sustainability leaders using rigorous environmental, social and governance criteria, such as corporate governance, social policies,

environmental management and corporate citizenship and philanthropy. In particular, the DJSI includes the best companies in each industry that manage to achieve long-term shareholder value by managing to set the highest standards for corporate governance and stakeholder engagement. This includes corporate codes of conduct and public reporting, managing human resources in a way to foster employees' capabilities and satisfaction level through learning and development practices, as well remuneration and benefit programs. DJSI defines sustainability as a business approach that creates long-term shareholder value by embracing opportunities and managing risks related to social, environmental, and economic performance. The companies themselves have to apply and supply answers to a SAM questionnaire to be considered for inclusion in the index. The Index ranks companies' corporate sustainability performance, based on analysis of economic, environmental and social issues like corporate governance, risk management, branding and climate change.

In addition, Kinder, Lydenberg, Domini Research and Analytics (KLD) have compiled the Domini Social 400 Index, which is the functional equivalent of the Standard and Poors 500 Index for socially responsible firms. KLD rates companies that belong to S&P 500. In particular, Domini Social 400 Index is developed by KLD to measure the performance of firms that have positive social and environmental records, as well as meet specific financial standards (Servaes and Tamayo, 2013). KLD excludes from the DS 400 Index those companies that acquire their revenues through the production of alcoholic or tobacco products, provision of gaming products or services, electric utilities with interest in nuclear power plants, or companies that acquire two or more 2% of their gross revenues from production of military weapon systems.

Morgan Stanley Capital International (MSCI) Sustainability Index is another example of a financial institution that has created portfolio of socially responsible investment stocks. In particular, MSCI sustainability indices incorporate firms with high ESG ratings relative to their sector peers, thus they integrate sustainability analysis into the index construction process. MSCI

sustainability indices target at companies with the highest ESG ratings; those that make up 50% of the adjusted market capitalization in each sector of the underlying index. MSCI Sustainability Indices are reviewed on an annual basis at the May Semi-Annual Index Review (http://www.msci.com/products/indexes/esg/).

Morgan Stanley Capital International (MSCI) is a market leader in global equity indices and has over 2.8 trillion dollars in assets benchmarked to MSCI ACWI family. The MSCI Index Families are designed to support Environmental, Social, and Governance (ESG) investing and help institutional investors manage their portfolio. MSCI ESG indices are the continuation of indices that have been developed over the past 20 years by Kinder, Lydenberg, and Domini (KLD), which became part of MSCI following MSCI's acquisition of Risk Metrics, which had acquired KLD in June 2009. For approximately each year beginning in 1991, this database provides data on a collection of 150 companies that comprise the Domini 400 Social SM Index and companies in the S&P 500. MSCI ESG, then KLD, extended its coverage in 2003 to fully cover companied included in Russell 3000.

MSCI ESG excludes from its coverage the non-green companies and as we see this exclusion does not have any impact on the fund's performance. Figure 23 depicts the degree of correlation between MSCI ESG and MSCI. In fact, the two indices are almost identical. That's said as the correlation is close to +1which is evident in Figure 23. This implies that making a broad equity index ESG friendly does not lead to any sacrifice in performance. It needs to be highlighted though that the performance profile has not been affected, either positively or negatively. This can be largely attributed to the fact that the majority of the index is common in MSCI World and MSCI ESG World, where only a relatively small subset of stocks has been removed from the latter index, and the extent of the diversification benefit (almost 2000 securities are part of these indices). In all, this analysis indicates that there is no extra compensation for ESG sensible investing but also stresses that investors with appetite for ESG do not need to sacrifice on performance or on their ability to diversify their portfolios and this is visible in Figure 23.

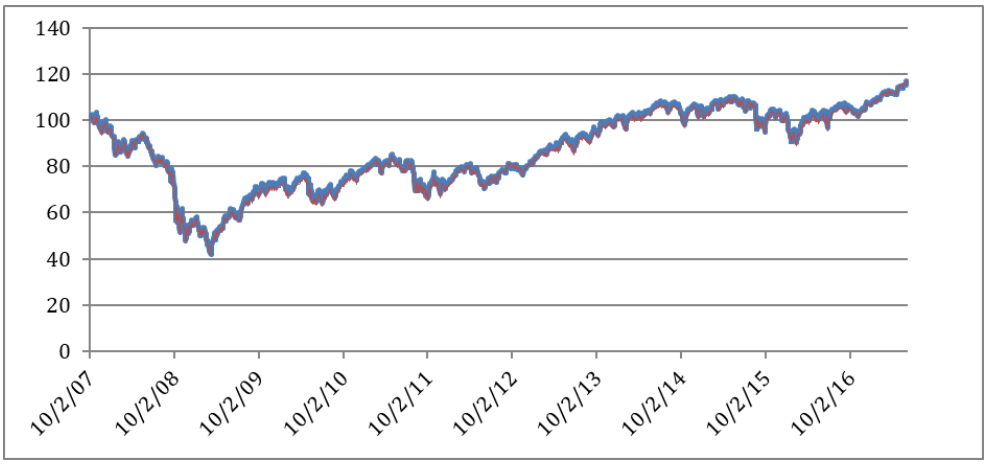


Figure 23. Values of MSCI ESG and MSCI indices

STOXX Limited is another established and leading index specialist that has constructed sustainability indices. STOXX indices are licensed to issuers of financial products, capital owners and asset managers as well as to companies. As far as sustainability is concerned, STOXX offers two families of distinct sustainability indices, with different methodologies addressing different client needs (http://www.stoxx.com/indices/types/sustainability.html):

- STOXX ESG Leaders indices: The STOXX ESG Leaders indices are sustainability indices based on a fully transparent and rule-based selection process. Sustainalytics, a leading global provider of ESG research and analysis, provides key performance indicators (KPIs) to construct a relative rating using a fully transparent weighting model.

- STOXX Sustainability indices: The STOXX Sustainability indices track the performance of sustainable companies based on the proprietary research approach of the renowned sustainable private bank, Bank Sarasin. Their analysis is based on general as well as industry-specific criteria covering all three dimensions of sustainability: environmental, social and governance.

Finally, Financial Times Stock Exchange (FTSE) 4 Good Index Series has been designed to evaluate the performance of those companies that meet the globally recognized corporate sustainability standards, and consequently facilitate investment in these companies. The FTSE 4 Good selection criteria have been designed such a way so as to reflect a broad consensus on

corporate responsibility practices established at a global level. FTSE 4 Good criteria are regularly revised so that they keep on reflecting the standards of responsible corporate practices and reflect developments in socially responsible investment as they evolve. FTSE 4 Good is a tool that is broadly used by consultants, asset and fund managers, investment banks, stock exchanges, and brokers when it comes to evaluating or creating responsible investment products (Singh et al, 2009).

7.2 Correlating with third party measures

In order to explore whether our measure obtained from sustainability reports has value, we check its consistency with established measures of sustainability performance. The rationale behind this analysis is that the measure coming out from sustainability reporting is as valuable as existing measures, not based on sustainability reports. Such measures are publicly available and are provided by third party indices, which are linked to financial markets and reflect social and environmental sustainability rankings provided by outside providers.

We don't argue that existing third-party measures on sustainability performance have any weaknesses or that our measure using sustainability reports only is superior. The main argument is that sustainability reports are part of the information provided publicly by companies and may reveal information about the type of sustainability practices adopted by the company and extent of implementation. This dissertation sought to explore this information.

Creating a measure obtained from sustainability reports and other sources is a multi-faceted measure where the methodology is clear. This is particularly important for researchers who need to create measures that can be replicated by others. While existing third party measures exist, we do not know the exact methodology by existing third party measures are constructed, at least not to the extent that we can replicate their measure. Such measures use public as well as private data.

In contrast, the measure we propose as a starting point can be replicated by others. Moreover, it is based solely on sustainability reports, which is why we say that it measures not sustainability in general but practices disclosed by the companies in their sustainability reports.

Existing measures include:

- DJSI: The Dow Jones Sustainability Index is the oldest and most comprehensive of a group of CSR and Sustainability ratings Indexes compiled by commercial and non- profit groups. The companies themselves have to apply and supply answers to a SAM questionnaire to be considered for inclusion in the index. The Index ranks companies' corporate sustainability performance, based on analysis of economic, environmental and social issues like corporate governance, risk management, branding and climate change.
- ESG data: Bloomberg ESG data is collected from company-sourced filings such as Corporate Social Responsibility reports, annual reports, company websites and a proprietary Bloomberg survey that requests corporate data directly. Proprietary Bloomberg score based on the extent of a company's Environmental, Social, and Governance (ESG) disclosure. Companies that are not covered by ESG group will have no score and will show N/A. Companies that do not disclose anything will also show N/A. The score ranges from 0.1 for companies that disclose a minimum amount of ESG data to 100 for those that disclose every data point collected by Bloomberg. Each data point is weighted in terms of importance, with data such as Greenhouse Gas Emissions carrying greater weight than other disclosures. The score is also tailored to different industry sectors. In this way, each company is only evaluated in terms of the data that is relevant to its industry sector. This score measures the amount of ESG data a company reports publicly, and does not measure the company's performance on any data point.
- KLD: KLD uses a variety of sources to capture social performance data about each company. Each company's investor relations office is sent a yearly questionnaire about CSP practices and KLD maintains continuing relations with investor relations offices to assure the accuracy of data. KLD maintains the independence and integrity of its ratings, but the firm is willing to respond to company concerns where accuracy is at issue. Corporate data sources include annual reports, 10K forms, proxy statements, and quarterly reports, as well as reports issued for specific CSP arenas, such as environment and community.

Third-party measures vary in the emphasis they place on different aspects of sustainability and have different weights. Besides, third party indices are

restricted to very big companies (S&P, FTSE100). For example, KLD rates companies in the S&P 500. Council on economic priorities (CEP) is another commonly used measure for sustainability performance, but it only follows a small group of firms in only four industries; consequently, reliance on CEP for sample selection might be problematic (Clarkson et al., 2007). Similarly, toxic emissions represent only one facet of a company's environmental, and ultimately, sustainability performance (Herbohn et al., 2014).

Third party measures are constructed, based on proprietary data, using a wide array of sources including private and public data. In fact, third party measures like those by DJSI or ESG use sustainability reporting minimally to judge sustainability performance of companies. On the other hand, we measure the adoption of operational practices mentioned in sustainability reports only. As such, it is a priori not obvious there should be correlation with between our measure and these third party scores. The reason why we are doing this correlation is to check for consistency between the measure obtained from sustainability reports and existing measures already considered to be valid. The rationale behind this analysis is that the measure coming out from sustainability reporting is as valuable as existing measures, not based on sustainability reports.

Firstly, we correlate the degree of association between ESG disclosure score and DJSI, which is a binary data variable (0-1). This analysis aims ta exploring how closely correlated existing third party measures are to each other. We test both parametric and non–parametric rank correlations between total disclosure and DJSI ranking. In this case, both Pearson (0.33, $p<0.01$) and Spearman (0.32, $p<0.01$) yield the same outcome, rejecting the null hypothesis of no association.

7.2.1 Dow Jones Sustainability Index (DJSI)

Ingram and Frazier (1980) argue that if companies' sustainability disclosures are accurate reflections of companies' activities, a high degree of correlation should exist between actual performance ratings and the content of disclosure. To this end, in order to test the reliability of our content analysis developed measure, we correlate our measure for reported sustainability with third party

providers' indices that measure sustainability performance. To begin with, we examine the difference in disclosure between companies that are listed in the Global DJSI and companies that are not. 85 out of the 331 companies of our sample belong to Global Dow Jones Sustainability Index (DJSI) of the corresponding year for which we obtained the sustainability report. The reason why we chose DJSI is that it uses best selection rules in its construction (Statman, 2006). The Dow Jones Sustainability Index is the oldest and most comprehensive of a group of CSR and Sustainability ratings Indexes compiled by commercial and non- profit groups.

We have calculated the total sustainability disclosure score for each company by summing up the scores of the environmental and social sustainability variables. The total disclosure score ranges from 3 to 46. Obviously the range is quite broad implying that there are companies that are reporting quite a lot and companies that are reporting very little on sustainability. Thus it is worth highlighting that 7 out of the 10 highest-ranking companies in total sustainability disclosure belong to the corresponding years' DJSI. The ten highest ranked companies are presented in Table 34.

Table 34. The ten companies achieving the highest sustainability disclosure score

Company	Sustainability disclosure score	DJSI	Year
Ups	46	✓	2013
Acciona	45	✓	2012
Carillion	45		2013
Telus Corp.	43	✓	2013
Air FRANCE - KLM	42	✓	2013
Fiat Chrysler	41	✓	2013
Associated British Foods	41		2013
Swedish Match AB	41		2013
Intesa Sanpaolo	40	✓	2013
Teck Resources	40	✓	2013

In principle, the 85 companies that belong to DJSI have a sustainability disclosure score ranging from 46 to 17, and more specifically, 75 out of these 85 companies, score higher than 20. This fact indicates that companies that are part of the DJSI have higher level of disclosure in their sustainability reports compared to companies that are not part of the DJSI. Exceptions to this argument are Coca-Cola and CA Computers, which despite both being part of DJSI in 2013 and 2014, correspondingly, achieve quite low scores (close to10) in their sustainability reports disclosure.

Al Tuwaijiri et al (2004) propose that good sustainability performing companies disclose more than poor performing companies. To test this proposition, a dummy variable is constructed (= 1 when the company belongs to DJSI, 0 otherwise) in order to measure the correlation between a company's appearance in DJSI and its level of disclosure (Dhaliwal et al., 2011; Nikolaeva and Bicho, 2011). Sustainable Asset Management (SAM) collects the relevant data and constructs the Dow Jones Sustainability Index. A similar methodology

is followed by Wiseman (1982) and Patten (2002) who create an index of disclosure by scoring sustainability reports on a number of indicators, and then correlate the index of disclosure with measures of actual environmental performance provided by the Council on Economic Priorities (CEP).

Finally, we implement an independent t-test to examine whether there is any statistically significant difference in the type of disclosure between companies that belong to DJSI and those that do not. T-test is statistically significant (p=0.001), indicating that there are significant differences in sustainability disclosure between the two groups (companies that are included in DJSI and those that are not). Indeed, T- test indicates that companies belonging to DJSI have higher sustainability disclosure scores (26.94 ± 0.94) compared to companies that are not part of DJSI (20.54 ± 0.52). We also implement the Mann-Whitney test, which is the non-parametric equivalent of t-test, and it also elicits statistically significant differences among the two groups. The results of t-test are presented in Table 35.

Table 35. Output of the independent t-test between total sustainability disclosure score and DJSI

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	246	20.54	0.52	8.14	19.52	21.56
1	85	26.94	0.94	8.67	25.07	28.81
diff=	mean(0) -	mean(1)			t	-6.14
Ho:	diff=	0			df	329
	Ha: diff < 0		Ha: diff != 0		Ha: diff > 0	
Pr(T < t) = 0.0000		Pr(|T| > |t|) = 0.0000			Pr(T > t) = 1.0000	

Finally, we perform binomial logistic regression to examine the effect of total sustainability disclosure score (Model 1) and the five distinct sustainability variables derived by the EFA (Model 2) on DJSI ranking. The content analysis score is used as the predictor variable (Ingram and Frazier, 1980). To this end, we aim at investigating whether the constructs that we developed have some

explanatory power over being part of DJSI. The outcomes of the logistic regression are presented in Table 36.

Table 36. Logistic regression between DJSI and the five sustainability variables

Dependent variable: DJSI		
	Model 1	Model 2
Total disclosure score	0.814***	
Human rights		1.026**
Labour practices		1.125
Materials		1.121***
Supply chain		0.924**
Protection		0.036
Pseudo R^2	0.09	0.105
LR chi2	35.22***	39.74***

*** Significance at 0.01 level; ** significance at 0.05 level

Logistic regression analysis is statistically significant and indicates that the total sustainability disclosure score of companies' sustainability reports is more likely to be higher in companies that are part of DJSI compared to those that are not. Coming to the individual variables, human rights, emissions, and materials conservation are the three variables that positively and significantly differentiate companies that belong to DJSI from companies that do not. Whereas disclosure on labour practices, supply chain, recovery, and manufacturing do not appear to differentiate companies that belong to DJSI from those that do not. Provided that certain practices are more important to certain sectors, we argue about the relevance of contingency on industry as regards the individual variables that are significantly differentiating companies that are part of DJSI from those that are not. In overall, empirical analysis indicates that DSJI is explained by the measure we developed from the sustainability reports content analysis.

We carry out a similar analysis by correlating the total disclosure score derived from content analysis with the DJSI ranking. We test both parametric and non–

parametric rank correlations between total disclosure score and DJSI ranking. In this case, both Pearson (0.32, $p<0.01$) and Spearman (0.31, $p<0.01$) yield the same outcome, rejecting the null hypothesis of no association. This relationship indicates that there is positive and significant relationship at a modest level between companies' inclusiveness in Dow Jones and their total disclosure. This implies that companies that belong to DJSI, and thus are considered to be highly sustainable, tend to score on average higher in their sustainability reports disclosure.

7.2.2 Environmental, Social, and Governance (ESG) data

As a second analysis to check for consistency, we examine the degree of association between our sustainability disclosure score and Environment, Social and Governance (ESG) score, obtained from Bloomberg. ESG disclosure score is a measure of how complete the company's reporting is on a range of social, environmental, and governance topics based on a scale of 0% to 100% (Eccles et al., 2014). We obtained ESG data for 95 companies of our sample, including S&P 500 and FTSE 100 firms.

Again, we have calculated the total sustainability disclosure score for each company by summing up the scores of the environmental and social sustainability variables. We test both parametric and non–parametric rank correlations between total disclosure and ESG disclosure score. In this case, both Pearson (0.30, $p<0.01$) and Spearman (0.33, $p<0.01$) yield the same outcome, rejecting the null hypothesis of no association. Thus, the correlation coefficient does not exceed the value of 0.35, which indicates that the level of correlation between disclosure and ESG rankings is modest.

Figure 24 presents the degree of correlation between sustainability disclosure score and ESG score. Overall, it seems that total disclosure score and ESG score are positively correlated, meaning that companies with a higher disclosure score, as derived from content analysis, are also the ones having a higher ESG score.

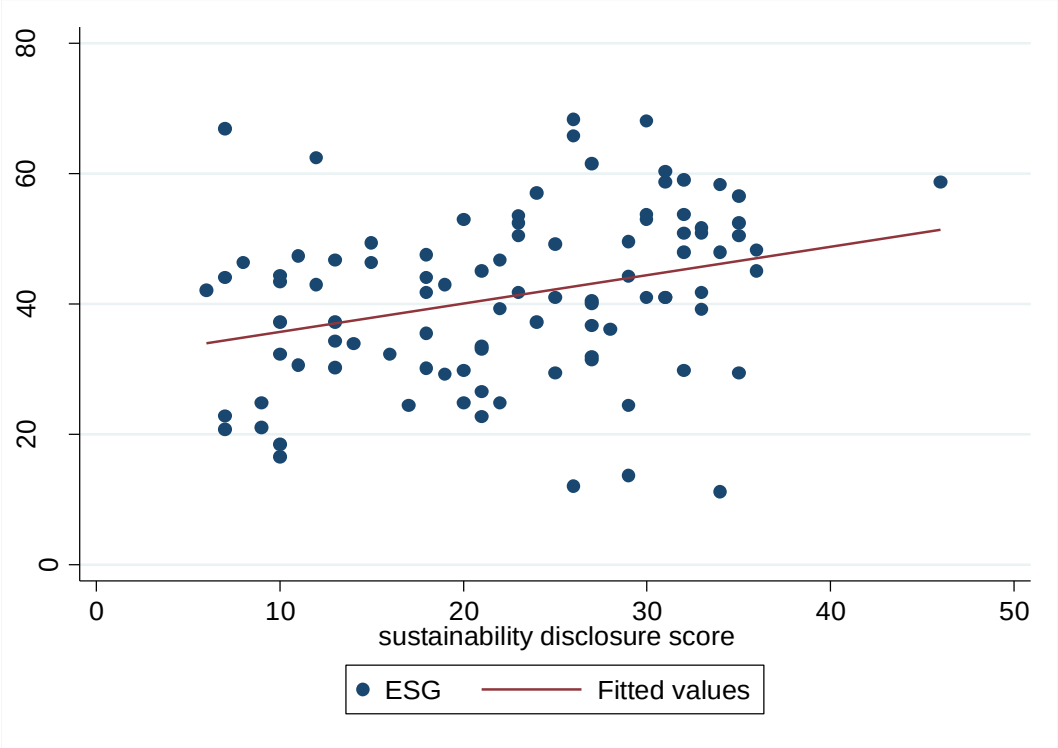


Figure 24. Correlation analysis between total sustainability disclosure score derived from content analysis and ESG score

Finally, we implement OLS regression to examine the link between the ESG disclosure score and total disclosure score (Model 1) and the five distinct sustainability variables derived by the EFA (Model 2). To this end, we aim at investigating whether the sub-indices that we developed have some explanatory power over ESG score. The results are presented in Table 37.

Table 37. OLS regression between ESG score and the five sustainability variables

Dependent variable: ESG score		
	Model 1	Model 2
Total disclosure score	4.001***	
Human rights		2.746
Labour practices		21.990***
Materials		-2.036
Supply chain		7.095
Protection		-1.919
F	9.22***	3.98***
R^2	0.09	0.18
adj R^2	0.08	0.14

*** Significance at 0.01 level; ** significance at 0.05 level

Regression analysis indicates that total disclosure in sustainability reports is positively and significantly related to ESG score. Regression analysis indicates ESG score is predicted at 22% by the total sustainability disclosure score derived from the sustainability reports content analysis.

A number of studies has correlated the degree of environmental disclosure with actual measures of performance, providing mixed results as for the type relation. To begin with, Wiseman (1986), Freedman and Jaggi (1982), and Ingram and Frazier (1980) who find no significant correlation between companies' environmental disclosure (the last two studies do not explain their content analysis scoring methodology) and council on economic priorities (CEP) ratings of environmental performance. Freedman and Wasley (1990) use Wiseman's indexing method to evaluate environmental disclosure and correlate it with CEP ratings; they find no significant association either. Patten (2002) and Hughes et al. (2001) find a negative association between environmental disclosure (both studies use a modified Wiseman index) and environmental performance based

on toxic release inventory (TRI) and CEP respectively. Finally, Al-Tuwaijri et al. (2004) and Clarkson et al. (2007) correlate sustainability disclosure (using a 0/1 disclosure scoring measure and disclosure index based on GRI respectively) and toxic release inventory (TRI) data, and both studies find a positive association between the two measures.

Figure 25 summarizes the level of correlation between DJSI, which is a binary variable, ESG score, which is a continuous variable, and the sustainability disclosure score derived from sustainability reports' content analysis, which is a continuous variable. All three sustainability measures are positively and significantly correlated with each other at 30% using Pearson correlation coefficient. Further to that, Dhaliwal et al. (2011) found out that DJSI is correlated with KLD performance scores using Pearson coefficient at 30%, which is the same level with our findings. Our analysis demonstrates that our measure based on sustainability reporting is consistent with third-party measures of sustainability performance, not based on sustainability reports. As such, we conclude that our developed measure based on sustainability disclosure is as valuables as existing measures provided by third parties.

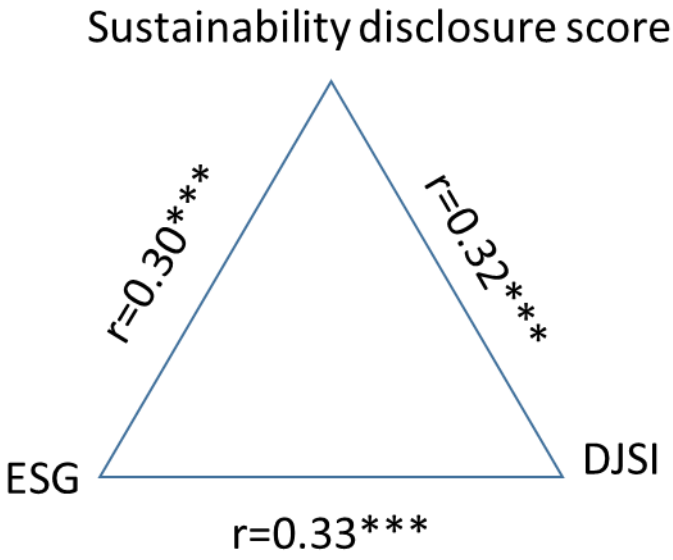


Figure 25. Level of correlation between the three measures for sustainability performance

Correlation analysis indicates a positive and significant relationship, which indicates that public data from companies' disclosure may convey their

sustainability efforts, in line with signalling theory. These results may indicate that companies with good sustainability performance are more forthright in disclosing their sustainability practices (Al-Tuwaijri et al., 2004). Hence, we argue that a measure based solely in sustainability reporting is at least consistent with existing measures that seek to indicate how well a company is doing as regards sustainability based on proprietary methods, not accessible to researchers.

This finding is in agreement with signalling theory, which predicts that companies with superior sustainability performance use sustainability reports to signal their sustainability efforts (Al-Tuwaijri et al., 2004; Verrechia, 1983). The Nike case provides further support to our argument. Prior to 2002, Nike Issued sustainability reports with false claims regarding the labor practices of the subcontractors in the third world. When the claims were proven false, stockholders took legal action Nike, which was entitled to pay $ 1.5 million to a labour standards organization (Murray, 2005). This example illustrates that stakeholders are willing to punish false disclosures included in companies' sustainability reports (Mahoney et al., 2005).

Chapter 8: Exploring links with financial performance

8.1 Introduction

The purpose of this chapter is to examine whether our developed measure obtained from sustainability reports can shed light on the inconclusive results in the literature regarding the link between sustainability and financial performance. In particular, we examine whether companies with higher total sustainability disclosure score also have higher financial performance, given that companies are reporting to signal to shareholders among others. By looking at sustainability reports, we have used the operational measure developed to test the link between sustainability practices and financial performance. The reason we link the extent of reporting with financial performance is that social and environmental information is desired and useful information for investment decisions (Wiseman, 1982). Various studies have tested such a link, coming up with weak evidence, and therefore it makes it worthwhile to test the link with financial performance to disclosed information on sustainability practices. In this study, we examine links between our composite measure developed from sustainability reports and firm financial performance. This analysis is aimed at investigating whether our analysis produces the same results as other studies that explore that link using existing measures already considered to be valid (KLD, ESG). To this end, for the same sample of companies used in the second chapter, we collect financial data to explore this link using structural equation modelling and the constructs already developed in chapter 5.

This is an exploratory dissertation and, based on the literature, it seems worthwhile to investigate the link between disclosed sustainability practices and financial performance. For instance, Dwaliwal et al (2011) argue that sustainability practices can affect firm' financial performance. The idea behind this analysis is that literature supports that certain environmental initiatives do not only bring about environmental benefits, but can also lead to increased cost margins or new revenue streams (Churet and Eccles, 2014; Hughen et al., 2014; Westlund, 2001). As such, it is strongly argued in the literature that we

need to separate out those sustainability practices that are able to deliver competitive advantage (Churet and Eccles, 2014; Lubin and Esty, 2014). A number of empirical studies have linked certain sustainability practices and performance outcomes, but most of them fail to consider both social and environmental practices (Pullman et al., 2009). A number of studies have found positive and significant relationships between environmental and social sustainability practices and financial performance (Rao and Holt, 2005; Zhu and Sarkis, 2004). Consequently, it is worthwhile establishing a link to reported sustainability to help companies identify which practices are linked to desired performance outcomes.

As such, in this chapter we investigate the third research objective, which is formulated as follows:

RO3: Can our measure shed light on the inconsistent results in the literature on the link of sustainability performance with financial performance and firm size?

Although share price information could be used, and indeed has been used by other researchers, it was not practical to use in this context.

First, although sustainability reports are addressed to investors among other stakeholders, shareholder value (the value companies create for their investors) can be measured by not only stock-price based measures, but also accounting-based measures such as ROI and ROA (Al-Tuwaijri et al., 2004; Son et al., 2016). In fact, stakeholder theory predicts a positive association between accounting-based measures and level of sustainability disclosure (Roberts, 1991). ROA and ROS measures are common measures of corporate performance, as both measures scale profitability by firms' assets and size (Waddock and Graves, 1997) and these are the measures used in the thesis.

Besides, share price would be meaningful if we used longitudinal data. Thus, this measure is quite volatile and does not make sense to use it in one-year data. Indeed though, share price has extensively been used in event studies that look at the value of reporting. Share price volatility is the measure of information asymmetry. To this end, a number of event studies has looked at the event of publishing a sustainability report and market reaction (Cormier and

Magnan, 1999; Clarkson et al., 2008; Jones et al., 2007; Guidry and Patten, 2010; Flammer, 2013; Carnevale and Mazzuca; 2014). Thus, a couple of studies that have adopted the lens of signalling theory to study the motivations behind publication of sustainability reports have used accounting ratios, instead of share price (Mahoney et al., 2013; Herbohn et al., 2014; Cormier and Magnan, 2003). This is the case as sustainability reports change the importance that investors assign to the accounting variables (Carnevale and Mazzuca, 2014).

A number of studies that are looking at the relationship between sustainability disclosure and financial performance have also used only accounting measures to operationalize this association. For instance, Hackston and Milne (1996) and Patten (1991) have used ROA and ROE to revisit the relation between the amount of sustainability disclosure (using number of pages) and corporate profitability. Cowen et al. (1987) and Roberts (1991) use ROE as a measure of financial performance and correlate it with the number of disclosures.

Table 38 summarizes the studies that have used ROA and ROS as metrics of financial performance. We are only looking at relevant studies that cover the topic of sustainability.

Table 38. Summary of studies that have used ROA and ROS as metrics of financial performance

Return on Assets (ROA)	Eccles et al., 2014; Berrone, 2013; Benau et al., 2013; Servaes and Tamayo, 2013; Flammer, 2013; Tang et al., 2012; Montabon et al., 2007; Orlitzky et al., 2003; Berman et al., 1999; Clarkson et al., 2007; McGuire et al., 1998; Russo and Fouts, 1997; Hackston and Milne, 1996; Ameer and Othman, 2012; Lopez et al., 2007; Waddock and Graves, 1997

Return on Sales (ROS)	Wagner et al., 2002; Servaes and Tamayo, 2013; Waddock and Graves, 1997; McGuire et al., 1988

Other measures of financial performance have also been used by current sustainability related studies. More specifically: profit before tax (Ameer and Othman, 2012; Lopez et al., 2007); share price change (Eccles et al., 2014; Vance,1975; Abbott and Monsen, 1979); return on investment (Montabon et al., 2007; Abbott and Monsen, 1979); return on equity (Eccles et al., 2014; Benau et al., 2013; Servaes and Tamayo, 2013; Orlitzky et al., 2003; Wagner et al., 2002; Balabanis et al., 1998; Hackston and Milne, 1996; Waddock and Graves, 1997); and return on capital employed (Churet et al., 2014; Wagner et al., 2002; Balabanis et al., 1998) have also been used in existing literature.

Provided that the majority of sustainability related studies have used ROA and ROS to operationalize financial performance, we also use the particular measures. Return on assets is defined as the ratio of net income to total assets. Al-Tuwaijiri (2004) states that net income measures a firm's profitability without considering the firm's size. This limitation can be addressed using ROA as a measure by scaling profitability by the firm's investment in their asset base. In a similar context, return on sales is defined as the ratio of net income scaled by firms' size as expressed by revenues.

8.2 Social and environmental sustainability reporting and financial performance

We use a linear structural equation modelling (SEM) approach to validate the link between the five variables obtained from the CFA (human rights, labour practices, materials, supply chain, and environmental protection) and financial performance variables. SEM estimates a series of separate but interdependent multiple regression equations simultaneously. SEM, which is also known as latent variable analysis or causal modelling, is used to simultaneously test a measurement and a structural model to investigate a hypothesis/ses (Kassinis and Soteriou, 2003). SEM can best be defined as a class of methodologies that seeks to represent hypotheses about the means, variances and covariances of

observed data in terms of a smaller number of structural parameters defined by a hypothesized model.

SEM is a two-way process comprising of a) the measurement model, which similarly to CFA, considers relationships between manifest variables and constructs; and b) the structural model, where relationships between constructs are specified. For the measurement model, we test the links between the individual social and environmental practices (indicators) and their corresponding construct. The five measurement models are already examined through CFA in the Chapter 5. To test the structural model, the factor scores for each of the five constructs are used. Then we test the model with the resulting five bundles of social and environmental variables and the two financial performance variables using SEM, run as multiple equations.

Financial performance is captured by Return on Assets (ROA) and Return on Sales (ROS) corresponding to the year for which we obtained the sustainability report. A limitation of this analysis is that we are using single year data. Thus a couple of studies have used cross-sectional data to measure the link between environmental performance and profitability (Patten, 1991; Wang and Sarkis, 2013; Wiseman 1982; Al-Tuwaijri et al., 2004). We obtain financial indicators (i.e. total assets, total equity, total debt, and income before extraordinary items) from Computstat database, which is provided by Wharton Research Data Service and gives financial information extracted from corporate annual reports. Figure 26 illustrates the indicators we obtained from Computstat in order to calculate the ROA and ROS variables.

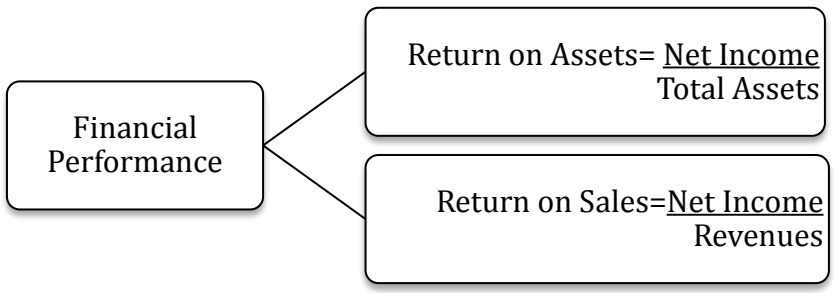


Figure 26. Metrics for financial performance used in this study

Our research model including the five environmental and social sustainability and the two financial variables is presented in Figure 27.

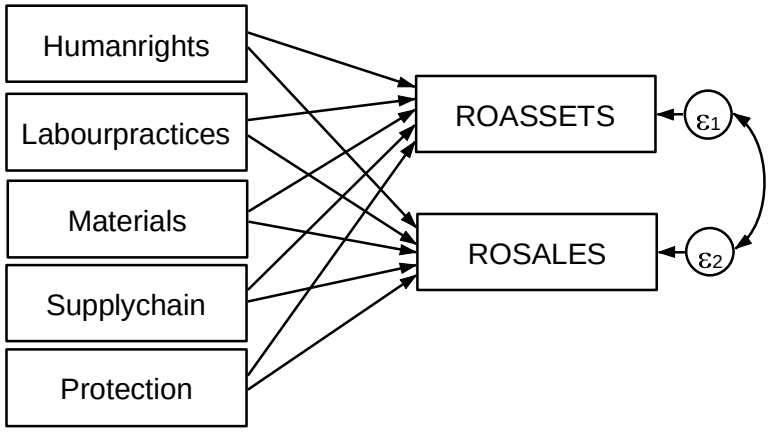


Figure 27. Graphical illustration of the structural model using the five sustainability variables and the two financial performance variables

Table 39 (same as Table 24) gives the descriptive statistics for the variables of the model, and Table 40 (same as Table 25) provides Spearman rank order correlations. We see that the environmental and social practices are correlated with each other at a moderate level.

Table 39. Descriptive table for the seven variables of the structural model

Variable	Mean	SD	Min	Max
Human rights	0	1	-1.062	6.006
Labour practices	0	1	-1.871	2.179
Environ. protection	0	1	-0.854	3.706
Materials conservation	0	1	-2.142	1.831
Supply Chain	0	1	-0.870	4.010
ROA	0.046	0.048	-0.018	0.416
ROS	0.090	0.161	-0.037	2.220

Table 40. Spearman correlation coefficients for the seven variables of the structural model

	Labour practices	Human rights	Materials	Supply chain	Protection	ROA	ROS
Labour practices	1						
Human rights	0.145**	1					
Materials	0.343***	0.122**	1				
Supply chain	0.235***	-0.009	0.204***	1			
Protection	0.485***	-0.057	0.305***	0.093	1		
ROA	-0.007	0.0429	0.075	0.184***	-0.041	1	
ROS	0.019	0.073	0.095	0.011	-0.001	0.681***	1

*** Significance at 0.01 level; ** significance at 0.05 level; * significance at 0.10 level

Table 41 presents the results of SEM. The maximum likelihood estimation (MLE) procedure is used; thus the overall convergence of the structural model indicates no significant relationship between the social and environmental sustainability and financial performance variables. The coefficient of determination (CD) of the model equals to 0.082, which indicates a low predictive value. In particular, the seven independent variables capture approximately 8.2 % of the total variance of the two dependent variables (ROA and ROS). Standardized scores of the financial variables are also utilized in the model so as to reduce the extremity of potential outliers, thus the outcome of the structural model is not differentiated (Narasimhan et al., 2006).

Table 41. Output of the structural model between the five sustainability variables and the two financial performance variables

	DV 1	DV 2
Independent variables	ROA	ROS
Labour practices	-0.11	-0.08
Human rights	-0.01	-0.003
Materials conservation	0.11*	0.07
Supply chain	0.13**	-0.08
Environmental protection	-0.01	0.17***

*** Significance at 0.01 level; ** significance at 0.05 level; * significance at 0.10 level; standardized path coefficients are reported.

In all, SEM analysis indicates that our multi-faceted measure derived from sustainability reports content analysis is not linked to financial performance. This may be attributable to fact that there is no significant link between sustainability disclosed practices and financial performance, at least in the short term. We wish to underline the fact that we use sustainability and financial data for the same year, and as such, the effects of this relationship might not be apparent immediately. Cowen (1987) also found that disclosure (by counting specic disclosed words) is not significantly correlated to financial performance. Patten (1991) and Hackston and Milne (1996) also implemented content analysis of reports by counting the raw amount of pages of social disclosure and found no significant relationship between disclosure and financial performance. Similarly, Freedman and Jaggi (1982) tested the association between their measurement of environmental disclosure and six accounting ratios.

SEM indicates that, at least in the short term, only environmental disclosure is positively associated with financial performance. Specifically, we see that financial performance is associated with disclosure of environmental practices, while there is no link with social practices. Particularly, we see that supply chain and materials conservation, are positively and significantly associated with

ROA. Also, environmental protection is positively and significantly associated with ROS. Thus, the regression coefficients (both standardized and unstandardized) are very low. The positive and significant relationship between environmental supply chain practices and financial performance is also confirmed in other studies (Zhu and Sarkis, 2004; Rao and Holt, 2005; Wang and Sarkis, 2013). Similarly, materials conservation and environmental practices are related to financial performance outcomes though reduction of costs (Christmann, 2000; Klassen and McLaughlin, 1996; Pullman et al., 2009).

In all, our developed instrument based on sustainability reports' disclosure gives similar findings with other studies that use established sustainability measures (ESG, KLD, CEP). More particularly, our findings are in line with McWilliams and Siegel (2000), who find that sustainability performance (captured by KLD data) has a neutral impact on financial performance. Renard et al. (2013) also conclude that sustainability performance (measured by ESG disclosure score) is not strongly correlated with financial performance, using ten financial ratios. Siew et al. (2013) also argue that there is lack of evidence as for the link between companies' non-financial performance (represented by ESG scores) and financial performance. Soana et al. (2011) studied the relationship between an ethical rating and financial performance and concluded that there is no statistically significant link between the two measures. In addition, Abbott and Monsen (1979) found no significant relationship between environmental performance (measured by reputational scales) and stock market performance.

Of course, there is also literature that supports a positive link between third party sustainability measures and financial performance (Waddock and Garves, 1997; Russo and Fouts, 1997; Ameer and Othman, 2012; Wang and Sarkis, 2013; McGuire et al., 1988; Roberts, 1992).

8.3 Comparing upper and lower clusters by industry

Further to SEM, which indicates that some aspects of sustainability appear to be positively linked with financial performance, we argue that there might contingency on industry to be accountable for the inconclusive link between

sustainability and financial performance. As such, we focus only on the following four industries; commercial services, metals and mining, energy and utilities, and household services that we identified in Chapter 6 to investigate this relation.

Specifically, in this section, we carry out cluster analysis to examine whether companies can be classified into homogenous sub-groups according to their sustainability disclosure score. Cluster analysis is an exploratory data analysis tool for organizing observed data into meaningful taxonomies, groups, or clusters. Cluster analysis, based on a combination of independent variables, maximizes the similarity of cases within each cluster. Hierarchical Cluster analysis is carried out by using the two social and three environmental constructs derived by EFA to create two homogenous groups of companies based on their social and environmental disclosure. In particular, we impose a purposive two cluster solution in order to create two clusters – upper and lower companies. It is worth highlighting that we do not try to find natural clusters; instead we carry out cluster analysis to separate upper from lower companies. Following determination of clusters in each industry, we examine whether upper cluster companies have higher financial performance. Waddock and Graves (1997) and McGuire et al. (1998), support the view that companies that are doing well, and thus have slack resources, have greater ability to invest in sustainability activities. On the contrary, firms that find themselves in financial difficulties may have less ability to invest in sustainability activities that extend beyond the mandatory boundaries. Also, Ammer and Othman (2012) argue that companies that place more emphasis on sustainability practices, have superior financial performance measured by return on assets, profit before taxation, and cash flows. This is also supported by the assertion provided by Ullman (1985) that companies with strong prior financial performance, are more likely to have high current levels of social and environmental disclosure. In this case, companies with relatively low financial performance are only doing, and consequently disclosing, the fundamental practices related to waste, water and energy consumption which are required by law.

8.3.1 Commercial services industry

Starting with commercial services, cluster 1 comprises of 21 companies and cluster 2 comprises of 13 companies. Cluster 2 has the highest mean in all five sustainability variables compared to cluster 1. Exception to this rule is labour practices, which scores almost equally in clusters 1 and 2. Thus, it can be argued that cluster 2 comprises of the upper cluster companies and cluster 1 comprises of the lower cluster companies. Table 42 presents the means of the two clusters in the five sustainability variables.

Table 42. Descriptive table for the five sustainability variables across the upper and lower cluster identified in the commercial services sector

	Cluster	N	Mean	SD	Min	Max
Human rights	Lower	21	-0.021	0.190	-0.313	0.353
	Upper	13	0.080	0.324	-0.313	0.589
Labour practices	Upper	21	-0.024	0.188	-0.269	0.375
	Lower	13	-0.033	0.240	-0.419	0.349
Materials conservation	Lower	21	-0.382	0.304	-0.980	0.045
	Upper	13	0.400	0.186	0.094	0.838
Supply chain	Lower	21	-0.157	0.157	-0.278	0.167
	Upper	13	-0.114	0.268	-0.278	0.464
Environmental	Lower	21	-0.251	0.056	-0.288	-0.137
	Upper	13	-0.032	0.261	-0.288	0.652

Based on the cluster analysis results, we conduct a one-way ANOVA to determine whether corporate financial performance is differentiating the two clusters in the commercial services. ANOVA is a widely used statistically method for investigating statistically significant differences between groups of

firms. We examine Return on Assets (ROA) and Return on Sales (ROS) as proxies of financial performance. Table 43 presents the financial performance of the two clusters.

Table 43. Descriptive table for the financial performance variables across the upper and lower cluster identified in the commercial services sector

	Cluster	N	Mean	SD	Min	Max
ROS	Lower	19	0.081	0.103	0.001	0.439
	Upper	12	0.237	0.307	-0.037	0.910
ROA	Lower	18	0.040	0.029	0.002	0.097
	Upper	12	0.102	0.116	-0.006	0.416

We see that the upper disclosure cluster has higher means in both ROA and ROS. The greatest differentiation though is to be found in ROS, as seen in Figure 28.

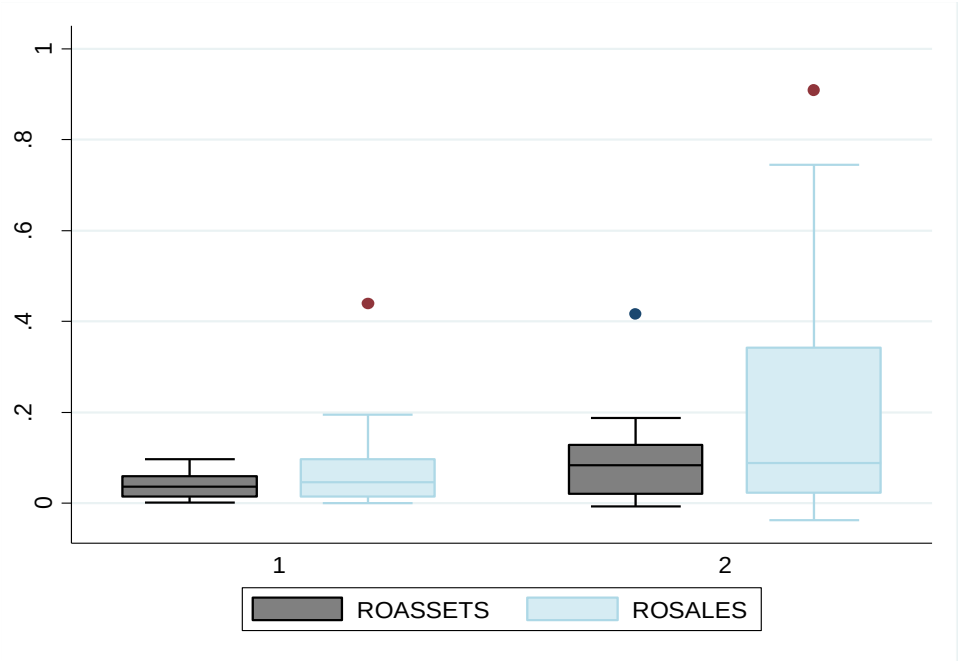


Figure 28. Graphical illustration of financial performance across the upper and lower cluster identified in the commercial services sector

ANOVA confirms that there is a statistically significant difference between the two clusters and ROS ($F(1, 29) = 4.25$, $p = .04$). Further to that, ANOVA confirms that there is also a statistically significant difference between the two clusters and ROA ($F(1, 28) = 4.79$, $p = .04$).

In all, we see that in commercial services, companies that have the highest degree of sustainability disclosure (upper cluster) also have superior financial performance, compared to the companies belonging to the lower cluster.

8.3.2 Metals and mining industry

We are performing a two-cluster solution for metals and mining industry, too, and the outcome is illustrated as follows; cluster 1 comprises of 14 companies and cluster 2 comprises of 10 companies. Cluster 2 has the highest mean in all seven sustainability variables, apart from supply chain, where cluster 1 has a higher mean. Thus, in overall, we argue that cluster 2 is the cluster comprising of the upper cluster companies and cluster 1 comprises of the lower cluster companies. Table 44 presents the means of the two clusters in the five sustainability variables.

Table 44. Descriptive table for the five sustainability variables across the upper and lower cluster identified in the metals and mining sector

	Cluster	N	Mean	SD	Min	Max
Human rights	Lower	14	-0.085	0.183	-0.313	0.353
	Upper	10	0.152	0.41	-0.117	1.175
Labour practices	Lower	14	0.026	0.211	-0.229	0.471
	Upper	10	0.198	0.129	-0.032	0.39
Material practices	Lower	14	0.094	0.255	-0.269	0.574
	Upper	10	0.098	0.364	-0.639	0.54
Supply chain	Lower	14	-0.129	0.183	-0.278	0.237
	Upper	10	-0.182	0.151	-0.278	0.184

Environmental	Lower	14	-0.025	0.224	-0.288	0.36
	Upper	10	0.838	0.191	0.54	1.164

We conduct a one-way ANOVA to determine whether financial performance variables differentiate upper from lower clusters. Table 45 presents the financial performance of the two clusters. We see that the upper cluster is not substantially differentiated from the lower one. Figure 29 graphically illustrates the financial performance of the two clusters.

Table 45. Descriptive table for the financial performance variables across the upper and lower cluster identified in the metals and mining sector

	Cluster	N	Mean	SD	Min	Max
ROS	Lower	13	0.042	0.076	-0.024	0.243
	Upper	10	0.258	0.693	-0.037	2.220
ROA	Lower	13	0.033	0.047	-0.012	0.134
	Upper	9	0.026	0.060	-0.018	0.178

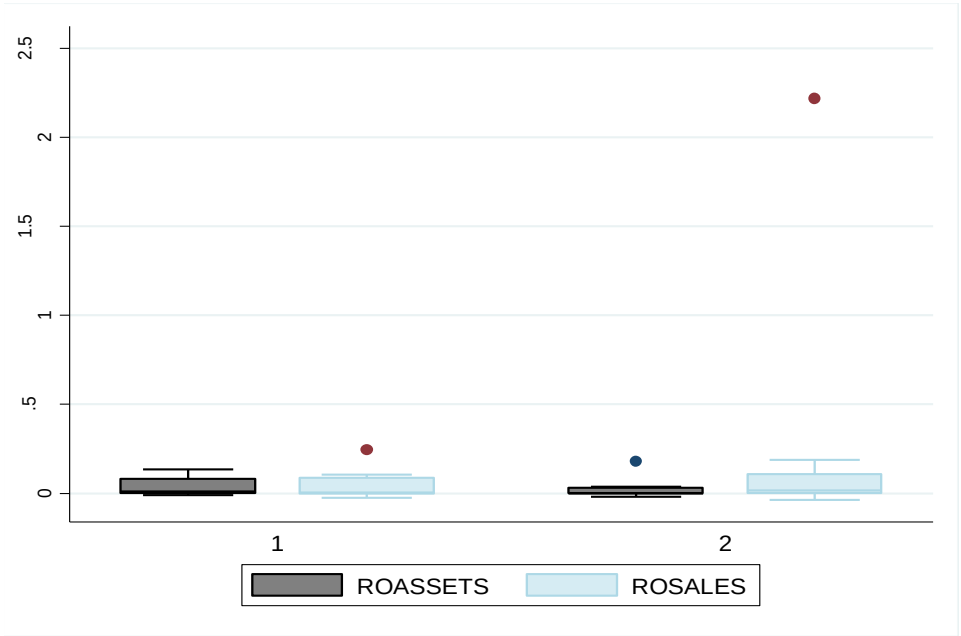


Figure 29. Graphical illustration of financial performance across the upper and lower cluster identified in the metals and mining sector

To further explore the difference between the two clusters, we carry out one way ANOVA. AVOVA indicates that there is not a statistically significant difference between the two clusters and ROS [F (1, 21) = 1.26, p = 0. 27]. Similarly, ROA does not have a significant differentiation upon upper and lower clusters [F (1, 20) = 0.07, p = 0. 79].

In all, we see that in metals and mining, there is not any link between sustainability disclosure and financial performance, as ANOVA does not determine any statistically significant differences between upper and lower clusters and financial performance.

8.3.3 Energy and utilities industry

For energy and utilities industry, cluster analysis indicates that cluster 1 comprises of 17 companies and cluster 2 comprises of 18 companies. Cluster 1 has the highest mean in all seven sustainability variables compared to cluster 2. Exception to this rule is supply chain, which scores almost equally in clusters 1 and 2. Again, clusters are tentatively labelled according to their total social and environmental disclosure. Thus, we argue that cluster 1 comprises of the upper cluster companies and cluster 2 comprises of the lower cluster companies. Table 46 presents the means of the two clusters in the five sustainability variables.

Table 46. Descriptive table for the five sustainability variables across the upper and lower cluster identified in the energy and utilities sector

	Cluster	N	Mean	SD	Min	Max
Human rights	Upper	17	0.005	0.208	-0.313	0.490
	Lower	18	-0.008	0.302	-0.313	0.687
Labour practices	Upper	17	0.189	0.167	-0.109	0.474

	Lower	18	-0.031	0.218	-0.419	0.216
Material practices	Upper	17	0.060	0.316	-0.384	0.530
	Lower	18	-0.416	0.317	-0.980	0.221
Supply chain	Upper	17	-0.217	0.085	-0.278	-0.098
	Lower	18	-0.167	0.169	-0.278	0.405
Environmental	Upper	17	0.523	0.296	-0.191	1.046
	Lower	18	-0.074	0.179	-0.288	0.217

Again, we conduct a one-way ANOVA to determine whether financial performance variables are differentiating upper from lower clusters in the energy and utilities sector. Table 47 presents the financial performance of the two clusters.

Table 47. Descriptive table for the financial performance variables across the upper and lower cluster identified in the energy and utilities sector

	Cluster	N	Mean	SD	Min	Max
ROS	Upper	15	0.103	0.086	0.004	0.246
	Lower	16	0.055	0.049	-0.003	0.182
ROA	Upper	16	0.029	0.015	0.005	0.058
	Lower	16	0.034	0.036	-0.001	0.131

As illustrated in Figure 30, it seems that ROS is highly differentiated in the two clusters. This is further explored by carrying out ANOVA, which also indicates that ROS significantly differentiates upper and lower clusters. In particular, one way AVOVA indicates that there is a significant effect of ROS at the $p<.10$ level

on the clusters [F (1, 29) = 3.71, p = 0. 06]. On the contrary, ROA does not have a significant effect on the two clusters [F (1, 30) = 0.24, p = 0. 62].

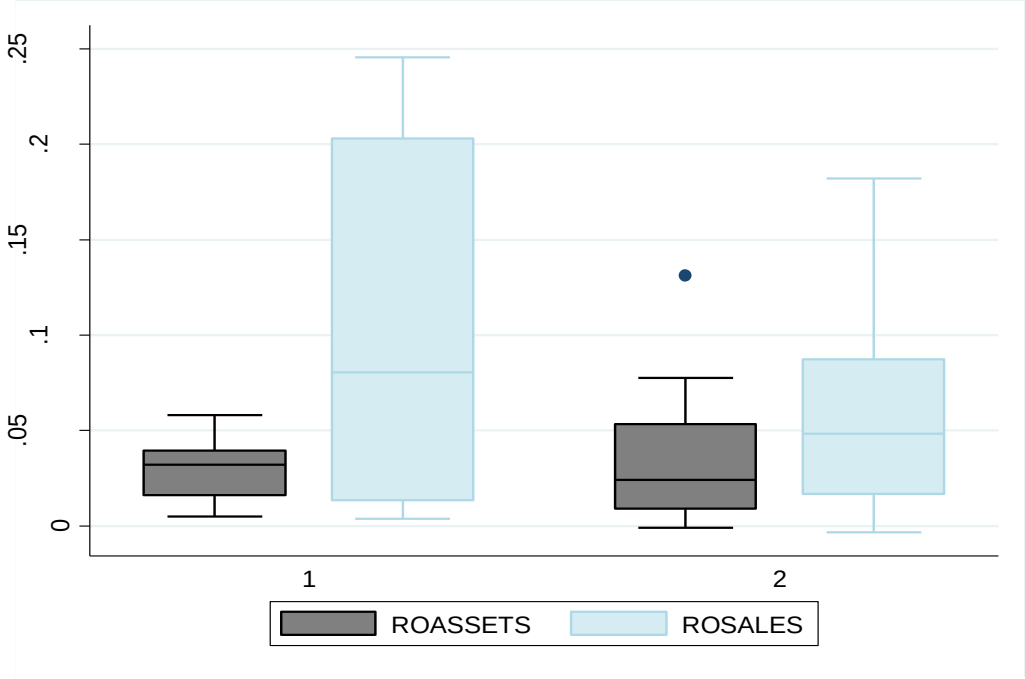


Figure 30. Graphical illustration of financial performance across the upper and lower cluster identified in the energy and utilities sector

In all, we see that in energy and utilities, there is seems to be a link between sustainability disclosure and financial performance, as ANOVA indicates that ROS significantly differentiates the two clusters, whereas ROA does not have any effect upon.

8.3.4 Household services industry

Finally, we are performing a two-cluster solution for household services industry, where cluster 1 comprises of 5 companies and cluster 2 comprises of 7 companies. Cluster 1 has the lowest mean in all five sustainability variables. Again, clusters are tentatively labelled according to their total social and environmental disclosure. Thus, it can be argued that cluster 1 comprises of the lower cluster firms and cluster 2 comprises of the upper cluster firms. Table 48 presents the means of the two clusters in the five sustainability variables.

Table 48. Descriptive table for the five sustainability variables across the upper and lower cluster identified in the household services sector

	Cluster	N	Mean	SD	Min	Max
Human rights	Lower	5	-0.168	0.231	-0.313	0.216
	Upper	7	-0.097	0.142	-0.313	0.118
Labour practices	Lower	5	-0.043	0.147	-0.187	0.150
	Upper	7	0.053	0.206	-0.191	0.456
Material practices	Lower	5	-0.069	0.556	-0.980	0.371
	Upper	7	0.649	0.213	0.337	0.838
Supply chain	Lower	5	0.068	0.178	-0.174	0.325
	Upper	7	0.590	0.176	0.277	0.830
Environmental	Lower	5	-0.023	0.138	-0.179	0.197
	Upper	7	0.123	0.376	-0.288	0.662

Table 49 presents the financial performance of the two clusters within the household services sector. It is interesting that the lower cluster has superior financial performance compared to upper cluster companies. This is further explored by carrying out one ANOVA, which also indicates that none of the financial performance variables are significantly differentiating the two clusters. There is not a significant effect of ROS at the $p<.05$ level for the two clusters [$F(1, 8) = 0.00$, $p = 0.98$]. Similarly, ROA does not have a significant effect on the two clusters [$F(1, 8) = 0.06$, $p = 0.81$]. Figure 31 graphically illustrates the financial performance of the two clusters.

Table 49. Descriptive table for the financial performance variables across the upper and lower cluster identified in the household services sector

	Cluster	N	Mean	SD	Min	Max
ROS	Lower	3	0.115	0.124	0.000	0.246
	Upper	7	0.113	0.036	0.077	0.173
ROA	Lower	3	0.107	0.122	0.000	0.239
	Upper	7	0.095	0.047	0.032	0.162

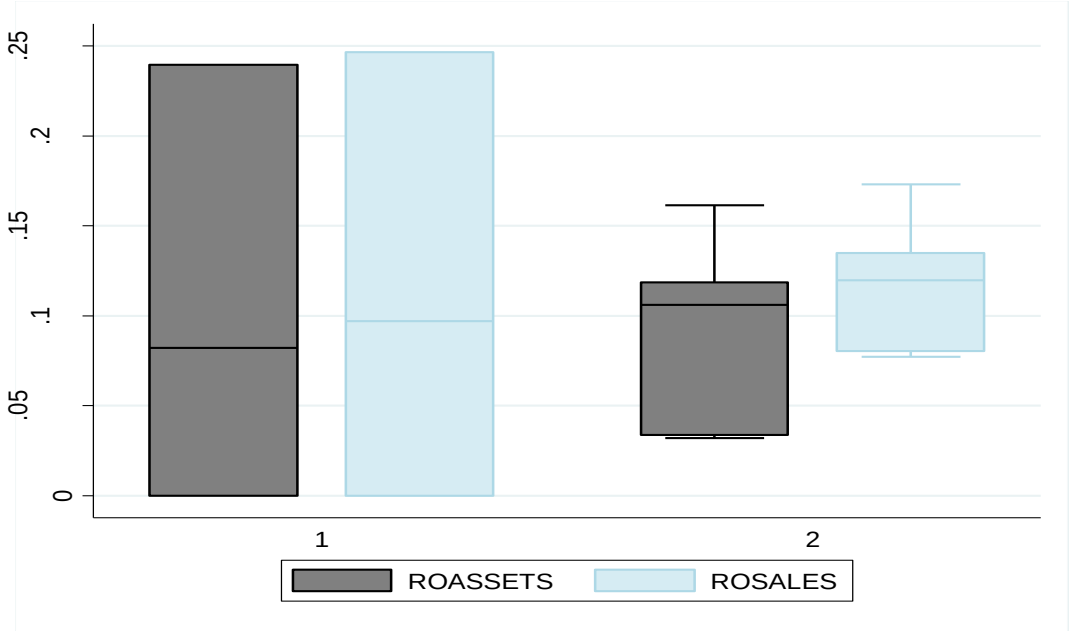


Figure 31. Graphical illustration of financial performance across the upper and lower cluster identified in the household services sector

In all, we see that in the household services sector there is not any link between sustainability disclosure and financial performance, as ANOVA indicates that there is not6 any statistically significant differences between upper and lower clusters and financial performance.

In this section we carried cluster analysis to examine the link of our developed measure for sustainability performance and financial performance. Cluster

analysis indicates that the type of industrial sector does not affect the level sustainability disclosure, as all of the four industries are either reporting high on both social and environmental sustainability or reporting low on both. This finding is in line with Cowen et al (1987) and Balabanis et al (1998), who also support that the level of disclosure does not differ by industry type.

As for financial performance differentiation, Table 50 summarizes the findings of the four ANOVAs, illustrating which of the financial variables are significantly differentiating upper and lower cluster companies in the four industries. In particular, ROA are only differentiating commercial services' level of sustainability disclosure, while ROS are only differentiating the level of sustainability disclosure in commercial services and energy and utilities industries.

Table 50. Summary of ANOVA results between the upper and lower cluster groups and financial performance in the four industrial sectors

Industry	ROA	ROS
Commercial services	Yes	Yes
Metals and Mining	Not sign.	Not sign.
Energy and Utilities	Not sign.	Yes
Household services	Not sign.	Not sign.

In all, this analysis indicates sector specificity as regards the relationship between the degree of sustainability disclosure and financial performance based on the proposed instrument.

8.4 The effect of companies' size on sustainability disclosure score

Size is a corporate characteristic that a number of studies argues that affects the level of sustainability disclosure (Balabanis et al., 1998; Patten, 1991, 2002; Cowen et al., 1987; Hackston and Milne, 1996). Size is commonly expressed as a proxy of revenues (Waddock and Graves, 1007; Patten, 1991; Cowen, 1987; Cormier and Magnan, 1999; Clarkson et al., 2007; Adams and Frost, 2008; Hackston and Milne, 1996; Deegan, 2002; Healy and Palepu, 2001).

Ullmann (185) argues that larger companies have the necessary resources and technical know-how to adopt sustainability practices. That is to say, as large companies tend to have additional resources but also greater business motives to produce higher quality reports (Siew et al., 2013). Also, large companies tend to incur greater public pressure or scrutiny, and thus, are under higher pressure to communicate their social and environmental sustainability practices (Russo and Fouts, 1997; Sharma and Henriques, 2005; Pagell and Wu, 2009). Finally, the degree of sustainability disclosure is subject to the informational expectations of investors or advanced reporting systems both of which factors are more apparent in large firms (Cowen et al., 1987; Carnevale and Mazzuca, 2014).

In this section, we examine whether revenues affect the level of companies' sustainability disclosure. To this end, we carry out ANOVA to examine whether there is a magnitude of difference in revenues between the upper and lower disclosure clusters. Again, we are focusing on commercial services, metals, energy, and household services.

Commercial services

Looking at the descriptive table for the commercial services clusters in Table 51, we see that the mean of revenues is not dramatically different between the two clusters, as upper cluster firms are outperforming laggard companies by 1,175 million dollars. This is further confirmed by carrying out one way ANOVA, which indicates that there is not a significant effect of revenues at the $p<.05$ level for the two commercial services clusters [$F (1, 29) = 0.06$, $p = 0. 81$].

Table 51. Descriptive table for revenues across the upper and lower cluster identified in the commercial services sector

	Cluster	N	Mean	SD	Min	Max
Revenues (mil.$)	Lower	19	6,735	11,010	7	45,567
	Upper	12	7,910	15,673	63	55,438

Metals and Mining

The same process is followed in the metals and mining industry, where we see that uppers' mean is by 2 million dollars higher than lowers' one (Table 52). Hence, one way AVOVA indicates that there is not a significant effect of revenues at the p<.05 level for the two metals and mining services clusters [F (1, 21) = 0.46, p = 0. 51].

Table 52. Descriptive table for revenues across the upper and lower cluster identified in the metals and mining sector

	Cluster	N	Mean	SD	Min	Max
Revenues						
(mil. $)	Lower	13	4,077	6,481	213	23,032
	Upper	10	6,268	9,116	3	29,342

Energy and Utilities

In the case of energy sector, we see that mean of revenues of the upper cluster is almost three times higher than the laggard. Table 53 presents the differences in revenues in the two clusters. Hence, one way AVOVA indicates that there is not a significant effect of revenues at the p<.05 level for the two energy and utilities clusters [F (1, 29) = 1.35, p = 0. 25].

Table 53. Descriptive table for revenues across the upper and lower cluster identified in the energy and utilities sector

	Cluster	N	Mean	SD	Min	Max
Revenues						
(mil.$)	Upper	15	41,130	96,637	1,539	379,136
	Lower	16	12,436	19,795	67	75,594

Household services

Finally, household services are exhibiting a wide difference in the mean of revenues among upper and lower cluster companies. Table 54 presents the differences in the two clusters; again upper cluster is outperforming the lower one by almost four times. Hence, one way AVOVA indicates that there is not a significant effect of revenues for the two household services clusters at the $p<.05$ level [$F (1, 8) = 1.10$, $p = 0. 32$].

Table 54. Descriptive table for revenues across the upper and lower cluster identified in the household services sector

	Cluster	N	Mean	SD	Min	Max
Revenues (mil.$)	Lower	3	8,466	8,175	32	16,355
	Upper	7	29,737	33,635	2,539	84,167

In overall, ANOVA determines that there is not any statistical difference in the mean of revenues between upper and lower cluster companies in any of the four industry classifications. Figure 32 graphically illustrates the relation between revenues and sustainability disclosure score for energy, metals, household, and commercial services. We see that the sustainability disclosure score is scattered around the range of revenues for all companies in the four industries.

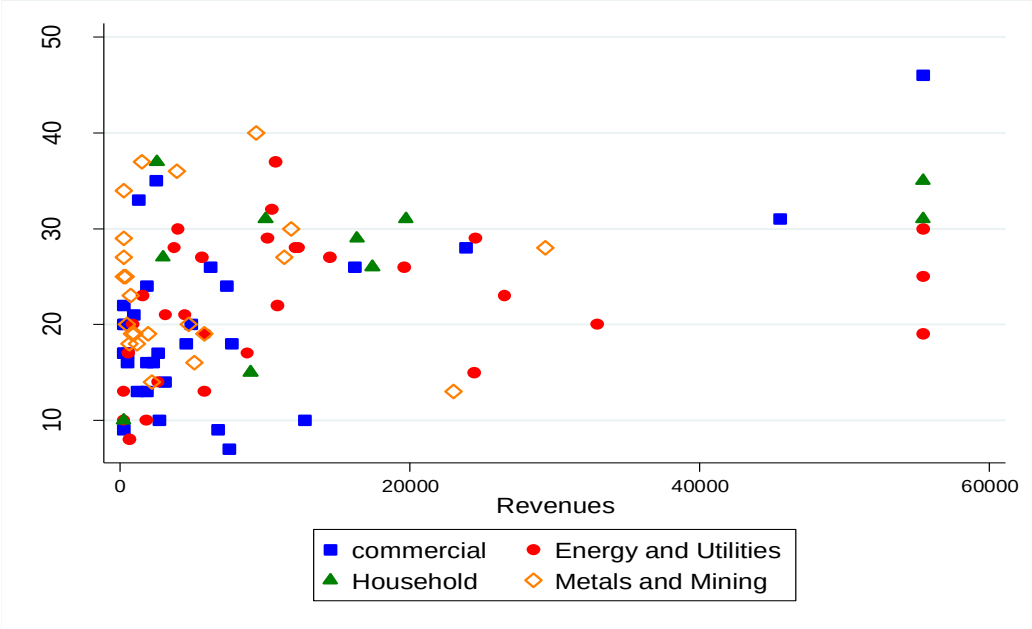


Figure 32. Correlation between total sustainability disclosure score and revenues including all companies for the four industries

To generalize these findings across all industries, we are comparing the degree of association of total sustainability disclosure score and revenues across all firms of the sample. Figure 33 visually exhibits this relationship; in the first image we see the degree of association between sustainability disclosure score and revenues per industrial sector. The second image incorporates all industries in one image. We see that revenues are not related to the level of sustainability disclosure.

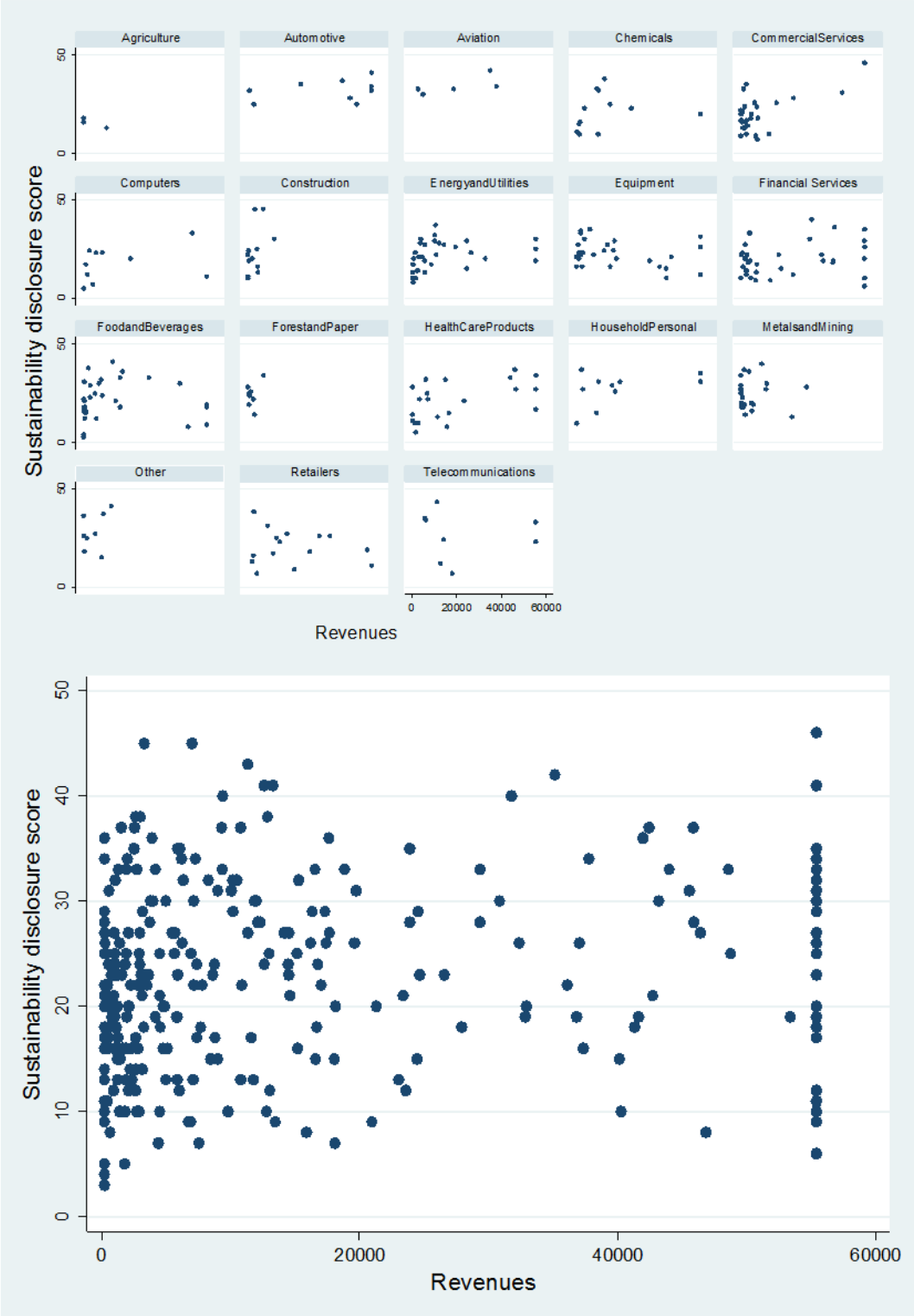


Figure 33. Correlation between total disclosure score and revenues including all industries of the sample

In all, our developed measure obtained from sustainability reports is not dependent on revenues. This analysis indicates that our composite measure does not seem to be dependent on size. Our findings are in line with Waddock and Graves (1997), Gray et al. (1995), and Roberts (1992) who find that firm size expressed by revenues is not related to the level of sustainability disclosure.

8.5 Discussion

In this chapter, we examined the link between our proposed measure obtained from sustainability reports and firm financial performance, as expressed by Return on Assets (ROA) and Return on Sales (ROS) ratio variables to shed light on the inconclusive results in the literature. In order to explore that link, we performed SEM. Our empirical analysis indicates that indicates that there is not any significant link between our measure of sustainability performance and financial performance, at least in the short term. This finding is consistent with Gray et al. (1995) and Hackston and Milne (1996) who also find that corporate sustainability disclosure is not related to financial performance.

Also, only environmental aspect of sustainability appears to be positively linked with financial performance. This result is consistent with Gamerschlag et al. (2011), who support that this is taking place because polluting industries have been confronted with powerful stakeholders for a long time, while labour practices have only been of concern since the late 1990s. The lack of a significant relationship between all sustainability dimensions and corporate financial performance might be attributed to the fact that certain practices are reported due to external pressures, regardless of whether these practices pay off (Berrone et al., 2013; Zhu and Sarkis, 2004). For example, regulatory requirements are dictating companies to adopt specific practices (Wang and Sarkis, 2013).

Provided that certain practices are more important to certain sectors, we argue about the relevance of contingency on industry. For this reason, we implement an additional analysis by taking into consideration the industrial sector. As such, we focus on commercial services, metals and mining, energy and utilities, and household services and identify upper and lower disclosing companies. ANOVA results within each industrial sector confirms that there is sector

specificity affecting the relationship between sustainability reporting and financial performance, based on the proposed instrument. As such, our analysis indicates that there is need to take industry into account in cross-industry samples. On the other hand, firm size does not affect the proposed measure we developed in any industrial sector, in agreement with some of the literature (Waddock and Graves, 1997; Roberts, 1992).

Al-Tuiwaijri et al. (2004) and Cormier and Magnan (2003) support that environmental and social disclosure is positively associated with financial performance. Our findings suggest that sustainability information, and particularly environmental, is desired and useful information for investors, providing support to the notion that sustainability disclosure reduces asymmetrical information.

Sustainability reports, contrary to third party rankings reflect the signals that companies want to release to their investors and stakeholders as for their sustainability practices. As such, we argue that the disclosure in the sustainability reports reflects valuable information that the reporting company wishes to communicate. Indeed, it is investors and other stakeholders appreciate the disclosure included in the sustainability reports, as it creates transparency and reduces information asymmetries (Carnevale and Mazzuca, 2014). This study follows the assumption highlighted by Krippendorff (1980) that the extent of disclosure can be taken as some indication of the importance of an issue to the reporting entity.

Chapter 9. Conclusion

9.1 Summary of this study

This is an exploratory study positioned at the intersection of the value of corporate reporting and sustainability performance, where we seek to investigate the following research question: What is the value of disclosure in sustainability reports? This research question is split into three distinct research objectives.

The first research objective is related to developing a measure for sustainability reporting and exploring its attributes. To this end, we create an instrument for sustainability reported practices based on content analysis of 331 corporate sustainability reports. In particular, we first review the relevant literature and existing guidelines and synthesize a list of 51 sustainability practices (**Chapter 3**). Next, we score each sustainability report on each of the identified practices. Descriptive analysis indicates that a sub-set of 32 represented environmental and social sustainability practices are prioritized in companies' reports (**Chapter 4**). Based on these 32 social and environmental practices identified in companies' sustainability reports, we develop two constructs for social sustainability – human rights and labor practices - and three constructs for environmental sustainability– environmental protection, materials conservation, and supply chain (**Chapter 5**). These constructs allow us to identify leader and laggard companies based on companies' total disclosure score in different sectors for comparison (**Chapter 6**).

The second research objective is to check consistency of our proposed measure with existing measures based on internal information that are considered valid. To this end, we correlate our measure with third party provided measures, namely DJSI, and ESG score (**Chapter 7**). T-test indicates that companies in our sample that are included in DJSI have higher disclosure scores compared to the companies that are not included in DJSI. Similarly, our analysis indicates that the total disclosure score and ESG score are positively and significantly correlated, meaning that companies with a higher disclosure score, as derived from content analysis, are also the ones having a higher ESG

score. Finally, a correlation analysis between the three measures is performed; All three sustainability measures are positively and significantly correlated with each other at 0.33 level (p=0.001). The findings indicate that our developed measure based on sustainability reporting is as valuable as existing measures not based on sustainability reporting.

Finally, **the third research objective** of this study is to see whether our proposed measure can shed light on the inconsistent results in the literature on the link between sustainability with financial performance and firm size. To explore this type of relationship, we implement structural equation modelling between the five sustainability constructs developed in **Chapter 5** and financial performance (expressed as ROA and ROS). The structural model indicates that, at least in the short term, only environmental disclosed practices are positively associated with financial performance (**Chapter 8**). This is a very interesting finding that indicates that individual practices might be contributing possibly, depending on the industrial sector.

Indeed, provided that certain practices are more important to certain sectors, our analysis also highlights the industry-sector contingency effect. For this reason, we further examine the relationship between sustainability disclosure and financial performance focusing purely on four industrial sectors. We identified two clusters, based on companies' disclosure, comprising of the upper and lower companies within each of the four sectors. Subsequently, ANOVA was performed to determine the difference between the two clusters and ROA & ROS in each industrial sector. This analysis provided mixed results as for the relationship between our measure for sustainability and financial performance. In particular results indicate contingency of sector specificity as regards the relationship between sustainability and financial performance based on our proposed instrument.

Finally, we examine the effect of firm size on our developed measure obtained from companies' sustainability reports. To this end, we carried out ANOVA between the upper and lower cluster companies of the four industries and revenues. In none of the four cases did ANOVA indicate statistically significant differences between upper and lower disclosing companies and revenues. As such, this analysis indicates that size is not linked to sustainability disclosure.

9.2 Contribution and implications

This study contributes to both the literature on the value of corporate reporting and the sustainability performance literature. To begin, we develop an instrument based on companies' sustainability disclosure. This measure differs from existing ones on the grounds that (1) it is not purely based on GRI guidelines as many studies have done so and (2) it is built based on companies' disclosure on adoption and extent of implementation of operational practices, and not on counting words or sentences.

Second, our findings indicate that our developed measure is as valuable as existing measures. Given the argumentation in existing literature that sustainability reporting is not an accurate reflection of real sustainability performance, we attempted to shed light on this issue by proposing a new instrument for based sustainability reporting. Using this measure, we check the consistency of our developed measure with existing measures of sustainability already considered to be valid. Correlation analysis indicates that our developed measure, DJSI, and ESG score are all significantly and positively correlated at the 30% level. This finding indicates that our composite measure based on sustainability reports is positively and significantly correlated with existing measures already considered to be valid. As such, the measure coming out from sustainability reporting is as valuable as existing measures, not based on sustainability reports.

Third, given the inconclusiveness in the existing literature regarding the link between sustainability and firm financial performance and size, this study attempted to shed light on this ambiguous relationship. Our empirical analysis indicate that only environmental sustainability practices are linked to financial performance, at least in the short term. Also, industry has a contingent effect on the link between our measure obtained from sustainability reports and financial performance. On the other hand, firm size does not affect our proposed instrument.

Our results have several implications. This research adds to the existing knowledge by exploring sustainability reporting as regards the disclosure of

practices for environmental and social sustainability. To this end, we create an instrument based on companies' sustainability disclosure. The proposed measure is positively and significantly correlated at the same level with third party measures, already considered to be valuable, at 30%. In addition, our analysis indicates the existence of industry contingent effect on the relation between companies' sustainability disclosure and financial performance.

There are at least two policy implications underpinning this research. Sustainability reporting has value in measuring a company's adoption and extent of implementation of operational practices. Moreover, a measure of disclosure such as ours is an accurate reflection of companies' sustainability practices as well as our developed measure based on sustainability disclosure is positively and significantly correlated with third party measures, which are already considered to be valid. Thus, disclosure of operational practices is a good, if indirect, measure of companies' sustainability efforts by way of adoption of practices and the extent of their implementation. The policy implication of this is that that companies must be required to report on the operational practices that they are implementing in their companies along with the results obtained showing extent of implementation. Another policy implication is around integrated reports. Although our results do not indicate much link between financial performance and sustainability disclosure, there is an industry contingent effect on the link between disclosed sustainability practices and financial performance even in the short term. Thus, not only must reporting guidelines consider industries but also the link between sustainability performance (howsoever measured, including indirectly by our proposed disclosure measure) would be clearer with integrated reporting. For example, environmental practices would be more relevant to energy intensive industries, while social practices are more applicable to restaurants, apparel, or textile industries.

Finally, the implications for practice are twofold. Sustainability reports do indicate companies' social and environmental sustainability efforts. Therefore, companies should disclose their operational practices to the extent possible. Second, a measure such as the proposed disclosure score by itself does not

appear to depend on industry or on the company size, which makes it useful having standard guidelines for any sector.

9.3 Limitations and directions for future research

The limitations of this study have to be recognized. To begin with, we have not studied why companies disclose or withhold information regarding sustainability practices. In this study we only look at what is being reported by companies by way of sustainability practices and the extent of adoption. Based on the sustainability reports, we identify operational practices that are reported by companies and develop an instrument out of them.

Also, this is a cross-sectional study, whereby we examine the link between reported sustainability operational practices and the metrics of financial performance using one - year data (matching the publication year of the sustainability report with that of the annual report). Future studies could attempt to replicate this analysis using multiple years of sustainability reports of the same company. Thus, the use of longitudinal data is avenue for future wok so that an extended index for sustainability disclosure is developed, using longitudinal data or another scoring methodology.

Also, the use of longitudinal data (an average of a three year period) is avenue for future wok so that an extended index for sustainability disclosure is developed using longitudinal data or another scoring methodology (Cowen et al., 1987). Hackston and Milne (1996) argue that measuring ROE and ROA over an extended period, gives a more reliable measurement of performance than measurement for a single year. Ammer and Othman (2012) and Wang and Sarkis (2013) use a two-year lag, while five-year average is used in Abbot and Monsen (1979) study. Second, it would allow further refinement and development of questions, e.g. those pertaining to ‘responsible sourcing’. Third, it would allow us to study the link in the long term between sustainability and financial performance as we noted earlier.

In addition, we recognize that our scoring methodology may be subjective and consequently the stability and reproducibility of the findings can be questioned. Thus, we have to underline that for the same companies our scores derived from content analysis are positively and significantly correlated with external

providers' scores. Hence, to ensure further credibility, we suggest that an additional content analysis using software is carried out for the same 331 companies in later years to cross-check; this would also allow us to perform longitudinal analysis.

Additionally, future work could examine the correlation of our sustainability disclosure score with the KLD score. KLD scores companies based on seven categories. The reason why we did not try it in the current study is that there are some issues with measuring the KLD data as a single item. KLD assigns a score ranging from -2 to +2 in six categories. Adding the positive items and subtracting the negative items to get the overall score for each category is the most common method, despite the arguments that the six categories are not equally important. Also, KLD (which is now part of the MSCI) has limited amount of ESG for the top 300 companies (Siew et al., 2013).

Future research could look at integrated reports to explore the link between disclosed social and environmental operational practices and financial performance. Integrated reports constitute the new type of reporting, as they combine analysis of financial and non-financial performance. Also, some companies do not produce a separate sustainability report and incorporate their sustainability disclosure into the annual report. However, despite being part of the annual report, the sustainability section is not audited. On the contrary, integrated reports are audited, and thus, their content is validated. Repeating the same analysis as our study using a sample of integrated reports, would work as a comparative benchmark as well as validate the measures that the study developed for environmental and social sustainability. In this study, we did not incorporate any analysis of integrated reports, as integrated reporting is at an early stage of development and research on that is still in its infancy.

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Appendices

Appendix 1

CATEGORIES AND ASPECTS IN THE GUIDELINES				
Category	**Economic**	**Environmental**		
Aspects[III]	• Economic Performance • Market Presence • Indirect Economic Impacts • Procurement Practices	• Materials • Energy • Water • Biodiversity • Emissions • Effluents and Waste • Products and Services • Compliance • Transport • Overall • Supplier Environmental Assessment • Environmental Grievance Mechanisms		
Category	**Social**			
Sub-Categories	**Labor Practices and Decent Work**	**Human Rights**	**Society**	**Product Responsibility**
Aspects[III]	• Employment • Labor/Management Relations • Occupational Health and Safety • Training and Education • Diversity and Equal Opportunity • Equal Remuneration for Women and Men • Supplier Assessment for Labor Practices • Labor Practices Grievance Mechanisms	• Investment • Non-discrimination • Freedom of Association and Collective Bargaining • Child Labor • Forced or Compulsory Labor • Security Practices • Indigenous Rights • Assessment • Supplier Human Rights Assessment • Human Rights Grievance Mechanisms	• Local Communities • Anti-corruption • Public Policy • Anti-competitive Behavior • Compliance • Supplier Assessment for Impacts on Society • Grievance Mechanisms for Impacts on Society	• Customer Health and Safety • Product and Service Labeling • Marketing Communications • Customer Privacy • Compliance

A1. GRI guidelines for social and environmental categories (GRI, 2013)

The Ten Principles of the United Nations Global Compact

HUMAN RIGHTS

PRINCIPLE 1
Businesses should support and respect the protection of internationally proclaimed human rights; and

PRINCIPLE 2
make sure that they are not complicit in human rights abuses.

LABOUR

PRINCIPLE 3
Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;

PRINCIPLE 4
the elimination of all forms of forced and compulsory labour;

PRINCIPLE 5
the effective abolition of child labour; and

PRINCIPLE 6
the elimination of discrimination in respect of employment and occupation.

ENVIRONMENT

PRINCIPLE 7
Businesses should support a precautionary approach to environmental challenges;

PRINCIPLE 8
undertake initiatives to promote greater environmental responsibility; and

PRINCIPLE 9
encourage the development and diffusion of environmentally friendly technologies.

ANTI-CORRUPTION

PRINCIPLE 10
Businesses should work against corruption in all its forms, including extortion and bribery.

Published by the UN Global Compact Office
Contact: globalcompact@un.org
September 2013 - 1.5M

A2. The 10 principles of United Nations Global Compact (UN Global Compact Office, 2013)

A3. Industry classification of the 331 companies of the sample

Industry	Number of companies
Agriculture	3
Automotive	9
Aviation	5
Chemicals	17
Commercial services	34
Computers	10
Construction	14
Energy and utilities	35
Equipment	30
Financial Services	33
Food and beverages	35
Forest and paper	9
Health care products	21
Household and personal	12
Metals and mining	24
Other	13
Retailers	17
Telecommunications	10

Appendix 2

A4. CFA results: Social sustainability practices

	X^2 (df)	X^2/df	RMSEA	SRMR	CFI	TLI	CD
Two factor model	28.90 (26)***	1.11	0.018	0.037	0.98	0.98	0.80

A5. Summary of findings- Social factor loadings

Construct	Indicator	Loading
Labour practices	Employ health and safety	0.54***
	Establish supplier codes of conduct	0.33***
	Train employees	0.64***
	Train on anti-corruption	0.43***
	Encourage employee diversity	0.50***
	Source responsibly	0.05
Human rights	Conduct community support activities	0.36***
	Engage employees	0.59**
	Commit to employees	0.36***
Covariance		
Labour practices* Human rights		0.20*

A6. CFA results: Environmental sustainability practices

	X^2 (df)	X^2/df	RMSEA	SRMR	CFI	TLI	CD
Five factor model	611.142 (230)***	2.65	0.071	0.093	0.404	0.345	0.98

A7. Summary of findings- Environmental factor loadings

Construct	Item	Loadings
Emissions	Reduce carbon footprint	0.04***
	Reduce fuel consumption	0.25
	Reduce GHG emissions	0.24
	Reduce other gases emissions	0.58
	Response to oil Spills	0.51
Supply Chain	Assess/evaluate suppliers	0.51***
	Collaborate with suppliers	0.55***
	Procure sustainably	0.36***
	Source locally	0.03
Materials Consumption	Reduce waste production	0.58***
	Reduce water consumption	0.56***
	Reduce packaging	0.21***
	Reduce consumption of resources	0.18**
	Reduce energy consumption	0.61***
	Use Renewable energy	0.20***
	Account for biodiversity	0.24***
Recovery Processes	Recycle waste	0.14
	Recycle water	-0.05
	Reuse materials/resources/products	0.28
	Use recyclable/ed materials	0.51
Manufacturing and Operations Practices	Make product LCA	0.88
	Use alternative modes of transportation (fuel)	0.21
	Certify to ISO 14001 standard	0.31