

Making sense of SSCM: How companies express sustainable supply chain management issues in their public reports.

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Abstract

This working paper examines recent sustainability reports published by corporations listed on the London Stock Exchange. Changes in UK legislation mean reporting of carbon emissions is now mandatory for these companies. This provides an opportunity to analyze the relative carbon associated with different sectors, and the significance of internal action, covered by sustainable operations management, and external action covered by sustainable supply chain management. The paper also considers how companies in particular sectors are publicly responding to wider questions of sustainable development. Content analysis and discourse analysis are conducted, and findings are discussed in relation to macro-scale sustainable development objectives.

Keywords: sustainability, supply chain management, operations, corporate reporting

Introduction: how does mandatory reporting relate to SSCM?

This working paper explores the extent to which corporations are addressing global sustainability challenges. The boundary of analysis is the top 100 corporations listed on the London Stock Exchange, known as the FTSE100. Although prior research has examined this and other stock exchanges in respect of voluntary disclosure (Okereke, 2007; Sullivan & Gouldson, 2012) from the April 2013 reporting period all companies listed on this exchange now have mandatory disclosure. Montabon, Sroufe, and Narasimhan (2007) use content analysis of corporate reports for operations management research into environmental practices. However, this paper does not fully address the significance of a whole supply chain in achieving sustainable development objectives.

Sustainability impacts in the supply chain have a high degree of significance. Companies may understandably be quick to celebrate their successes in reducing their

operational carbon footprint. But unless all the suppliers to these organizations ensure their operations also become 'zero-carbon', they are stuck in a fundamentally carbon intensive value-chain. Similarly, companies can readily reduce their organization's environmental footprint by outsourcing processes, moving them from their internal operations to their external supply chain. Even the environmental footprint of real estate can be readily removed from an organization's books via sale and lease back arrangements. A similar process can also be seen at the national, macro-economic scale, where countries, such as the UK, have exported manufacturing jobs to places like China who then export to the West.

The implementation of mandatory carbon reporting into the London Stock Exchange does not require a specific reporting methodology, but the GHG Protocol (Kolk, Levy, & Pinkse, 2008) has become the standard. This categorizes emissions as follows:

- Scope 1 emissions are direct emissions from an organization's internal operations such as industrial processes, a vehicle fleet or on-site gas boilers or generators;
- Scope 2 emissions are those related to off-site electricity production, namely from a national grid. These are also easy to define, as electricity generation is largely a centralised and regulated industry with carbon intensity conversion factors defined by government.
- Scope 3 emissions are those related to an organization's supply chain.

With Scope 3 emissions, reporting standards are less straightforward (Kolk et al., 2008). Although the engineering concept of embodied energy is long established as a design tool, and is extended to embodied carbon as an aspect of Life Cycle Impact Analysis, there is no consistent and coherent definition of how far in a supply chain this environmental impact should be calculated (Lenzen, 2008). As a result, how companies report Scope 3 emissions, or whether they do at all, is an important issue, given the potential for outsourcing emissions. Nonetheless, various standardised methods are emerging in the practice of carbon accounting, such as ISO 14064, ISO 16001, PAS 2050 and PAS 2060, the Carbon Trust Standard and CEMARS.

Examining the influence of embodied carbon at the national scale The Carbon Trust has also investigated economic modeling tools such as Multi-Regional Input-Output analysis and Environmentally Extended Bilateral Trade datasets (Wiedmann et al., 2010). However, between the scale of individual firm performance and national-scale balance of trade modeling of carbon, no basic aggregation of the carbon footprint of different economic sectors has been found.

Carbon tunnel vision vs. wider sustainable development issues

Of course, carbon emissions alone are not the sole indicator of sustainability performance. Hassini, Surti, and Searcy (2012) provide a wide survey of environmental metrics used in supply chain management. Meanwhile, Hutchins and Sutherland (2008) review metrics for social sustainability that can be used in life cycle analysis. For example, a product cannot legitimately brand itself as ethical if human rights abuses are inherent in the production of a key supplier. Child labour in textile production, being just one of many examples. Although carbon might be considered the 'first among equals' of sustainability issues, there are a wide range of relevant concerns that may or may not lie within the overall concept of sustainable development.

As shown by Kolk et al. (2008), corporate sustainability reporting demonstrates an apparent transfer of values from social movements. Such transfer is deserving of detailed critique and re-examination. Detailed analysis of FTSE100 corporate reports may thus reveal some of the underlying paradigms of environmental change and social intervention. Critical examination of inherent assumptions in this transfer in relation to corporate strategy, environmental science and human development can then be conducted. This paper therefore addresses the following research questions:

- What are the relative carbon footprints of key economic sectors in the FTSE100?
- How are broader concepts of sustainability and social responsibility expressed by FTSE 100 companies?

Theoretical background

At a fundamental level, corporate reporting is a reflection of performance measurement mandated by accountancy rules. The addition of corporate responsibility and sustainability reports has grown in recent years to become the norm for most large corporations. In the fields of sustainable operations management and sustainable supply chain management this involves an auditing of various metrics. The effectiveness of these is subject to rich debate (Hassini et al., 2012), not least the connection to corporate strategy.

Strategy is arguably a synonym of economic sustainability, dating from Porter (1985). A method for alignment between this and social and environmental sustainability is developed by Porter and Kramer (2006) introducing the concept of the Creation of Shared Value. However, Pagell and Shevchenko (2014) note that such an approach fails to respond to environmental and social impacts that are viewed as non-synergistic with economic performance. Whiteman, Walker, and Perego (2012) show despite increasingly mainstream presence of corporate sustainability, there is apparently little or no progress in actually addressing critical environmental impacts. Similar conclusions are drawn in Plambeck (2012), who states that tighter regulation will be necessary to achieve required environmental targets.

In addressing corporate reports, one aspect is the prevalence of the concept of 'the triple bottom line' promoted by the popular business book Elkington (1999), despite strong criticism of its foundations (Littig & Griessler, 2005; Robinson, 2012). Creating Shared Value deepens the concept in terms of individual firm strategy. By contrast, more robust environmental science studying industrial impacts shown by Rockström et al. (2009) and social priorities such as the United Nations Millennium Development Goals (Leach, Raworth, & Rockström, 2013) provide state of the art on environmental and social sustainability. What is needed is to study the potential for combining these approaches.

Fearne, Garcia Martinez, and Dent (2012) consider three dimensions of analysis for effective corporate sustainability initiatives based on value-chain analysis and Creating Shared Value. The first dimension suggested by Fearne et al. is an expanding boundary of analysis, from dyad to ultimate supply chain (Mentzer et al., 2001), to (non-customer) stakeholders. The second dimension is the nature of value maximisation considered, from cost and waste reduction, to increasing customer or consumer value, to shared value. The third dimension concerns the nature of governance, from relationships not being considered, to channel power, to collaboration.

This provides a theoretical model linking strategy to environmental and social outcomes. Each dimension of this model can be considered relative to the corpus of text provided by

the corporate reports in the FTSE100. For instance, some firms may discuss high levels of supply chain visibility, explicitly mention shared value, or discuss collaboration programmes being conducted in order to meet social and environmental goals. This would represent evidence of the third stage in each dimension. Management sense-making (Angus-Leppan, Metcalf, & Benn, 2010; Daft & Weick, 1984) provides a theoretical lens for corporate and managerial cognition of sustainability. Whiteman's critique is that management research into corporate sustainability has focussed on the needs of the company above the needs of society, and sense-making offers a means to see the extent to which this difference is evidenced by companies in their corporate reporting.

Methodology

Saldaña (2012) provides a comprehensive overview of coding methodologies for qualitative research, including content analysis and discourse analysis. Following this, a first level coding protocol of In Vivo (verbatim) content analysis is conducted. Key words relating to sustainability, social responsibility and supply chain are recorded. This paper covers only a pilot phase of this research but follows a three-stage structure.

In the first stage, provisional coding establishes the word 'Scope' in relation to mandatory carbon reporting, as in Scope 1, 2, 3 of the GHG Protocol. This can determine the extent of carbon footprint reported by each company, including their approach to Scope 3 supply chain emissions. Figures are measured in tonnes of carbon dioxide equivalent (CO₂e).

The second stage of the research looks at the In Vivo use of the terms "sustainability / sustainable" (entered as "sustainab*") and "responsibility / responsible" (entered as "responsib*"), to see what other terms beyond carbon are reported. Sustainability and corporate responsibility are assumed to be sufficiently related to be included together. Here, interpretation of the context is required, conducted via second cycle discourse analysis including 'elaborative coding' (Saldaña, 2012).

The third stage of the research considers a selection of reports from a range of sectors using the Planetary Boundaries model (Rockström et al., 2009) and the combination of these with human development indicators (Leach et al., 2013). Specific terms relating to nine environmental thresholds and eleven social priorities are considered at the individual firm and sector level using 'pattern coding' (Saldaña, 2012).

The sample for analysis includes the sustainability and corporate responsibility reports of the FTSE100 corporations. However, some corporations include sustainability information within their annual reports while others separately publish detailed data sets of their corporate responsibility metrics. The FTSE100 index is the 100 largest firms on the London Stock Exchange. As this is a working paper, the second and third stages of the research have not been concluded with all 100 firms, so a preliminary selection of around 30 reports from different sectors have been examined to date.

Findings

Descriptive data

The FTSE100 is a list of the top 100 companies on the London Stock Exchange as measured by the size of their market capitalisation. A total of 43 different sectors are categorised. This is a wide variety, meaning that although there are some sectors with a relatively large representation within the set, notably extractive industries (mining, oil &

gas) and finance, there are also a large number of sectors with only 1 or 2 companies represented (for example, there are only 2 tobacco companies and only 2 chemicals companies). This may reflect the nature of companies seeking stock market listing as a way to quickly raise revenue, in particular mining companies. It is also possible to lump together various sectors into similar categories, such as mining, oil & gas and energy, or financial services, banking and insurance. Companies can be easily aggregated by their value creating activities; those that dig things out of the ground, those that grow things, those that own factories that make things, those that use knowledge and information, etc.

Scope 1 emissions concern greenhouse gases released from assets owned by the company. They are taken to be fully within the organizations' control. Substitution of these with low carbon alternatives is a matter for the internal operations strategy of the organization. Sources covered by this category include industrial processes, in-house vehicle fleets and gas boilers for space heating. Some organizations may even have their own electricity generating facilities. Scope 2 emissions refer to those related to the production of electricity purchased by an organization from a utility company. Hence, Scope 2 emissions can be reduced by efficiency gains and purchasing from a low carbon electricity provider (e.g. a renewables-only or nuclear-only tariff).

Scope 2 emissions are therefore the Scope 1 emissions of the related energy provider. However, in the UK, only two energy utilities out of the 6+ operating in the country are listed on the London Stock Exchange (German and French companies operate much of the rest). Furthermore, the London Stock Exchange is not a list that reflects the composition of the UK economy. Many firms that are now forced to disclose their greenhouse gas emissions, especially in the extractive sector, are referring to emissions occurring in other countries. The list is also illustrative of individual companies that may have grown very large. Other sectors with potentially significant footprints but greater numbers of smaller companies in their sector will not be reflected here. The list does however provide a means to explore how the ownership of firms and the degree of out-sourcing present in their value-chain is reflected in their carbon footprints.

On this point, it is worth noting that this data is assembled from the corporate reports referring to the 2012 financial year, in reports published in 2013. Mandatory reporting came into effect from 2013, so will feature in reports published in 2014. Only three firms were found not to have disclosed emissions data. Two of these firms are now no longer listed on the FTSE100, both of whom were mining and energy companies operating in emerging markets such as Russia and Kazakhstan (Evraz and Polymetals International). The third firm is Melrose plc, an investor in mining and heavy industry. A further 4 companies in mining and oil & gas had fallen out of the FTSE 100 by January 2014, and two companies (Glencore International and Xtrata) had merged. A further 3 companies (Serco, Croda and Intu) also fell out of the FTSE 100. Once data from the mandatory 2013 period has been published, this research will be refreshed. However, the disclosure across different sectors reveals two important things. The first is the relative carbon footprints of key economic sectors. The second is the extent to which the carbon footprint is accounted for as being within the organization or outside of it.

Carbon analysis of the FTSE100

The first analysis of the dataset considers the distribution of Scope 1 emissions. Excluding the 3 non-disclosing companies the top 10 companies by emissions generate three times

more greenhouse gases than the remaining 87 disclosing companies, as accounted for by their internal emissions. See Table 1. The distribution of Scope 1 emissions by (aggregated) sector are shown in Table 2.

Category	Sectors	Scope 1 tonnes of CO ₂ e
Top 10 FTSE 100 companies by Scope 1 emissions	Oil & gas, mining, energy utilities, airlines.	329,807,154
Remaining 87% of firms on the FTSE 100	Various sectors also including services, manufacturing and agricultural products.	100,219,353

Table 1. Relative carbon footprints of the top 10 firms in the FTSE 100 by Scope 1.

Extending the analysis beyond the top 10 firms to consider the top 25 firms, we find that they collectively produce 419,430,811 tonnes of CO₂e. The remaining 72 firms have a combined carbon footprint of just 10,595,696. Sectors in the top 25 (beyond those listed in Table 1) include a construction products company (CRH plc), food and beverages companies (Tate & Lyle, Associated British Foods and SAB Miller), FMCG and pharmaceuticals (Unilever and GlaxoSmithKlein), a supermarket (Tesco), a supplier of generators to the mining industry (Aggreko plc) and two holiday firms, one in cruise liners (Carnival plc) and one with a fleet of planes (TUI). These additional firms consume large volumes of energy in manufacturing, electricity generation and transport.

The disclosed information does include Scope 2 emissions, and here there is some investigation possible regarding the relative size in comparison to Scope 1, and reasons for this. The supermarket Tesco, for instance, has Scope 2 emissions around 3 times higher than Scope 1, likely due to the relative energy demand of its retail stores (especially including refrigeration) in comparison to its vehicle fleet. Telecoms company Vodafone has Scope 2 emissions around 4 times higher than Scope 1, likely due to the electricity demand of its telephony and data networks in addition to that of its retail outlets. All companies listed declared active programmes to reduce their Scope 1 and 2 emissions, with various successes of reducing waste and transforming their processes outlined in their annual reports.

Reporting on Scope 3 emissions was more mixed however. The majority of firms make no mention of it. Many that do include Scope 3 emissions categorise it as the carbon emissions linked to transportation of their goods to customers, which for the mining sector is a substantial amount. Next, are various companies recording business travel and third party logistics as Scope 3 emissions. A small number of companies state that they are investigating the best way to include Scope 3 emissions, and one stand out example is the pharmaceutical firm GlaxoSmithKlein, dominant in medical inhalers, such as for asthma, and examining the downstream impact of the use of a greenhouse gas as a propellant.

Summary conclusions from the first phase of analysis are that a few companies have large, direct greenhouse gas emissions and these are in the extractive and energy industries. In their defence, these industries enable the operation of all other activities in the economy. A detailed value-chain analysis of environmental impact (Fearne et al., 2012) applied to downstream companies would include the energy associated with the extraction of the raw materials and energy used to create and distribute their products or services.

Sector	Scope 1 t CO2e	no. of firms
Mining	170,459,964	13
Oil and gas	140,312,709	6
Energy and water utilities	39,969,805	5
Airlines	23,230,095	1
holiday travel (Cruise liners and charter flights)	16,989,623	2
Manufacturing, chemicals and engineering services	14,192,545	22
Generator hire	12,639,771	1
Food, beverages, tobacco and fashion	6,661,460	8
Retail (incl. supermarkets and building trade)	3,514,907	8
Media, telecoms and publishing	715,064	7
Outsourcing management and security services	528,023	3
Hotels	447,000	1
Banking, financial services and property development	365,541	23

Table 2. Scope 1 emissions by sector (aggregated)

A specific example worth noting is the work of Aggreko who provide the generators for mining companies. As they generally work in remote places, they need portable energy systems to run their mining operations and these are invariably diesel generators. However, Aggreko, the Tier 1 suppliers to the mining companies, are actively working with engine manufacturers (Tier 2 suppliers) to develop more energy efficient diesel generators. These are making significant gains in reducing the carbon footprint of operations. Meanwhile, even lower carbon alternative energy systems, such as hydrogen fuel cells are being explored, and also dismissed as not being commercially deployable in this sector.

This is a clear example of supply chain co-ordination in order to address an issue such as carbon reduction. All parties in the chain benefit from cost reduction and the engine manufacturers benefit from new product development. Similar examples are likely to be found in other sectors over the coming few years. Even the fleet of cruise ships owned by Carnival plc may be upgraded over time with more efficient or even alternative fuel engines, significantly lowering their carbon footprint.

Analysis of wider sustainability issues in corporate reports

This stage of the research is still on-going but some preliminary comments can be made. All companies make a solid response to calls for corporate responsibility and sustainability reporting. Many have adopted standards such as the Global Reporting Initiative, Carbon Disclosure Project, United Nations Global Compact, and ISO14001.

The nature of particular sectors offers a number of avenues for further analysis, in particular the use of institutional theory (Lawrence, Suddaby, & Leca, 2011) may be particularly relevant. Consumer-facing sectors seem highly responsive to ethical and environmental issues, notably food companies such as Compass plc and Marks and Spencer plc.

However, the total impact of these sectors in terms of carbon emissions is insignificant in comparison to the giants of the extractive industry. In textiles and agricultural supply chains social impacts may be more significant issues. Interestingly, the mining companies seem particularly advanced in their work on social sustainability. Anglo-American for instance is a significant contributor to combating HIV, in part because it is prevalent amongst its workforce. Not only is a licence to operate among remote communities needed, but these companies need to be engaged over the long term to build the work-force needed, including education programmes and healthcare. Another leader is GlaxoSmithKlein, whose corporate responsibility programmes include major contributions to the eradication of diseases such as polio and malaria. Overall, it is clear that declarations of 'doing the right thing' and 'protecting the environment' are extremely common. The third stage of the research aims to consider these statements in the context of macro-scale goals such as are defined by (Leach et al., 2013), and which may emerge in more depth as the replacement to the Millennium Development Goals is established around 2015. The overall influence any given firm has within global markets prompts examination of both their wider supply networks and that of their competitors. Both vertical and horizontal co-ordination is a key area in bringing about collaboration to address some of these challenges.

Discussion

This research has sought to examine corporate sustainability in the wake of mandatory disclosure rules. A number of areas for future investigation have emerged so far.

Sustainable Operations Management vs Sustainable Supply Chain Management

Once completed, the research aims to shed some light on the carbon reduction activities that are internal and external to FTSE100 firms. The Scope 1 and 2 emissions of firms are primarily within the remit of their internal operations, and so addressing these is a matter for sustainable operations management. Addressing Scope 3 and other sustainability considerations in a supply chain requires a means for considering upstream and downstream contexts, which will include the internal operations of other firms. Yet some firms that have low internal sustainability impacts in their operations will have comparatively large impacts associated with their wider supply chains. Banking and finance firms for instance may have high degrees of influence over the resulting upstream energy footprints of many businesses as well as their own.

Manufacturers of food, beverages and textiles may see their upstream impacts increase from Tier 1 to 2 to 3, as the chain moves more towards primary agricultural inputs and possible change in land use or land management practices, uses of fertiliser, water, etc. Social impacts downstream are also clear in sectors such as tobacco and processed food, and the already substantial environmental footprint displayed for oil and gas companies still does not include the pollution created by the downstream consumption of their product in vehicles. Fearne et al. (2012) point to value-chain analysis as a means to start to address these impacts. A key area for future research is accounting for the social and environmental impacts of 'hollowed out firms'. These are those that have outsourced all their manufacturing, while keeping the most profitable elements of the value-chain internally (Buckley & Ghauri, 2004). American computer firm Apple for instance, keeps the highest value-generating stages of product design, advertising and customer relations in house while outsourcing all of the lower value stages in between.

Organization level vs. national level disclosure

Another issue emerging from the preliminary findings is the level of analysis for environmental footprints. Under the requirements of the UN Kyoto Protocol, countries need to disclose carbon emissions at the national level. However, it is worth noting that the FTSE100 does not provide a sample of the economic (and thereby environmental) output of the UK economy. The top 100 firms listed on the London Stock Exchange includes many whose main operations are in other countries, not least companies in raw material extraction. Internal Scope 1 and 2 emissions may be accounted for but technically take place in other Kyoto signatory countries. Meanwhile, certain economic sectors such as automotive are not included. UK-based manufacturing is under ownership of firms listed on other exchanges (e.g. BMW in Oxford and Nissan in Sunderland are owned by companies listed on German and Japanese exchanges respectively).

In part, what is relevant is that in a now globalised industrial system, national boundaries represent just one form of typology for studying impact. Nations are of course the level at which sovereign government operates, and the United Nations is a forum for dialogue between these sovereign governments. However, industry is now largely trans-sovereign and multi-national, and so exploring the ways in which corporate emissions, both internal and external, are now being reported involves exploring the ways in which environmental footprints are accounted for at the level of the value chain rather than nations. A major world stock market index such as the FTSE100 therefore provides a valid sample from which to explore the implementation of sustainable supply chain management.

Limitations and implications of this research

The key limitation of this research is that it includes companies listed on the UK stock market only. In terms of key sectors such as energy (coal, oil and gas) this represents only around a third of global investment - the New York and Moscow stock exchanges represent similar volumes, with Chinese, Brazilian and Canadian markets adding a smaller percentage (Carbontracker, 2011) However, the London exchange is still a globally significant market and similar studies in future can investigate the degree of disclosure of sustainability impacts by other firms.

What the first phase of this research helps reveal is the relative importance of different sectors. Firms that have a high public profile on environmental issues (Marks and Spencer, Ikea, Nike, etc.) actually have relatively insignificant environmental impacts. Meanwhile, preliminary findings from the second stage suggest that sustainability impacts other than carbon have less clear-cut metrics and a different regulatory context.

This paper has produced the first analysis of the mandatory disclosure of the carbon data in the FTSE100 from the perspective of sustainable operations management and supply chain management. It is also the first to extend the analysis of corporate reports, since this legal change, into the wider areas of sustainable and responsible business. The data presented here will be of value to anyone concerned with the scholarly and practical issues of carbon reduction and wider sustainable development goals.

Acknowledgements

This research has been produced thanks to a fellowship funded by the UK Economic and Social Research Council, the British Academy of Management and the Society for the

Advancement of Management Science.

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