

## Accounting for Carbon and Reframing Disclosure: A Business Model Approach

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### Abstract

This paper contributes to the research in accounting and the debate about the nature of carbon footprint reporting for society. This paper utilises numbers and narratives to explore changes in carbon footprint using UK national carbon emissions data for the period 1990 to 2009, six years (2006-2011) of carbon emissions data for the FTSE 100 group of companies and a case study that focuses on the UK mixed grocery sector. Our argument is that existing approaches to framing carbon disclosure generate malleable, inconsistent and irreconcilable numbers and narratives. In this paper we argue for an alternative framing of carbon disclosure informed by a reporting entities business model. Specifically, we suggest, that a reporting entity disclose its carbon-material stakeholder relations. This alternative, we argue, would increase the visibility of carbon generating stakeholder relations and avoid some of the difficulties and arbitrariness associated with framing carbon disclosure around a reporting entity boundary where judgements have to be made about responsibility and operational control.

Keywords: Carbon footprint, Business Model, Carbon Disclosure, Sustainability Accounting.

## Accounting for Carbon and Reframing Disclosure: A Business Model Approach

### 1. Introduction

This paper is split into three sections. The first section considers the critical accounting literature on environmental sustainability and carbon footprint accounting. This literature is concerned with, on the one hand, accounting and its relation to modernity and the extent to which progress, as constructed in natural science and the social sciences, is fundamentally incommensurate with ideas of environmental sustainability and a reduction in carbon emissions from household and business activities in society. In addition it is a literature that also engages with the struggle to quantify a reporting entities corporate carbon footprint when a number of competing actors are setting the framing agenda. In addition, there is the difficulty of defining a reporting entity boundary because judgements have to be made about ownership, control and responsibilities. In these circumstances it is often the case that the numbers and narratives that arise are: malleable, lack consistency and cannot be reconciled from one level (firm) to another level (national economy). A third strand of the critical accounting literature is concerned with the way in which the aggregate corporate carbon footprint presents a material challenge to environmental sustainability. That is, the sheer scale and significance of carbon usage by humans and its implications for our environment should be reflected in accounting numbers so as to inform and identify appropriate interventions. Therefore, regardless of the challenges and difficulties arising accounting has the potential to generate challenging numbers and narratives that provide a platform upon which to structure managerial incentives, modify corporate behaviour and inform regulatory interventions. In this paper we argue that accounting has a positive role to play in identifying material carbon generating stakeholder relationships. Where these carbon-material stakeholder interactions might be best captured in the prism of a business model framework of analysis grounded in accounting.

The second section of this paper engages with the issue of carbon footprint reporting and measurement at a macro, meso and micro-level of analysis to explore the malleability, contradiction and the irreconcilable nature of carbon disclosures. Using a middle ground framework we consider how macro numbers and associated narratives on carbon emissions for the UK economy can be deconstructed to reveal aggregate emission trajectories and contradictory forces. At the meso level we review the changing pattern of carbon footprint disclosures across the FTSE 100 and note that only 62 companies disclose carbon footprint consistently over a six-year period (2006-2011). Our analysis of this group of reporting companies reveals that over this five year period the aggregate carbon footprint has not changed. Moreover, that the corporate data disclosed (Scope 1 and 2) does not reconcile with national aggregates. At the micro level we employ data for firms involved in the UK grocery sector and reveal the malleability and contradictions associated with measuring carbon footprint.

The final section of this paper presents an alternative business model conceptual frame within which to locate carbon footprint disclosures. In recent years the accounting bodies such as Institute of Chartered Accountants in England and Wales (ICAEW, 2010) and European Financial Reporting Advisory Group (EFRAG, 2012) have been concerned with how a business model framework might enhance corporate financial disclosures and risk assessment. In this paper we argue that a business model can be conceptualised as an information genotype that broadly describes the operating activity characteristics of reporting entities because they share similar stakeholder relationships. The information generated out of interactions with various stakeholders variably impacts upon the financial and physical characteristics of reporting entities within their respective business model. Our objective is to employ this loose business models conceptual framework to argue the case for the disclosure of material carbon generating stakeholder interactions. Such disclosures, we argue, increase the field of the visible and can be employed to generate alternative numbers and narratives that inform interventions and policy framing. We are motivated by Hopwood's (2009) call to move away from abstract schemes to explore how alternative systems of disclosure might inform understanding and insight even though they may not be completely 'adequate'

'The research traditions now established in the area of the organizational and social analysis of accounting provide a good basis for looking beyond abstract schemes for change and improvement to explore the actuality of their functioning and operations, and to use this knowledge for the more realistic design of approaches to changing both the significance which environmental and sustainability considerations play in the corporate sphere and our ways of gaining insights into the adequacy or otherwise of these'. (Hopwood, 2009, p.439)

And challenged by Gray's (2010) suggestion that the key is to re-habilitate experiments around what sustainability accounting might look like and how numbers can be utilised to construct critical narratives about organisation commitment to a less carbon intensive future.

'The key, it seems, will therefore be to re-habilitate the experiments considered in 'What does accounting for sustainability look like?' as potential sources of counter narratives, as part of a multiple and plural expression of sustainability in organisations'. (Gray, 2010, p.59)

#### 1. Carbon footprint: framing and measurement

Think-tanks including the World Resources Institute (WRI), World Business Council for Sustainable Development (WBCSD) and International Organization for Standardization (ISO), have established rules and tools for measuring and reporting carbon emissions: their Greenhouse Gas Protocol and ISO 14064 becoming the *de facto* standards of corporate carbon footprint reporting, as recommended by government environmental departments (United Kingdom Department for Environment, Food and Rural Affairs, 2009; Australian Government Department of Climate Change and Energy Efficiency, 2010). In recent years accounting has also entered the contested field of carbon footprint measurement and reporting. While the natural and social sciences, economics and politics compete for academic control over this calculative space, environmental accounting research has also made its specific contribution (Matthews, 1997).

A significant amount of critical treatment is directed towards the ability – or otherwise – of accounting to faithfully represent the physical impact from reporting entities emissions on the environment. The packaging of greenhouse gases into proxies of carbon dioxide emissions via commensuration (Bowen and Wittneben, 2011) is a developing science and

national and international protocols tend to lag behind advances in measurement (Lohmann, 2009, MacKenzie, 2009). While acknowledging these criticisms, non-scientists encounter difficulty when trying to evaluate the impact of a physical quantity of emissions expressed in tonnes or other units of measurement. For these users of accounting information, temporal gains in accounting accuracy may offer limited utility. Even for those with appropriate expertise, the connection between organisational carbon footprint and planetary stability may be impossible to reconcile (Lamberton, 2005, Hopwood, 2009, Gray, 2010). An alternative approach suggests that, unlike the natural sciences, accounting is socially constructed (Hines, 1988) offering 'a way of telling a carbon performance story and such stories do not necessarily correspond with emissions reductions' (Bowen and Wittneben, 2011, p.1032).

In staking its claim for influence over corporate carbon footprint reporting, accounting is legitimised as the agent of 'accountability': a non-neutral attribute, unafraid to take sides (Tinker *et al*, 1991); to be interpreted according to a vision of society 'as it is and, to varying degrees, as it can and should be' (Gray, 1989, p.53, in Lehman, 1995). Legitimacy rests on the responsibility to act 'in the public interest recogniz[ing] the critical inter-relationship among the natural, social and economic systems' (Dillard, 2007, p.48, in Unerman *et al*, 2007). It requires the acceptance by society that organisations are perceived as legitimate by a wide range of stakeholders (Deegan and Unerman, 2006), which in turn necessitates some form of dialogue through which stakeholders may engage with, and influence corporate environmental policy (Cooper and Owen, 2007). Where accountability requires organisations to reduce carbon footprint, firms may be encouraged to innovate; finding new ways to cut emissions and associated waste; and to design environmentally-friendly products that appeal to consumers (Porter and Van der Linde, 1995). Thus accounting, through accountability and measurement, becomes a conduit towards competitive advantage in a Porterian sense (Porter, 1985, Dillard *et al*, 2005) but also reconciled with sustainability.

As we move into a world where accounting attempts to measure carbon emissions, a more radical accounting critique contemplates the world we are in. This literature takes the position that economic development is antagonistic to environmental sustainability, put

simply as the world's consumption pattern (measured as GDP) continues to grow this also generates and inflates our carbon footprint. Thus there are calls for the abandonment of modernity, 'paving the way for a reorganisation of society along more humane and ecologically sensitive parameters' (Spence, 2009, p.207). Some authors articulating a vision of the future that demands economic growth align with a broader public good, which directs us towards a world not driven by carbon consumption (Nair, 2011). This involves 'reshap[ing] capitalism and its relationship to society' and a recalibration of markets to respond to social as well as economic drivers (Porter and Kramer, 2011, p.64). At the practical level, accounting has 'the potential to privilege economic considerations, natural considerations or both': where it embraces multiple stakeholder engagement, accounting 'has the potential to retard the momentum of the currently irresponsible and exploitative trajectory' (Dillard *et al*, 2005). In a world that tries to meet the challenge of carbon footprint reduction, the notion of progress is redefined along less carbon-intensive lines. By adopting an inclusive framework, which engages with broad stakeholders around the internalisation of environmental costs, accounting becomes instrumental in creating a new reality for a post-carbon age (Hines, 1988; Dillard *et al*, 2005).

In common with the early contributors to the debate, we agree that an opportunity exists for a calculative sphere for corporate carbon footprint, which is grounded in accounting. However, attempts to achieve this have come up against problems associated with 'framing'; where the setting of organisational and reporting entity operating boundaries have been to some extent arbitrary, and also an exercise in standardisation. The practical manifestation of framing is represented by the allocation of operational boundaries into three 'scopes'. The first two scopes comprise direct emissions (scope 1) from combustion-based activities, and indirect emissions (scope 2) from purchased services as electricity, district heating etc. Scope 3 or other indirect emissions - described by the Greenhouse Gas Protocol as an optional category - are embedded in purchased supplies (World Resources Institute and World Business Council for Sustainable Development, 2001). Thus the challenge facing organisations is that of allocating their carbon footprint into the scope 1, 2 and 3 baskets. A specific example serves to illustrate the malleability associated with this classification and accounting process. It is possible for reporting entities to modify the structure of their balance sheets, for example, selling on assets and leasing these back. In

the UK, Kingfisher (a retail group) has undertaken sale and leaseback deals of its BandQ branded retail warehouses. These financially motivated manoeuvres can also impact upon the location of carbon within scope 1, 2 and 3, that is, within or outside of a reporting entities boundary.

Emissions from leased facilities and vehicles (leased assets) may be classified as Scope 1, Scope 2, or Scope 3, depending on the source of emissions, which approach a company uses to establish its organizational boundary, and which type of leasing arrangement is in place. Leased assets that fall within a company's organizational boundary should be classified as Scope 1 or 2 (depending on whether they are direct emissions or indirect emissions from electricity), while those that do not fall within a company's organizational boundary should be classified as Scope 3.

<http://www.ghgprotocol.org/calculation-tools/faq/#manufactured>

Thus the framing of carbon footprint reporting as being within or outside of the reporting entities boundary is both complex and malleable. And as Lohmann observes every attempt to bring something 'inside' creates new 'outsides' resulting in porous, malleable and unstable boundaries because the spaces of calculation and non-calculation cannot be walled off in rigid, mutually-exclusive spheres (Lohmann, 2009, p.502). By standardising boundaries for diverse organisations, in an attempt to provide a 'one-size-fits-all' reporting methodology, the goal of widespread adoption enshrined in the Greenhouse Gas Protocol appears to have triumphed over a more diagnostic approach; gifting firms the appearance of legitimacy. Not only do the current operational boundaries provide firms with licence to exclude certain emissions, but the current practice results in firms reporting congealed carbon footprint numbers from which it is impossible to tease out meaningful interpretive critical narratives. The result is a myopic form of reporting: attention is focused on operational scopes – the lowest unit of analysis – while the constituent elements congealed in these scopes remain blurred and out of sight. Measurement is also inextricably intertwined with the scientific conversion of greenhouse gases into carbon equivalents where the natural scientific conversion factors are also not stable and are subject to modifications and adjustments. Consider the case of Tesco PLC a UK food retailer which reports its carbon footprint.

As in previous years, we have updated the GHG conversion factors we use to reflect the most recent UK Government guidance. We have also recalculated our emissions from previous years on the same basis so that performance from one year-to-year can be assessed on a like-for-like basis.



Tesco plc (2012)

[http://www.tescopl.com/assets/files/cms/Resources/Our\\_carbon\\_footprint\\_08052013.pdf](http://www.tescopl.com/assets/files/cms/Resources/Our_carbon_footprint_08052013.pdf)

Moreover, Tesco employs a complex set of criteria to partition carbon footprint measurements in order to create a reporting boundary for scope 1 carbon emissions (see figure 1).

Insert Figure 1 about here

This process of partitioning boundaries between the reporting entity/organisation and the 'other' is itself malleable and can affect carbon footprint measurements because the partition all depends upon whether Tesco deems it is in its operational or financial control. Moreover, operational and financial control are used interchangeably and blended with issues about ownership, physical and contractual relations where a significant degree of managerial discretion and judgement are possible.

We have followed an 'operational control approach' to help us determine when to include emissions within our direct carbon footprint-reporting emissions from operations where we have full authority to introduce and implement operating policies. In the case of distribution we have gone beyond this operational control approach, including emissions from distribution provided by third party contractors, where this has been arranged by Tesco.

Tesco plc (2012) <http://www.tescopl.com/index.asp?pageid=107>

Thus carbon footprint measurements are generated out of scientific conversions and discretionary decisions about what is and what is not within the direct 'operational' and 'financial' control of the reporting entity. This is made additionally complex when the reporting entity is itself changing form as corporate acquisitions, divestments and outsourcing are taking place. For example, Tesco's sale of its Japanese operations accounted for 6 percent of its overall carbon footprint and without this knowledge about this divestment the numbers alone would be misleading. Tesco also tends to produce a carbon intensity index where carbon usage is set against sales revenue or benchmarked against the physical retail area of its stores (carbon emissions per square foot). Whilst carbon intensity per square foot of retail space is falling in recent years the overall carbon footprint, in tonnes, is on an upwards trajectory (see the mixed retail case later in this paper).

Ascui and Lovell (2011) finally observe that carbon measurement is contested and malleable because it is a reporting landscape that is subject to the collision of a range of framing agents.

We have shown that carbon accounting is contested, meaning many different things to different people. Drawing on social science theories of framing, we believe that carbon accounting can best be understood as a set of ongoing discursive acts, each setting boundaries, defining terms and claiming ownership of the issue, leading to what we have characterised as a jumbled landscape created by the collision between five major frames of reference: physical, political, market-enabling, financial and social/environmental modes of carbon accounting.

Ascui and Lovell (2011, p.991)

In the next section of this paper we consider the various levels of aggregation at which carbon footprints can be measured and disclosed: macro, meso and micro. Our macro data is extracted from the UK national data reported by the Office for National Statistics (ONS), meso analysis from the FTSE62 that is the sixty-two companies listed in the UK FTSE100 constituent list for which we have six years of consecutive carbon footprint data (2006-2011) and at a micro-level focal firms that constitute the UK grocery sector. The purpose of this analysis is to reveal the difficulty in reconciling levels of analysis and malleability of the numbers and narratives that can be constructed at each level of analysis.

## 2. Carbon footprint: Levels of analysis and malleability

To date, no attempt has been made in the accounting literature to expose the extent of contradiction between carbon footprint numbers reported at micro, meso and macro levels; the analysis of tensions being confined to organisational fields (Ascui and Lovell, 2011; Bowen and Wittneben, 2011) and case-study evaluations directed at a single firm and its national economy (Milne and Grubnic, 2011). We present an analysis of carbon footprint accounting across three levels, using United Kingdom data. At national level, a macro analysis describes the total greenhouse gas emissions of the UK economy, with data provided by the Office for National Statistics Environmental Accounts. As a proxy for the corporate sector, which is responsible for a significant share of national greenhouse gas emissions, we have selected the FTSE 100 index of leading companies, measured by market

capitalisation. The choice of the FTSE 100 as a national corporate sector proxy is influenced by the scale of its economic footprint and the tendency of its constituents to disclose environmental data. Finally, we consider the UK grocery retail sector and its constituent firms to explore contradictory issues surrounding carbon footprint measurement and performance.

At each level, carbon footprint is estimated rather than measured; emissions are derived by multiplying activity statistics by emissions factors, and weighting the answer by reference to a Global Warming Potential (GWP). This process commensurates individual greenhouse gases into tonnes of carbon dioxide equivalents (CO<sub>2</sub>e), with the intention of providing a 'unifying' measure of carbon footprint. Over time, often annually, methodologies, conversion factors and GWP undergo revision, and national economies and reporting firms typically restate reported emissions of prior years alongside current performance. Moreover, the Kyoto Protocol has adopted the position that signatories must report emissions at point of issue, rather than consumption; and emissions from aviation and shipping are excluded from national inventories under the Protocol. These controversial decisions have led to disagreement over the truthfulness of national greenhouse accounting (Helm *et al*, 2007). Moreover, the use of carbon footprint data from the FTSE 100 group is problematic due to the changing character of constituents, through the acquisition and disposal of assets; and the 'revolving door' of firms entering and exiting the index. Over the period covered (2006 – 2011), only 66 of the opening 100 FTSE 100 constituents retained their positions within the index, with the remaining positions progressively taken by new entrants (FTSE Client Services, 2012a).

At firm level, the anomaly of consumption versus point of issue has been accommodated by the designation of scope 3 emissions, which we have argued presents a standardised often malleable computation. Voluntary carbon footprint reporting has given rise to diverse presentation of corporate carbon footprint data in annual reports. Complete datasets are not available even for the FTSE 100 population of firms over an extended period and whilst we find that 86 FTSE 100 constituents have disclosed carbon footprint at least once during 2006 – 2010, only 62 have consistently reported five years of continuous data. Thus the measurement of carbon footprint and stabilising the accounting space are especially difficult

when measurement methodologies change, scopes adjust and calculative boundaries are malleable and firms not under an obligation to report.

### 3.1 Macro UK carbon footprint

The UK national carbon footprint comprises the emissions of six greenhouse gases; namely carbon dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), Nitrous Oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>). In the United Kingdom, the Climate Change Act 2008 enshrines the country's Kyoto obligations into law; committing the United Kingdom to a reduction in greenhouse emissions of 80% against 1990 levels by 2050, and a 34% reduction by 2020 (Great Britain Parliament, 2008). Accordingly, national greenhouse emissions data presents a moving series which may be overlaid against the profile of industry and corporate sector carbon footprints. Not only does this permit the assessment of corporate commitment to national climate change policy but highlights anomalies and contradictions between different levels of reporting.

Figure 2 presents the United Kingdom's total greenhouse gas emissions during 1990 – 2009, and the proportion attributable to business sectors. It reveals that business sectors account for a steady 77% of greenhouse gas emissions, according to figures prepared by the Office for National Statistics, making corporate business a significant force in climate change strategy.

Insert Figure 2 about here

Between 1990 and 2008, business sectors reduced greenhouse gas emissions by 19 percent but just 4 percent of this reduction took place in the period 1999 – 2008. During this same period carbon dioxide consolidates its position as the dominant corporate greenhouse gas emission increasing as a proportion of the mix over the period (figure 3).

Insert figure 3 about here

This is because methane (CH<sub>4</sub>) which is converted into a CO<sub>2</sub> equivalent has reduced because of the extensive closure of deep mined coal since 1990 coupled also with a switch away from landfill for composting domestic food waste. While nitrous oxide reductions relate to a process of deindustrialisation within the United Kingdom (Helm *et al*, 2007). Earlier reductions in carbon dioxide emissions are attributed to the 'dash for gas'; as power firms substituted almost 50% of coal used in electricity generation for cleaner gas between 1990 and 2000 (DEFRA, 2006 in Helm *et al*, 2007). These phenomena are effectively one offs and cannot be expected to yield similar emission reductions in future years, implying that achievement of the United Kingdom's climate change obligations will increasingly depend on continuous and steady corporate sector carbon dioxide (CO<sub>2</sub>) reductions. We now turn to consider the data on CO<sub>2</sub> emissions at a meso and micro level of analysis of business entities.

### 3.2 Meso: FTSE 100 carbon footprint

Moving from the macro analysis of national carbon footprint to a meso-level of analysis we now focus on the UK FTSE 100 group of leading companies. These firms represent a significant component of the national corporate sector, accounting for approximately £1.4 trillion of aggregate stock market capitalisation (see figure 4) over the period 2006-2011.

Insert figure 4 about here

In this article our carbon footprint analysis is based on a sample of 62 firms from the FTSE 100 group, where five years of consecutive carbon data (2006-2011) have been publicly disclosed. Two firms (Anglo American and Royal Dutch Shell) have been excluded from the sample due to the combination of their size and emissions volatilities which distort

underlying interpretations. Another firm (Standard Chartered) has been excluded owing to methodological inconsistency over the five year period. Finally, the 2006 emissions data of two other firms (TUI Travel and Rio Tinto) have been adjusted to take account of substantial business combinations. Table 1 presents our estimation of the data from TIU Travel and reveals the difficulty of ‘pinning’ down specific reporting entity carbon footprints when there are inconsistencies from one annual corporate social responsibility report to the next.

Insert Table 1 about here

Carbon footprint data has been compiled for each firm listed in the FTSE 100 (as at end year 2011), where emissions have been disclosed in corporate annual reports, social responsibility reports and company websites. Table 1 reveals how discrepancies and inconsistencies arise where the same year’s data is reported but adjusted in successive company reports. Often these differences are explained by improvements in methodology, updated conversion factors or in the case of TUI Travel, emissions rose sharply in 2007 due to the merger of TUI AG with First Choice Holidays plc. Accordingly, we have adjusted the 2006 data by 8 million tonnes CO<sub>2</sub>e to reflect TUI Travel in its post-merger configuration and the shaded cells are the data we have used in our analysis. Thus the collection of consistent carbon emissions data for the FTSE 62 group is not an easy task and our aggregate data comes with a considerable health warning<sup>1</sup>

Using the aggregate data we have compiled for the FTSE62 group we find that that they emitted 463 million tonnes CO<sub>2</sub>e in 2011; up 1.4% from the 457 million tonnes emitted in 2006. It should be noted that these aggregate carbon emissions cannot be reconciled to the national carbon data because they are computed using different methodologies. Table 2 compares the aggregate carbon footprint with the market capitalisation for our FTSE62 group of firms. For the period under review, table 2 reveals that one tonne CO<sub>2</sub>e is generating approximately £3,000 of market value for shareholders.

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<sup>1</sup> The FTSE 62 carbon footprint is found from surveying all company announcements: annual reports, corporate social responsibility documents and all other media published by each firm to enable cross checks and maintain as much disclosure consistency as is possible.

Insert table 2 about here

Although many FTSE firms generally disclose that they are committed to reducing their carbon footprint our analysis reveals that the FTSE62 group of firms have not managed to significantly reduce their CO<sub>2</sub>e emissions over the period 2006-2011. We now turn to consider the UK food retail sector carbon emissions.

### 3.3 UK Mixed retail sector carbon footprint

In this section we have selected major firms that constitute the UK food and grocery retail sector. In the UK this is dominated by five major supermarket groups: Tesco, J. Sainsbury, Asda, Wm. Morrison Supermarkets and Marks and Spencer Group. All but Asda, which is owned by Walmart, are constituents of the FTSE 100 index. UK mixed retailers have embraced a strategy of aggressive expansion of selling space in recent years; with store surface area increasing by approximately 50% over the period 2006 -2011 (Table 3). The majority of this increase has been driven by the expansion of Tesco, with some growth also in J. Sainsbury and Wm. Morrison.

Insert table 3 about here

Table 3 reveals that even within the food and general retail sector, there are significant differences in the carbon footprint per unit of retail space. Wm Morrison's carbon footprint at a 105 kg's CO<sub>2</sub>e per square foot is approximately twice the level of Tesco and J. Sainsbury. Moreover while Wm. Morrison is not currently showing signs of reducing its carbon footprint, J. Sainsbury and Tesco have reduced their emissions per square foot by 15% and 23% respectively. Comparative data is not available for Marks and Spencer (for whom we do not have floor areas). However the practice of reporting carbon emissions intensity per square foot of retail space is misleading because it conceals what is happening to the overall carbon footprint.

Figure 5 illustrates Tesco's reported carbon emissions per square foot for the period 2006 to 2011 and reveals that this key ratio is falling from roughly 53 to 40 kilogrammes of carbon emissions per square foot. However, Tesco's retail store space is expanding at a faster rate than the fall in carbon used per square foot and so overall carbon usage increases from 4.3 to 5.3 million tonnes during the period. Table 4 converts carbon emissions per square foot into total carbon emissions for major firms in the UK food and general retail sector. This data reveals that Wm. Morrison's total carbon footprint remains relatively stable, J. Sainsbury's emissions are up 18 per cent and Tesco emissions increase by 25 per cent (Tesco accounting for 78 per cent of the sector increase).

Insert figure 5 about here

Insert Table 4 about here

At a national level the UK data on carbon emissions suggests that there are reasons to be optimistic about reducing carbon usage. However, in deconstructing the reported data we find that structural adjustments in the economy: closure of coal mines, adjustments to landfill policy for waste composting and deindustrialisation provide one off explanations for the reduction rather than continuous reduction trajectories. Because step-wise reductions are not repeatable this might suggest structural limits governing the extent to which the UK can continue to reduce carbon emissions. Carbon emissions reported by the FTSE62 group of firms have remained flat in recent years. At industry level UK food retailers are, on average increasing their carbon footprint and one firm, Tesco accounts for the majority of the increase.

A macro, meso and micro level of analysis of the UK's carbon emissions reveals problems associated with framing disclosure when reporting entity boundaries can change and judgements made about what is within and outside of the firms operational control. Not only are the carbon disclosures malleable they do not reconcile, that is they are not additive



at different levels of aggregation: firms, industry and national economy. In the final section of this article we suggest that an alternative framing of carbon disclosure is possible one that locates carbon footprint disclosure within a business model framework of analysis. Our objective is to employ a loosely conceptualised business model framework to increase the visibility of material carbon-stakeholder interactions. A business model framework of analysis will, we argue, generate complementary forms of measurement, incentives and regulatory interventions that are variably designed to slow and/or reduce the trajectory of carbon emissions.

### 3. Business Models: Reframing carbon disclosure and intervention

In this final section of the paper we argue the case for constructing a loose business models conceptual framework for carbon footprint accounting. This alternative framework builds on previous academic contributions and sets out to overcome some of the challenges surrounding the need to establish 'boundaries' within which to account for carbon. The focus of carbon reporting is, as we have observed, with establishing boundaries between the reporting entity/firm and the 'other' so as to construct scope 1, 2 and 3 levels of carbon disclosures. The boundary between the firm and the 'other' is as we have already argued malleable and capable of manipulation. The alternative, we suggest, is to break away from firms and industries and locate reporting entities within a loose business model conceptual framework. In this final section of the article we argue that a business model approach generates a useful and complementary framework of analysis because it changes the field of the visible. Our argument is that within a business model conceptual framework corporate carbon footprint is revealed as the product of carbon material stakeholder interactions. Given the variety of business models the nature of what constitutes carbon material stakeholder interactions will vary from one business model to another and this, in turn, could inform policy making, incentives and regulatory interventions.

The literature on business models is itself fragmented, and there is not a complete agreement upon what exactly constitutes a business model (Zott et al, 2010). This may be due to the fact that there are a variety of industry, firm and functional specifications. This

lack of precision about what constitutes a 'business model' framework is identified by Zott et al who observe that:

Despite the overall surge in the literature on business models, scholars do not agree on what a business model is. We observe that researchers frequently adopt idiosyncratic definitions that fit the purposes of their studies, but are difficult to reconcile with each other. As a result cumulative progress is hampered (Zott et al, 2010, p.2)

The ICAEW report 'Business Models in Accounting' (2010) argues that business models are relevant to financial reporting and measurement, but does not offer a general business model conceptual framework.

ICAEW first explicitly addressed the question of business models in accounting in its thought leadership work in the Financial Services Faculty's 2008 publication *Measurement in Financial Services*. This argued that business models are relevant to measurement. It seems to be impossible in fact to devise a sensible approach to financial reporting measurement that does not reflect firms' business models. (ICAEW, 2010, p. 12)

In this section our purpose is to describe a loose business model framework of analysis that is conceptually organised around broad organising elements: *structure, purpose* and *evaluation* (see Haslam et al 2012). That is a business model, we argue, needs to have a structure, be guided by a broad sense of purpose and grounded in accounting where numbers and narratives provide a resource for critical evaluation and reflection. With regards to structuring a business model Osterwalder et al (2005) observe that existing definitions fall into three broad generic approaches according to level of application and abstraction. Thus a business model can be viewed as:

- i) an overarching conceptual framework for describing all real world businesses at the most abstract level
- ii) a classification scheme for describing different types of generic business models with common business characteristics, such as the banking, pharma, e-business and no-frills air-travel business models
- iii) specific operational business models in the real world, such as the Dell or Amazon business models

Haslam et al (2012) argue that a business model can be constituted out of focal firm/reporting entity interactions with its stakeholders in the econ-sphere (see also Freeman, 1994) and that reporting entities/firms can be located within a specific business model because they share similar material stakeholder interactions and regulatory influences, for example commercial and investment banking, mixed food retail, private equity and Big-pharma. In a review of the literature on business models Fiel (quoting Timmers, 1998) that business models are:

An architecture for the product, service and information flows, including a description of the various business actors and their roles; and a description of the potential benefits for the various business actors; and a description of the sources of revenues. This definition has also influenced the definition of Weill and Vitale (2001) and is also very similar the definition of Mahadevan (2000). These conceptualizations see the business model as an architecture and address the business network with a focus on the different roles of the actors.

(Fiel, 2011, p.19)

Business models are thus structured by variable interactions between focal firm's/ reporting entities and their respective stakeholders in an econo-sphere where the information generated by these stakeholder relations congeals into and modifies a reporting entities financial and physical numbers (Haslam et al, 2012). Distinct from structuring business models the literature also stresses the importance of strategic purpose. Chesbrough (2006) observes that a business model performs two important functions that of value creation and value capture.

First, it defines a series of activities that will yield a new product or service in such a way that there is net value created throughout the various activities.

(In Fiel, 2011, p.12)

A point also reinforced by Zott et al (2010) in their review of the business models literature which observes:

A fourth insight that emerges from our review of the literature is that business model scholars have shifted emphasis from value capture to value creation highlighting the latter without ignoring the former. Indeed, the business model promotes a dual focus on value creation and value capture. (Zott et al, 2010, p.25)

Thus a business model can be attributed with both a structure and a purpose. The purpose of a business model is generally that of delivering financial returns on investment above the cost of capital for investors but this could be modified or augmented by society to include a

physical dimension that of reporting and disclosing a focal firm/reporting entities carbon footprint within its business model. A final strand to the literature on business models emphasises the importance of evaluation and how numbers and narratives can be used to critically evaluate progress and outcomes (Froud et al, 2006). Magretta (2002) refers to 'tying narrative to numbers' and states that there are two tests for a business model: the narrative test ('does the story doesn't make sense') and the numbers test (does the profit and loss add up).

Instead of viewing stakeholders as normative constituents of the firm (Freeman, 1994), it is possible to twist the stakeholder/firm relationship so that stakeholders are viewed as active partners in a carbon generating matrix. From this perspective the reporting entity is engaged in a series of carbon-generating stakeholder relations some of which are more 'carbon-material' than others. The nature of these carbon-intensive stakeholder relationships will vary according to the characteristics that structure a business model and within which reporting entities are subtended. Rather than try to establish reporting boundaries that try to partition what is inside and what is outside the reporting entities control and influence and responsibility (Bowen and Wittneben, 2011). We suggest that the reporting entity (within its business model) is a counterparty involved in a chain of carbon generating activities. Our use of the term of 'material' contrasts with that outlined in the Conceptual Framework for Financial Reporting (2010), where materiality has become subsumed within an entity-specific aspect of relevance (IFRS Foundation, 2010, AC34). Our argument is that it is necessary to reinstate the centrality of materiality and demand that reporting entities identify and disclose carbon-material stakeholder interactions. This, we argue, would complement disclosures that employ arbitrary decisions to set operational boundaries, for example when estimating scope 1, 2 and 3 carbon emissions. Our suggestion is to place the responsibility firmly on reporting entities to disclose carbon-material stakeholder interactions.

The significance of our approach is that it 'captures' a focal firm's carbon footprint within its business model and structure disclosures as arising out of carbon-material stakeholder interactions. A reporting threshold could be set, for example, at disclosing the top five carbon-material stakeholder interactions. These could be with specific suppliers of

materials, external service providers, energy suppliers, distribution services, data warehousing, transport and leasing arrangements. Carbon material stakeholder interactions carbon could be 'inside' or 'outside' of a reporting entities boundary in terms of ownership and operational control. In table 5 we illustrate with a hypothetical reporting entity where the material-carbon stakeholder interactions totalled 90 tonnes CO<sub>2</sub>e in 2006 and now 81 tonnes in 2012.

Insert table 5 about here

A reporting entity, within its business model, would be required to disclose its carbon reducing policies with its carbon material stakeholders in terms of: trajectories, trade off's and factors that are promoting or frustrating a reduction in carbon emissions. In circumstances where carbon reduction is less tractable, within a specific business model, this would help to inform regulatory policy interventions and structure incentives to modify behaviour. Depending upon the nature of the focal firm/reporting entity business model there would thus be varying 'dialogues' between stakeholders towards adjusting carbon for all our futures.

#### 4. Summary

In June 2012 the United Kingdom Department for Food and Rural Affairs released the delayed result of a consultation on mandatory corporate greenhouse gas reporting. Subsequent to this report it is now intended that firms listed on the UK stock exchange will be expected to disclose their carbon footprint(s) and this prompted a positive response from the Carbon Trust.

Mandatory carbon reporting for companies listed on the London Stock Exchange from April 2013 will encourage even more businesses to reap the benefits of accurately understanding their carbon emissions. Measurement helps businesses to gain insight to help them take the right strategic decisions to ensure long term success. (Carbon Trust, 2012)

In this article we have identified 62 out of the FTSE 100 firms disclosing information on their carbon footprint over a five-year period (2006-2010). Mandatory disclosures will at least help our quest to track more firms listed in the FTSE 100 and judge their progress. However,

the evidence we have so far suggests that reducing carbon footprint is a struggle up a hill called difficulty. And that we can confirm Gray's (2010) pessimistic observation that 'sustainability', as an objective, rarely coincides with corporate and organisational boundaries.

In this paper we have outlined an alternative argument for locating corporate carbon footprint disclosure within a loose business model conceptual framework that is grounded in accounting. Our objective is to set reporting entities the task of identifying and disclosing their five most significant carbon-material stakeholder relationships. It is, of course possible that all we are doing is generating new forms of narratives about socially constructed numbers that offer a way of telling a carbon performance story and such stories do not necessarily correspond with emissions reductions (Bowen and Wittneben, 2011:1032). However, our argument for locating carbon footprint in a loose business models conceptual framework is that this changes the field of the visible and stakeholder dialogues. The nature of a focal firm's carbon-material stakeholder interactions will vary depending upon the activity characteristics of a specific business model. Thus a loose business models conceptual framework offers the possibility of generating alternative critical narratives and numbers that would promote: ongoing dialogues, inform intervention, and generate incentives and policy framing towards carbon reduction (Ghemawat and del Sol, 1998, Grey, 2010). There is always the possibility that the reporting entity disclosing its carbon-material stakeholder relations may not be able to deliver reductions in carbon emissions because of factors beyond a reporting entities control. In these circumstances strong government, coupled with regulatory intervention informed by carbon material disclosures could be directed towards unblocking limiting factors. In the meantime, and in the absence of strong government, socially and environmentally minded accountants can start to experiment and, as Hopwood (2009) suggests, explore different ways of framing carbon disclosure for a sustainable future.

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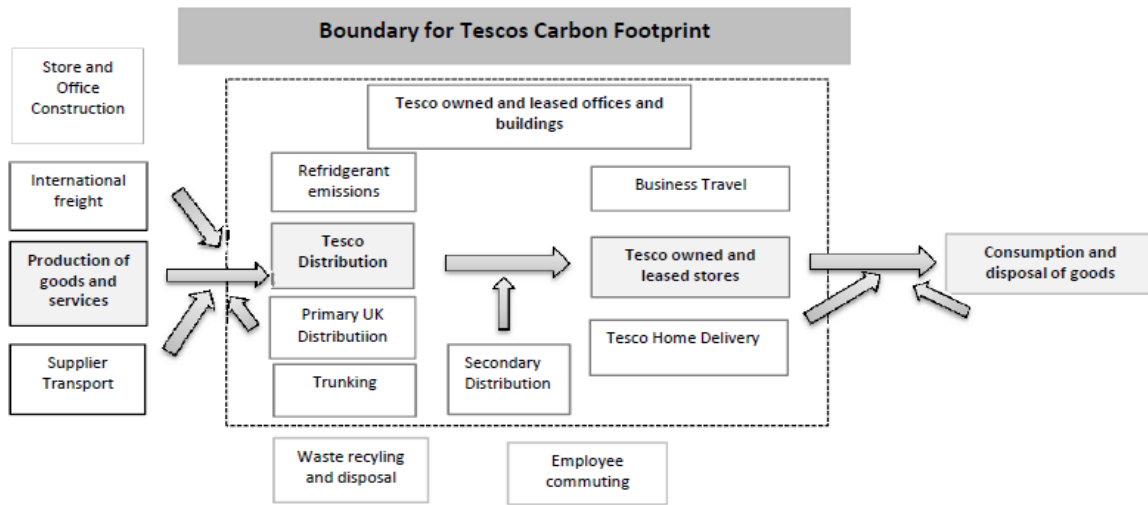
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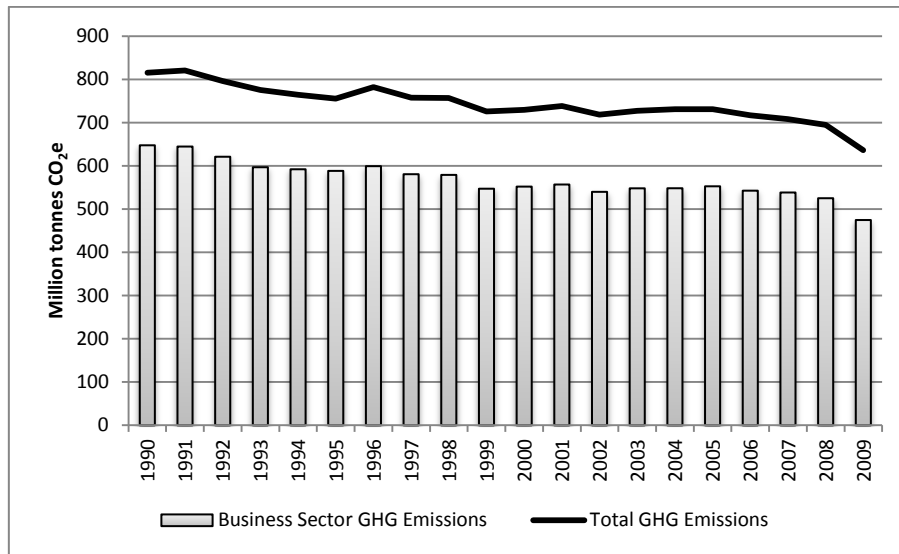
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Figure1: Tesco carbon footprint boundary



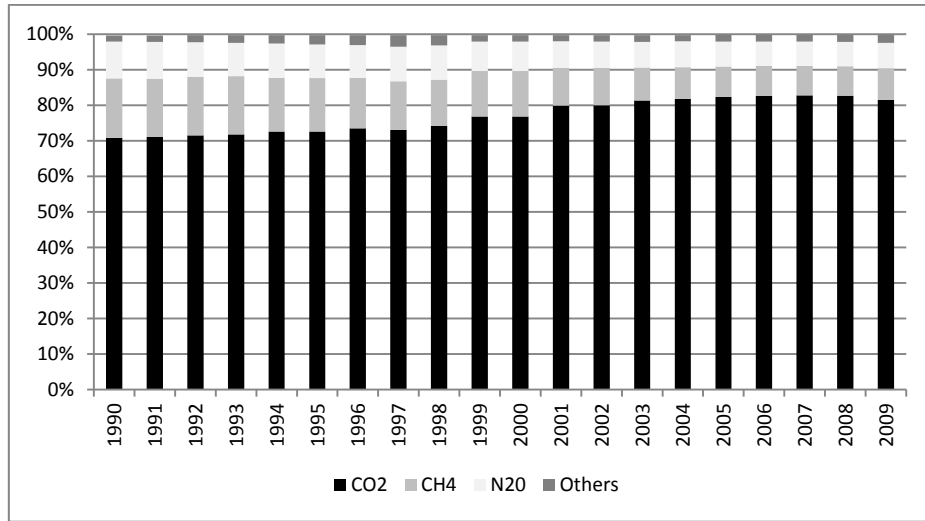
Tesco plc (2012) <http://www.tesco.com/climatechange/carbonFootprint.asp>

Figure 2: UK Greenhouse Gas Emissions 1990-2009 (million tonnes)



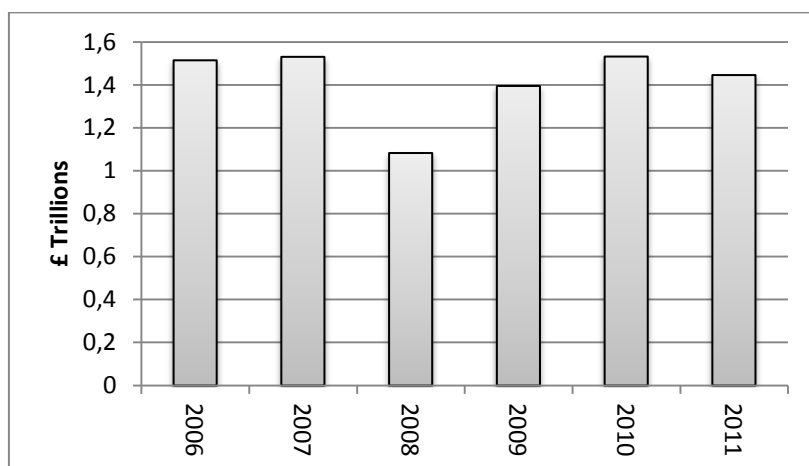
Source: United Kingdom Office for National Statistics (2011)

Figure 3: Composition of UK Corporate GHG Emissions in CO2e (%): 1990 - 2009



Source: United Kingdom Office for National Statistics (2011)

Figure 4: FTSE 100 Market Capitalisation



Source: FTSE Client Services (2012b)

Table 1: Estimation of TUI Travel Carbon Footprint (tonnes CO<sub>2</sub>e)

	2011	2010	2009	2008	2007	2006
CR Report 2006						1,272,800
CR Report 2007					16,439,949	8,465,463
CR Report 2009			6,402,202	6,617,501	7,268,835	
CR Report 2010		6,100,123	6,402,202	6,617,501	7,268,835	
Adjustment						8,000,000
CR Report 2011	6,428,164	6,100,123	6,402,202	6,617,501		
<b>TUI Travel Carbon Footprint</b>	6,428,164	6,100,123	6,402,202	6,617,501	16,439,949	9,272,800

Source: TUI Travel Corporate Responsibility Reports 2006 – 2010

Table 2: FTSE 62 Group of Firms: Market Capitalisation per tonne CO<sub>2</sub>e

	Carbon Footprint (million tonnes)	Market Capitalisation (£ million)	Market Capitalisation (£ per tonne CO <sub>2</sub> e)
2006	457.10	1,266,609	2,771
2007	456.05	1,344,241	2,948
2008	442.55	962,994	2,176
2009	430.20	1,268,194	2,948
2010	447.38	1,393,567	3,115
2011	463.57	1,283,041	2,768
Change/ Average	1.41%	1.30%	2,788

Source: London Stock Exchange datasets 2006-2010 and corporate annual reports, social responsibility reports, corporate websites

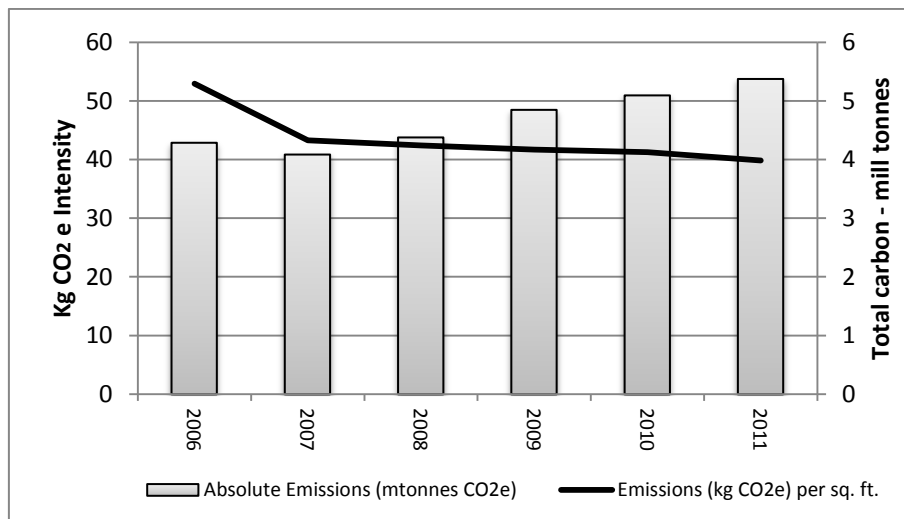


Table 3: UK Food and General Retail Carbon Emissions per Square-Foot of Retail Space

<b>Store Square Footage (thousand sq. feet)</b>	<b>2011</b>	<b>2010</b>	<b>2009</b>	<b>2008</b>	<b>2007</b>	<b>2006</b>
Wm. Morrison Supermarkets	12,261	11,867	11,131	10,837	10,505	10,633
J Sainsbury	19,108	17,750	16,703	16,161	15,715	15,166
Tesco	103,600	93,985	88,451	76,338	68,189	55,215
<b>Total Square Footage (thousand sq. feet)</b>	<b>134,969</b>	<b>123,602</b>	<b>116,285</b>	<b>103,336</b>	<b>94,409</b>	<b>81,014</b>
<b>Carbon Footprint (kg's of CO<sub>2</sub>e) per Sq. Foot</b>						
Wm Morrison Supermarkets	105.0	112.3	102.1	107.3	108.3	120.7
J. Sainsbury	44.8	40.1	43.3	43.3	41.9	47.9
Tesco	39.8	41.2	41.7	42.4	43.3	52.9
<b>Carbon Footprint (kg's of CO<sub>2</sub>e) per Sq. Foot</b>	<b>60.5</b>	<b>63.0</b>	<b>63.8</b>	<b>65.0</b>	<b>67.8</b>	<b>82.7</b>

Source: Company annual reports, social responsibility reports and corporate websites

Figure 5: Tesco plc Carbon Footprint (mill tonnes CO2e) and Carbon Intensity (square foot of retail space) 2006-2011



Source: Company annual reports, social responsibility reports and corporate websites

Table 4: UK Food and General Retail Sector – Absolute Carbon Emissions (tonnes CO<sub>2</sub>e)

<b>Company</b>	<b>2011</b>	<b>2006</b>	<b>Change 2006 to 2011 %</b>
Marks and Spencer Group	641,000	404,000	58
WM Morrison Supermarkets	1,287,259	1,283,050	neg
J Sainsbury	856,000	726,398	18
Tesco	5,377,984	4,289,670	25
<b>Total Emissions (tonnes CO<sub>2</sub>e)</b>	<b>8,162,243</b>	<b>6,703,118</b>	<b>22</b>

Source: Company annual reports, social responsibility reports and corporate websites

Table 5: Hypothetical reporting entity carbon material stakeholder relations (tonnes CO<sub>2</sub>e)

	Total	Electricity	Material Suppliers	Data warehousing	Car Fleet Leasing	Travel (Air)
2006	90	40	30	15	5	4
2007	86	38	29	12	7	6
2008	85	37	28	12	8	5
2009	84	37	27	12	8	5
2010	84	37	27	12	8	5
2011	82	36	26	12	8	5
2012	81	36	24	12	9	6

Source: Authors