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**The use and usefulness of PAS 2050 carbon footprinting and
labelling in the UK food supply chain**

By Zaina Gadema

Doctoral Thesis

Submitted for the Partial Fulfilment of the Requirements for the Degree of

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زينا ساول ليللا شامس ماريم

Dedication

For my children:

Leyla
Saul
Shemiss
Mariam

You are each wonderful and unique. I love you dearly.

To my mum, Carole Kelly (formerly Ayesha Gadema).
You are a true inspiration. Your love for us all, unconditional and boundless.
Heartfelt thanks forever.

To John Thompson, my amazingly steadfast, loving and wonderful Step Father.
I love you with all my heart.

My brothers:
Mohamed Gadema and Ali Gadema
My sister in-law: Amanda Gadema (formerly Williams)

In Memory Of

Angela Best, my beautiful friend and Auntie to my children. An inspirational mother and young grandmother from Manchester, settled in Tottenham, London. Your big smile, happy persona, kindness and determination to overcome adversity in times of hardship were nothing short of amazing. I miss you terribly. Taken from your beautiful family too soon. Brutally murdered, aged 51 on 15th December 2016 in Tottenham, London.

My little sister Karima Gadema. I will never forget your little self with the huge smile. You were so beautiful and grateful for any small thing. Your excitement and thrilled shrieks of joy at the hatching of tiny chicks remain etched in my mind. The loss of you so suddenly is simply too tragic to put into words. I look to the sky searching for bright stars every night and think of you. Died age 5, Libya/Tunis border region, August, 2012.

My dearest cousin, Ilias Gadema from Tripoli, Libya. The gentlest of boys, most gracious and loving of men and dear to us all. Taken too early, tortured and murdered by Gadaffi loyalists. Died age, 27, disappeared in Sirte, found and identified in Tripoli, November, 2011.

Mabruka, my dear friend and confidant. You helped me in my hour of need despite the dangers you faced in doing so at the height of the Gadaffi Regime. I will never and have never forgotten. May you rest in peace. Died age 42, June 2012, Tripoli, Libya.

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Declaration

This thesis was submitted to the Newcastle Business School at Northumbria University for the partial fulfilment of the requirements for the degree of doctor of philosophy.

This doctoral work was undertaken at the Newcastle Business School with Professor Fraser McLeay as the main supervisor and with Nigel Coates as a co-supervisor.

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others.

Any ethical clearance for the research presented in this thesis has been approved. Approval has been sought and granted by the Faculty Ethics Committee.

I declare that the Word Count of this Thesis is 84,216 words.

Name: Zaina Gadema

Abstract

Accelerated climate change due to enhanced global warming, challenges sustainability efforts including those in the food industry. Since the introduction of the World's first voluntary carbon footprinting standard in 2008, known as PAS 2050, there are significant gaps in the understanding of its uptake.

This thesis examines the role of carbon footprint labelling of food products in helping to deal with the environmental problem of climate change. The research looks to the limitation of life cycle analysis/assessment, together with the imprecision of the assumed scientific base for action in the context of the food supply chain. It draws upon a series of theoretical lenses, particularly nudge economics, that underlie behavioural change in market economies as well as the parallel contexts of public health. The theoretical contribution of this thesis is that it demonstrates no single lens can fully capture the complexity of behavioural change for the environment.

A case study approach was adopted to elucidate the drivers and barriers for uptake and use at the supply and demand elements of the UK food chain. Interrogation of the supply side was undertaken via detailed qualitative interviews, held at three key stages of the supply chain covering production, distribution and retail. While there was some evidence that those closer to production had higher environmental values, the power of the retail sector, particularly through pricing and quality control, dictated conditions of production. Such power worked against environmental considerations in the food industry.

On the demand side, a consumer questionnaire survey of 428 respondents with some open-ended interrogation indicates that while consumers show willing to change consumption patterns to address environmental issues, they are confused by the current range of information that is available. Price and quality remain the dominant factors rather than broader environmental and social concerns.

The results of this thesis suggest that the drive for carbon footprint labelling is towards omni-labelling, although voluntary measures do not provide a guarantee of good environmental performance. Consumers think about environmental issues but not a willingness to pay because environmental concerns are not embedded in the social psyche. The complexity of carbon equivalents cannot be captured in a single label, not least because of multiple processes and producers in the supply chain as voluntary carbon footprint standards and labels will not necessarily shape business motivations for ecological responsiveness.

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Abbreviations

BRC	British Retail Consortium
BSI	British Standards Institution
CCA	The Climate Change Act: 2008
CF	Carbon Footprint
CSR	Corporate Social Responsibility
COP	Conference of the Parties
DEFRA	Department for the Environment and Rural Affairs
EEA	European Environment Agency
EMAS	Eco-Management and Audit Scheme
EMS	Environmental Management System
EU	European Union
FCRN	Food Climate Research Network
FSA	Food Standards Agency
GHG	Greenhouse Gas Emissions
HSR	Australian Health Star Rating system
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
LCA	Life Cycle Assessment/Analysis
METI	Japanese Ministry of Economy, Trade and Industry
MTL	Multiple Traffic Light labelling
NGO	Non Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
ONS	Office of National Statistics
PAS 2050	Publicly Available Specification, 2050
PCF	Product Carbon Footprint
PCR	Product Category Rules
SASA	Social Accountability in Sustainable Agriculture
SCM	Supply Chain Management
SCP	Sustainable Coffee Partnership
SKU	Stock Keeping Unit
TBL	Triple Bottom Line
UK	United Kingdom
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDESA	United Nations Department of Economic and Social Affairs
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
WBCSD	World Business Council for Sustainable Development
WCED	World Commission on Environment and Development
WRI	World Resources Institute
WTO	World Trade Organization

Chapter 1 – Introduction

1.1 Background and Context

Since the introduction of the world's first carbon footprinting standard behind carbon labels in 2008 in the UK, the role of such carbon footprint labels in reducing climate change impact has gauged much attention and debate in the scholarly research (Freidberg, 2015). However, there is a need for further research on the role that the carbon footprint labelling of food products can play in helping to deal with the environmental problem of climate change (Liu et al., 2016). To have an impact, any carbon labelling regime would have to alter the current behaviour of food consumers and the food industry. Consumers and industry are part of a multi interest food community, which includes government and civic society organisations. There would need to be a multi-stakeholder partnership to address the multi-faceted issue of climate change. To function as a lever for behavioural change, consumers would have to respond to a carbon footprint labelling regime and businesses adopt such a label using life cycle calculations standardised for businesses and their supply chains. A collective response may impact carbon equivalent emissions and therefore make a contribution to dealing with the problem of climate change. In this sense, effectiveness would mean a carbon labelling regime would stimulate a change in behaviour amongst food industry actors and consumers would alter their behaviour in terms of food shopping. Efficiency would mean the carbon labelling would be undertaken at the minimum cost (Shewmake et al., 2015). A key focus of this research study is a further exploration of the issues raised above.

Over the last decade there has been a sustained and continued interest in and recognition of carbon footprinting in a bid to address the numerous adverse impacts of climate change. Publication of the Stern Report in 2006 and the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) in 2007 formed salient temporal markers in firstly highlighting the urgent need to mitigate and adapt to climate change and secondly, the equally urgent need for economic and political investment to do so. In Newcastle, February 2017, Stern reflected on the impact of his own report in the wider context of climate change action and noted that progress had been slow (Stern, 2017). Stern asserted the longer inaction occurs, the higher the price of adaptation and mitigation to climate change in the future.

It seems to be the accepted 'science' that enhanced global warming is the single largest planetary problem (Maibach et al., 2014; Brenton et al., 2009 and Carvalho, 2007). This problem of climate change is usually expressed as being a carbon problem although it is really a carbon equivalent problem (Wiedmann and Minx, 2007). Agricultural production, not least because of methane one of the carbon equivalents, significantly enhances the risks particularly as food production will be aimed at providing food for some 9.3 billion people by 2050 and 10.1 billion by 2100 (UN, 2011).

According to a UK government report (Foresight, 2011), that specifically looks to the future of food and farming, the food industry is required to directly address the carbon challenge in times of climate

change. Within this report, it is claimed it can do so from both a supply and demand angle, where 'demand' is seen as a static component of the food chain. To date, a commonly and widely adopted mechanism to measure and manage environmental impact within the food industry is the well established regime of voluntary environmental management systems overseen by the global International Organization for Standardization (ISO). The two mechanisms are ISO 14000 and 14001 upstream (Beske et al., 2014; Potoski and Prakash, 2013; Marimon et al., 2012; Arimura et al., 2011; and Jiang et al., 2003) and, where consumer change is pushed by carbon footprint labelling, downstream. According to Marimon et al. (2012), the very creation of the nationally and internationally applicable but voluntary ISO 14000 and 14001 series was the consequence of a formal request at a forum of the 1992 United Nations (UN) Rio Conference on Environment and Development that requested ISO to create an Environmental Management System (EMS) standard.

Vogler (2013) strongly suggests that while climate change is probably "*the paradigm case of a multi-sectoral issue, affecting the broadest swathe of EU policies...*" p. 629, institutionally, it was defined as an environmental question. The phenomenon of climate change has nevertheless fundamentally galvanised a universal acceptance that decarbonisation is vital despite the discursive nature of the climate change debate itself. As Okereke et al. (2012) observe, climate change is such a diverse and urgent twenty first century issue, it has been framed as an environmental threat (Gore, 2006), a market failure (Stern, 2006), as a moral dilemma (Hulme, 2009) and a socio-political challenge (Giddens, 2009).

In the UK, the introduction of the UK Climate Change Act (CCA) in 2008 precedes contemporaneous climate change policy agreements. The CCA (2008) places a legal commitment upon the UK Government to reduce 80% of its greenhouse gases (GHGs) by 2050 based on 1990 as the baseline reference date (Defra, 2008a). The CCA (2008) remains a central plank of government policy and demonstrates UK commitment to European standards and to the UNFCCC obligations codified in the Paris Climate Change Agreement and adopted by consensus on 12th December 2015 (UNFCCC, 2016). The relevance of the CCA (2008) continues to interest the business community given the mandatory requirement to decarbonise the UK.

Lillywhite and Collier (2009) and Liu et al. (2016) show the UK has led on the development of standards for carbon footprinting and labelling, notably as multi-stakeholder initiatives, principally supported by the UK Government and led by industry. Indeed, the Carbon Trust, a civic society organisation and NGO, first introduced carbon labels for food products in 2006 and published the practice based standard for carbon footprinting (a publicly available specification – PAS) known as PAS 2050. It is a voluntary standard with national and international applicability (Liu et al., 2016). The next series of paragraphs outline the conditions and rationale underlying PAS 2050 development and publication. These sections are largely and necessarily descriptive but essential in providing the context of carbon footprinting standards and the carbon labelling of food products.

1.2 Standardisation Process for Carbon Footprinting: PAS 2050

The PAS 2050 carbon footprint standard was first published on 29th October 2008 and later updated in 2011 (DEFRA, 2012a). PAS is a publicly available specification (PAS) and 2050 is the target date for carbon (equivalent) emissions reductions. It is as is the case with its predecessor, the environmental management system, ISO 14001, a voluntary standard giving businesses the choice for uptake (unlike the mandatory reporting of GHG emissions by London Stock Exchange (LSE) quoted companies (legally required under Section 85 of the Climate Change Act 2008 and under section 416(4)). The PAS 2050 standard provides detailed guidelines for the assessment of GHGs arising from goods and services underpinned with life cycle analysis (LCA) methodology to calculate the associated life cycle of GHG emissions (in carbon equivalents).

A number of key market-led and government agency organisations contributed towards the development of PAS 2050 as well as civic society and NGO stakeholders. These included: The British Standards Institution (BSI), The Department for Environment and Rural Affairs (DEFRA) and The Carbon Trust (an independent not for profit organisation¹ with a mission to drive towards a sustainable, low carbon economy (Carbon Trust, 2012)) alongside a number of industry stakeholders. Some of the industry stakeholders who piloted the carbon footprinting standard and followed through with communication of carbon footprint labels based on PAS 2050 methodology included amongst others, *Tesco*, *Walkers Crisps*, *Boots and Kingsmill Bread* (Carbon Trust, 2008). PAS 2050 essentially sets out a specification and guidelines for the carbon footprinting of products and services underpinned by a standardised LCA approach that can be applied either autonomously by companies or by whole supply chains (BSI, 2008). PAS 2050 is nationally and internationally applicable and publicly available. It was revised and updated in 2011 (PAS 2050: 2011) principally to reflect and align its content with development of the GHG Protocol where the Sustainability Consortium and the Consumer Goods Forum (both are international NGOs) have adopted the GHG Protocol as a basis for data collection (pre-sustainability, 2013). The revised standard provides further clarity on the treatment of recyclable materials. It also includes biomass emissions and other emissions from biogenic sources (IEMA, 2011). Later revisions of PAS 2050 in 2011 (PAS 2050:2011) led to the Carbon Trust becoming the world's first organisation to achieve accreditation to certify against the new (2011) version of PAS 2050, its standard for product carbon footprinting and premise for the separate stage of certification for carbon footprint labelling.

PAS 2050 is also a gateway to labelling. It is an essential tool for doing so rather than providing a guaranteed carbon label entitlement. As such PAS 2050 is required to move towards the stage of

¹ The Carbon Trust was formerly supported by the UK Government (Bockel et al., 2011). It was originally established in 2001 as an independent company by the UK Government to help businesses, organisations and the public sector to reduce carbon emissions (Carbon Trust, 2013).

verification and communication through a separate process of certification for carbon footprint labelling. Seeking certification and communication of carbon footprint measurements through carbon labelling is a stage distinctly separate from the crucial step of measuring emissions using the PAS 2050. Carbon footprint labelling typically involves other costs and conditionality agreements administered and governed by the Carbon Trust.

Development, piloting and publication of this voluntary carbon footprint standard took place at a time when the UK Government bolstered credence in the issue of climate change resulting in the world's first national and legally binding act to reduce carbon emissions. Interestingly, the Climate Change Act (2008) had original targets to reduce carbon levels to at least 60% lower than the 1990 baseline by 2050. However, in light of increasing public pressure, recommendations from the Climate Change Committee and environmental pressure groups including Friends of the Earth and the World Wildlife Fund (WWF), the then Secretary of State for Energy and Climate Change (Ed Miliband) increased this to a level of at least 80% carbon reductions by 2050 on 16th October, 2008. Later revisions of PAS 2050 in 2011 (PAS 2050:2011) led to the Carbon Trust becoming the world's first organisation to achieve accreditation to certify against the new (2011) version of PAS 2050, its standard for product carbon footprinting and premise for the separate stage of certification for carbon footprint labelling. Carbon footprint labels are now a universally accepted mode of communicating carbon footprint information and the global warming potential of products to consumers (McKinnon, 2010).

Efforts to standardise and bring credibility to the carbon footprinting process by providing guidance and specifications to businesses is significant not only from a UK perspective but from an international one too. Certainly, the UK's work on carbon footprinting via PAS 2050 is looked upon by leading international organisations such as the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI) as an exemplar of best practice. For instance, developers of PAS 2050 (BSI, DEFRA and The Carbon Trust) are also working closely with the WBCSD and the WRI in their attempts to standardise measurement of GHG emissions across supply chains under the Greenhouse Gas Protocol. An excerpt from a Greenhouse Protocol press release relating to the launch of the GHG Protocol's Product and Supply Chain Initiative illustrates this point:

"Businesses have been calling for a robust, consistent standard for measuring the carbon footprint of their goods and services" explained Kay Williams, the representative from DEFRA, the UK's environmental agency.

"DEFRA along with the Carbon Trust have responded by sponsoring the British Standards Institute to develop PAS 2050. However, products and supply chains are global and we need an agreed international standard to assess these embedded emissions. By working with the GHG Protocol we hope to share our knowledge to develop a credible, practical and internationally acceptable method."

GHG Protocol (2012) p.1

Indeed, the WBCSD and WRI refer to PAS 2050 explicitly at the international level as an example of 'best practice' and a 'key reference' document in attempts to standardise GHG/carbon footprinting in

product supply chains (GHG Protocol, 2012). PAS 2050 is also a voluntary policy-led imperative that exhibits and extols its close alignment with the GHG Protocol's standards although the PAS 2050 LCA methodology remains as Baddeley et al. (2012, p. 69) explain '*the most detailed and comprehensive to date.*'

Certainly, strong calls have been made from government, academic, NGOs and business communities for a greater level of research into gaining insights as to how to reconcile the heterogeneous nature of food businesses and the environmental debate and again, with the singular process of carbon measurement (Lang and Barling, 2013; Food Ethics, 2011; Foresight, 2011; Hartlieb and Jones, 2009). Indeed, Steenblik and Moise (2010) conducted research assessing a range of technical complexities and trade implications (in an international context) associated with methods to calculate carbon emissions. They conclude complex scoping and policy issues frequently hinder the simplification and streamlining of carbon footprint methodologies.

Pressure to decarbonise production, supply and distribution systems are an inevitable consequence to twenty first century food supply chain businesses (Christopher, 2013). Yet, the extent to which decarbonisation, 'greening' efforts, sustainability and climate change factors affect UK food supply chain businesses remain notoriously challenging to determine (Garnett, 2013). As PAS 2050 is specifically tailored for business use, it will undoubtedly be of financial and operational concern to businesses seeking carbon reduction and energy efficiency gains (Vandenbergh et al., 2011 and Sinden, 2009). This is especially pertinent as twenty first century businesses become increasingly concerned with developing supply chain capabilities to facilitate the adoption of proactive environmental policies (Christopher, 2013; Ingwersen, 2012; Arimura et al., 2011; Unruh and Ettenson, 2010; Senge, 2010; and Arimura et al., 2008).

The fact that PAS 2050 firmly lies within the wider domain of public policy for the environment, underwritten with sustainability objectives, also renders carbon reductions a strategic issue for some organisations (Potoski and Prakash, 2013; Unruh and Ettenson, 2010; Walker et al., 2008; Potoski and Prakash, 2005; and Porter and Van der Linde, 1995). A PAS also normally takes companies 8-12 months to achieve whereas an ISO would require approximately 3 years. Acting proactively and on the premise of the *Precautionary Principle*, for instance by seeking protection from potential mandatory compliance is one option, though PAS 2050 could also form the basis of or be incorporated within existing environmental management systems. Environmental management systems are typically associated with proactive and sustainable business development though labelling carbon credentials for information and communication but it is not often a viable or economic option for businesses (Vogler, 2013; Fox and Vorley, 2004; MacMaoláin, 2003 and Majone, 2002).

Publication of PAS 2050 occurred at a time when the environmental challenge to food businesses and food supply chains became stronger than at any other period of private enterprise. The challenge is

a corporate one that seeks to minimise business impact on the environment (Peloza and Shang, 2011; Senge, 2010; Walker et al., 2008; and Potoski and Prakash, 2005). This is coupled with a wider imperative to embrace the fundamental but often multiple interpretations of sustainable development into a more tangible, pragmatic sense, where pluralistic realities of epistemological and normative perspectives are respected (Sneddon et al., 2006). In addition, adoption of carbon footprinting and environmental standards are inherently influenced by a complex milieu of interdependent and interrelated social, economic and environmental issues faced by food supply/commodity chains, which operate increasingly at the globalised level and within structuralist confines (Baines, 2014; Burch et al., 2013; and Manning and Baines, 2004). PAS 2050 essentially emulates the voluntary nature of a set of preceding voluntary standards; certification based EMSs such as the ISO 14001 standard and the EU's EMAS scheme (Potoski and Prakash, 2013; Marimon et al., 2012; Arimura et al., 2011; Arimura et al., 2008; and Chapple et al., 2005).

The term carbon footprint, even if not fully understood, is a fairly familiar one to consumers (Freidberg, 2014 and Boardman, 2008). With respect to the scientific and business communities, carbon footprinting is now a ubiquitously used term rooted in the 'ecological footprint' lexicon coined by Rees (1992) who later developed a method of calculation, outlined by Wackernagel and Rees (1996).

'Carbon footprints' are defined by the Carbon Trust as:

"... a methodology to estimate the total emission of greenhouse gases (GHG) in carbon equivalents from a product across its life cycle from the production of raw material used in its manufacture, to disposal of the finished product (excluding in-use emissions).

"... a technique for identifying and measuring the individual greenhouse gas emissions from each activity within a supply chain process step and the framework for attributing these to each output product (we [The Carbon Trust] will refer to this as the product's 'carbon footprint')."

CarbonTrust (2007) p.4

Research in the academic literature (Shewmake et al., 2015; Dendler 2014; and Upham et al., 2011) indicates much optimism for such methods but carbon footprinting, though an increasingly used term promulgated by the UK Government and the EU (backed by a publication on national footprints in 2005 and later in 2008 (EEA, 2005 and EPLCA, 2008)), generally lacks transparency in its meaning and methods of calculation (Wiedmann and Minx, 2007 and Wiedmann et al., 2007).

In terms of market proliferation, carbon footprint labels on individual stock keeping units (SKUs) at the UK food sector level (Vandenbergh et al., 2011) are at a relatively early stage of adoption and diffusion. Indeed, understanding of overall effectiveness (in terms of its capacity through the medium of carbon footprint labelling to drive decarbonisation and encourage 'green' behaviour) is not well established (Guenther et al., 2012 and Upham et al., 2011). In addition, the life cycle approaches that such carbon footprinting and labelling entail in terms of methods of calculation, verification and communication have gained increasing attention within the academic literature.

Given the key focus of this thesis is on carbon footprinting and labelling, the following section therein introduces the UK food industry context with a specific case example of Tesco regarding the early developments of the carbon footprint process standards that respectively support the separate certification for carbon labelling.

1.3 Carbon Footprint Labelling

As explained above, a commonly accepted way of communicating carbon reduction efforts and carbon footprints of relative business's food products is via carbon footprint labelling. Brenton et al. (2009) define carbon labels or carbon reduction labels as the end result of a complex product-process of carbon measurement of a particular product along the supply chain. For the UK, carbon labelling initiatives commenced in 2007. In the UK, some supermarket retailers initially embraced carbon footprinting and labelling efforts with gusto, most notably Tesco, the UK's largest supermarket retailer. Indeed, in January 2007, Tesco famously pledged to carbon label 70,000 of its own brand products it sells (Rigby et al., 2007). Sir Terry Leahy, Tesco's CEO at the time announced in a speech at the Forum for the Future that:

"The market is ready. Customers tell us they want our help to do more in the fight against climate change. We have to make sustainability a significant, mainstream driver of consumption."

Rigby et al. (2007) p. 1

By 31st January 2012, Tesco were again in the press (and under the stewardship of new CEO, Philip Clarke who took over in 2011) but for sensationally retreating from this ambitious target (see Lucas and Clark, 2012 and Grocer, 2012) reporting new plans to phase out the carbon label co-developed with the Carbon Trust. Tesco blamed poor uptake of the scheme by other supermarket retailers and implied such a weak response by the said retailers is what failed to galvanise its viability. A week following these press reports Tesco responded by publishing a statement in The 'Grocer' a weekly food industry journal publication. In the press release, entitled ***Tesco's not taking a step back from carbon reduction*** (Grocer, 2012a) Tesco underscores its continued and future commitment to carbon footprinting and carbon reduction. The statement admits that despite Tesco having carbon footprinted over 1,100 products and labelled 500 of these since 2008 (more than any other UK company by sales volume) that faster and cheaper ways to footprint and label are needed. However, the press release did not indicate how Tesco will provide carbon footprint data for consumers once the label is phased out. Interestingly, on 13 June 2012 Tesco were named 'Green Retailer of the Year' 2012 at the retail industry's prestigious annual *Grocer Gold Awards* in recognition of Tesco's continued commitment, significant efforts and wide range of initiatives to reduce carbon consumption despite increasing the size of the business (Grocer, 2012b).

Certainly, impetus for PAS 2050 at the corporate level remains. For instance, PepsiCo whose *Walkers* brand were the first to use the PAS 2050 carbon footprint label expressed disappointment at the uptake

of the scheme but unlike Tesco pledged to continue its carbon footprint labelling. Martyn Seal, European Director for Sustainability at PepsiCo stated:

“Although we’ve not seen the take-up we’d like, we still support carbon labelling as a way of helping consumers and businesses understand and reduce emissions.”

Grocer (2012)

The quote above essentially demonstrates a retail business perception that carbon footprint labels are in demand and by implication assumes consumer engagement and knowledge of carbon footprint regimes. However, little is known as to the ‘realities’ of the consumer response to The Carbon Trust’s carbon footprint labels on individual SKUs (Upham et al., 2011). For instance, despite what Tesco term as ‘disappointing’ market uptake amongst retail competitors, pledges were made that carbon footprint efforts would continue although cheaper and more time efficient methods for doing so were needed. Tesco’s initial excitement for carbon footprint labels and unexpected retraction of their initial verve for carbon footprint labels, added to what appears as retailer dissonance, demonstrates that insightful inquiry as to the food supply chain business response to PAS 2050 is a useful starting point in attempts to understand the use and usefulness of its carbon footprints and labels in UK food supply chains.

Notwithstanding what on face value appears as dissonance at the retailer level, increasing international confidence in the Carbon Trust and its work on carbon footprint standards and labelling is strengthening (Liu et al., 2016). For example, and as mentioned previously, The Carbon Trust became the world’s first organisation to achieve accreditation to certify against the new (2011) version of PAS 2050, its standard for product carbon footprinting (Carbon Trust, 2013). A key element of a ‘green’ corporate agenda as McKinnon (2010) states is the communication of the “*embedded*” amounts of CO₂e in different goods and services namely via voluntary carbon footprint labelling. Ideally, such information would enable consumers to differentiate the carbon intensity of products, calculate CO₂e savings and switch to less carbon heavy alternatives. In the UK, the Carbon Trust governs the certification process of carbon labelling of products. Carbon labels are intended to provide consumers with information relaying the total amount of CO₂e from point of source through to final point of sale (*ibid.*, 2010).

In 2006, The Carbon Trust launched its first Carbon Reduction Label followed in 2007 with the launch of its more refined practice process based Carbon Footprint Label utilising the ‘draft versions’ of the PAS 2050 method claiming such labels would enable customers to: “...*choose those products that have smaller footprints and therefore contribute less to climate change*” (Carbon Trust 2009). These product level carbon footprint labels communicate either a reduction and/or a measure of carbon emission equivalents based on the PAS 2050 process. This followed earlier piloted trials of PAS 2050 methodology in the beginning of the same year (The Carbon Trust, 2008). These early attempts

were often driven by business alongside governmental support although these were confined to a limited number of consumer products (Brenton et al., 2009 and Hartlieb and Jones, 2009).

For UK food consumers, front-of-pack (FOP) and back-of-pack (BOP) carbon footprint labels began to appear on a growing range and number of food and drink products following the official publication of PAS 2050 towards the end of 2008. Examples of UK products with carbon footprint labels based on the PAS 2050 standard include Walkers Crisps, Kingsmill Bread, Tesco's own orange juice and Quaker Oats. The Carbon Trust claim that in 2010, 90% of households in the UK were known to have bought a product with a Carbon Trust carbon labelled product. In addition, it is stated that in the same year, over 90 brands had been carbon footprinted and labelled across 19 countries (Carbon Trust, 2013a). The Carbon Trust's early carbon footprint labels communicated some level of carbon loading associated with the respective product. In fact, the Carbon Trust's early versions of carbon footprint labels were crammed with information. These displayed a products' calculated carbon loading content, a prominent and 'recognisable' footprint logo as well as a statement of intent and commitment to work on ongoing carbon reduction with the Carbon Trust. An example can be seen in Figure 1 below.



Figure 1 Carbon Footprint Labels on Food and Drink Products
Dietz et al. (2011)

However, the detail in the way carbon labels communicate information shifted considerably since the first launch of PAS 2050 in 2008 and its subsequent revision in 2011. From 2013, the Carbon Trust's updated version of these carbon footprint labels provide the option of two types of display and are correspondingly more 'logo' centric than information based as shown in Figure 2:



Figure 2 Updated Versions of the Carbon Trust's Carbon Footprint Labels
Carbon Trust (2013a)

The first carbon footprint label outlined to the left in Figure 2 above is one of the two versions provided by the Carbon Trust information. This is a label known as a 'Reducing CO₂ Label' showing a commitment to reducing carbon, with no need to include the actual carbon footprint loading. The other known as a 'CO₂ Measured Label' gives the option to communicate the measured carbon footprint although this information is now to be found on the respective product's online website rather than the label itself, plus there is no requirement to demonstrate a commitment to carbon reduction (Carbon Trust, 2013a).

For its carbon labelling options, the Carbon Trust continues to offer certification against PAS 2050 and/or the GHG WRI/WBSCD Protocol Product Standard where for use; the reduction labels require pledged commitments to actual reductions and re-certification every two years. The CO₂ Measured Label on the other hand allows the communication of the carbon footprint of a product or a service with or without the certified footprint measurements and cannot be used to communicate a commitment to emissions reductions or any that may have been achieved (Carbon Trust, 2013a). Other requirements for carbon footprint labelling include meeting the Footprint Expert Guide and the Code of Good Practice. These differences between the latest (at the time of writing) carbon footprint labels versus previous carbon labelling types for food products are provided for information in order to demonstrate how consumers in the UK are currently (again, at the time of writing) presented with carbon footprint labels on products.

Carbon footprinting methods and standards are currently in their infancy though the momentum for carbon footprinting food has gained increasing attention in the UK, Sweden, and France (Vandenbergh et al., 2011; Nartova, 2009; and Edwards-Jones et al., 2009), Germany, Japan, Korea and the US (McKinnon, 2010). Indeed, the rapid emergence of labelling schemes (including PAS 2050's carbon footprint label) has led to a range of food products produced and traded in compliance with determined sets of criteria (by the relevant authoritative body governing such schemes), though the nature and emphasis of claims varies, dependent on the organisation and or/product type (Liu et al., 2016).

Considering the background and context to this research inquiry outlined in the preceding sections, the subsequent paragraphs summarily detail the research problem, its main research question, sub questions and sub themes. It follows by explaining the approach to literature gathering and what is contained in later chapters to this thesis.

1.4 Conclusion

In light of the above, the approach to the carbon footprint problem is outlined in Figure 3 below. Here, while the figure is not linear or hierarchical, it illustrates that food policy is underlain by fragmented theories that produce diverse interventions. This shows that in terms of addressing environmental sustainability concerns, these interventions range from 'deep to light green' (Reisch et al., 2016; Geels et al., 2015; Marsden, 2013; Reisch et al., 2013; Tzilivakis et al., 2012; DEFRA, 2010; and Hopwood, Mellor and O'Brien, 2005). The critical environmental challenge at a global level is to minimise carbon or carbon equivalents. This means addressing both the supply (industry) and demand (consumer) groups that form part of a wider multi-stakeholder group comprising a number of different actors. These actors occupy a central, interdependently and inextricably linked 'space' within the diagram below and includes civil society (food shoppers/consumers), civic-society organisations, non-governmental organisations (NGOs), the food industry and government policy-makers.

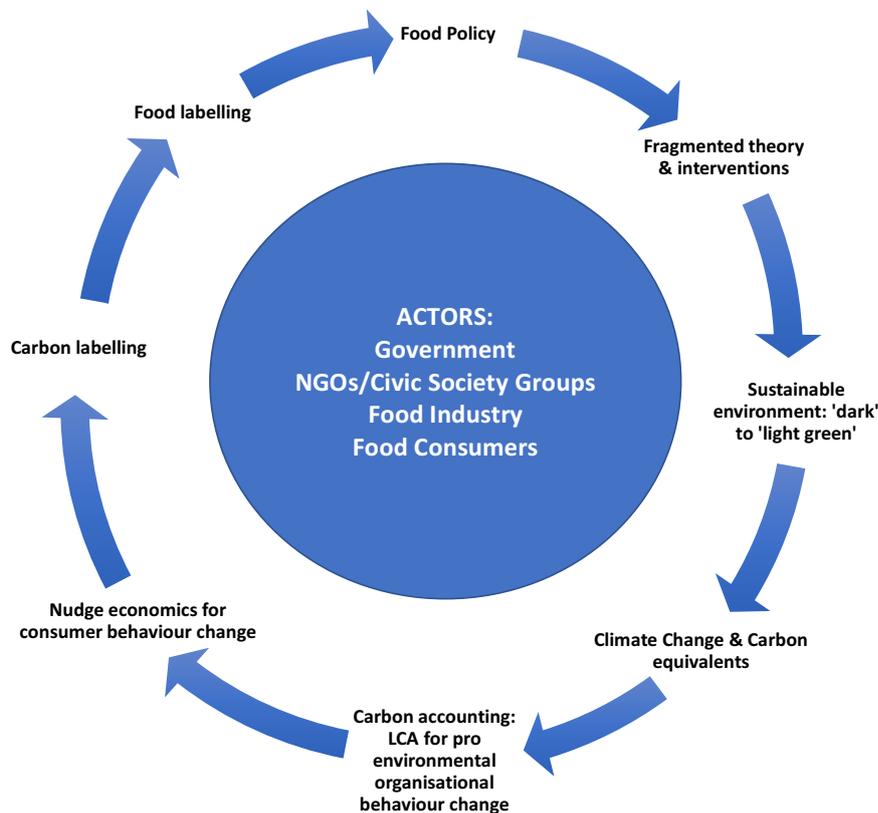


Figure 3 Approach to the main research question and sub-questions

The process starts by trying to embrace an accurate carbon accounting system within a framework of product life cycle analysis. This would underpin regulation and self-regulation of industry and be measurable through such interventions as the voluntary environmental management standard, ISO

14001 to gauge carbon reduction obligations under the Greenhouse Gas Protocol. Carbon accounting could also be the science that underlies carbon footprint labelling which informs consumer choice. Consumers are however, well known for saying they will support initiatives without changing behaviour (Upham et al., 2011; Black, 2010; Peattie, 2010; Young et al., 2010; Pelsmacker et al., 2005; and Tiesl et al., 2002). That necessitates an exploration of what would 'nudge' them to a different consumer behaviour by exploring parallel food contexts to food policy. Nudging is essentially the issue of addressing consumer behavioural change to produce a wider social dynamic of change (Hansen and Jespersen, 2013 and Thaler and Sunstein, 2008).

In order to further explore the carbon footprint problem, a series of research questions have been developed and defined for this study. The fundamental research issue is how does carbon footprinting and carbon labelling operating within the context of a 'nudge' policy tool address the problem of climate change impact in food systems (Hansen and Jespersen, 2013; Hartlieb and Jones, 2009 and Verbeke and Roosen, 2009)? Indeed, the main research question of this study was raised at the very outset of Chapter 1. This asks:

What is the role of carbon footprint labelling of food products in helping deal with the environmental problem of climate change?

From this, a key question is firstly, whether carbon footprint standards can nudge food chain actors' behaviour towards lower carbon production and supply of food; and secondly, whether communication via carbon labels can influence consumer choice and lead to greener purchasing? If so, is this likely to reduce overall global environmental footprints? While it is beyond the scope of this research inquiry to address the latter, this study explores consumers' perceptions of carbon labels. It also examines the perceptions of key food industry actors regarding specifically, the voluntary practice-based carbon footprint-labelling regime, that is PAS 2050.

The main research question raised earlier in this chapter therefore addresses issues with two different groups of actors, namely food consumers and food supply chain actors. Therefore, a series of sub-research questions were generated and, with the identity of two separate groups, a series of research sub-themes also emerge. The sub-research questions together with these sub-themes are outlined in Table 1 on the following page.

The sub-research questions and sub-themes are used to organise the literature review of the food industry which is contained in Chapter 2 and the parallel contexts of food safety, health and nutrition and omni-labelling for sustainability from a consumer behaviour perspective. In reviewing the conventional theoretical business literature and the literature on parallel contexts which explores the theoretical basis for behavioural change, there were sufficient gaps in the literature that required a level of theoretical reframing. This theoretical reframing has been accumulated into twelve

propositions which are clearly laid out at the end of each theoretical section. While the propositions are examined throughout the case study material, they are accumulated in Chapter 7 to make a statement about the theoretical limitations of current approaches to behavioural change through voluntary market mechanisms.

Table 1 Sub Research Questions and associated Research Sub-themes

Sub research questions (S.Q.) against relative Sub themes	
S.Q.1.	What is the possible space and form of carbon labelling for both the food industry and consumers? Product Level Carbon Footprints
S.Q.2.	From case studies, is it possible to assume a certain consumer and industry response? UK Food Shoppers and Food Chain Businesses
S.Q.3.	How will UK food shoppers perceive carbon footprint labelling? Attitudes/Perceptions: Consumer behaviour
S.Q.4.	Is it possible to capture in a label the complexity of carbon content from a supply chain with multiple processes and multiple producers? Carbon Footprint Standards and Labelling
S.Q.5.	How will producers perceive carbon footprint and label schemes? Ecological Responsiveness
S.Q.6.	How will perceptions of voluntary carbon footprint standards and labels shape business motivations for 'ecological responsiveness'? Motivations for behavioural change

More specifically, Figure 4 on the next page illustrates the systemised nature of this research approach and the totality of the research inquiry as laid out in this section. Essentially, the core question at the heart of this doctorate is: *What is the role of carbon footprinting and labelling of food products in helping deal with the environmental problem of climate change?* This question arises because supply firms as well as The Carbon Trust claim that carbon footprinting and labelling can make a substantive contribution to addressing the issues of climate change. In order to substantiate these claims, a series of sub questions arise as explained above, which require looking at both the supply and demand side of the food chain and the role of The Carbon Trust in supervising those claims. The MQ and SQs, however, cannot be considered without reference to theory that would provide background to the unsubstantiated claims. There is no single theory that covers the range of inquiry. Rather, there are partial theories and parallel contexts that might explain uptake of carbon footprinting and labelling. These partial theories are categorised by dominant subject matter and for each theory, a proposition is laid out that is explored against the empirical data. The broad conclusion of the thesis is that carbon footprinting and labelling is at best a partial success underlain by partial theory.

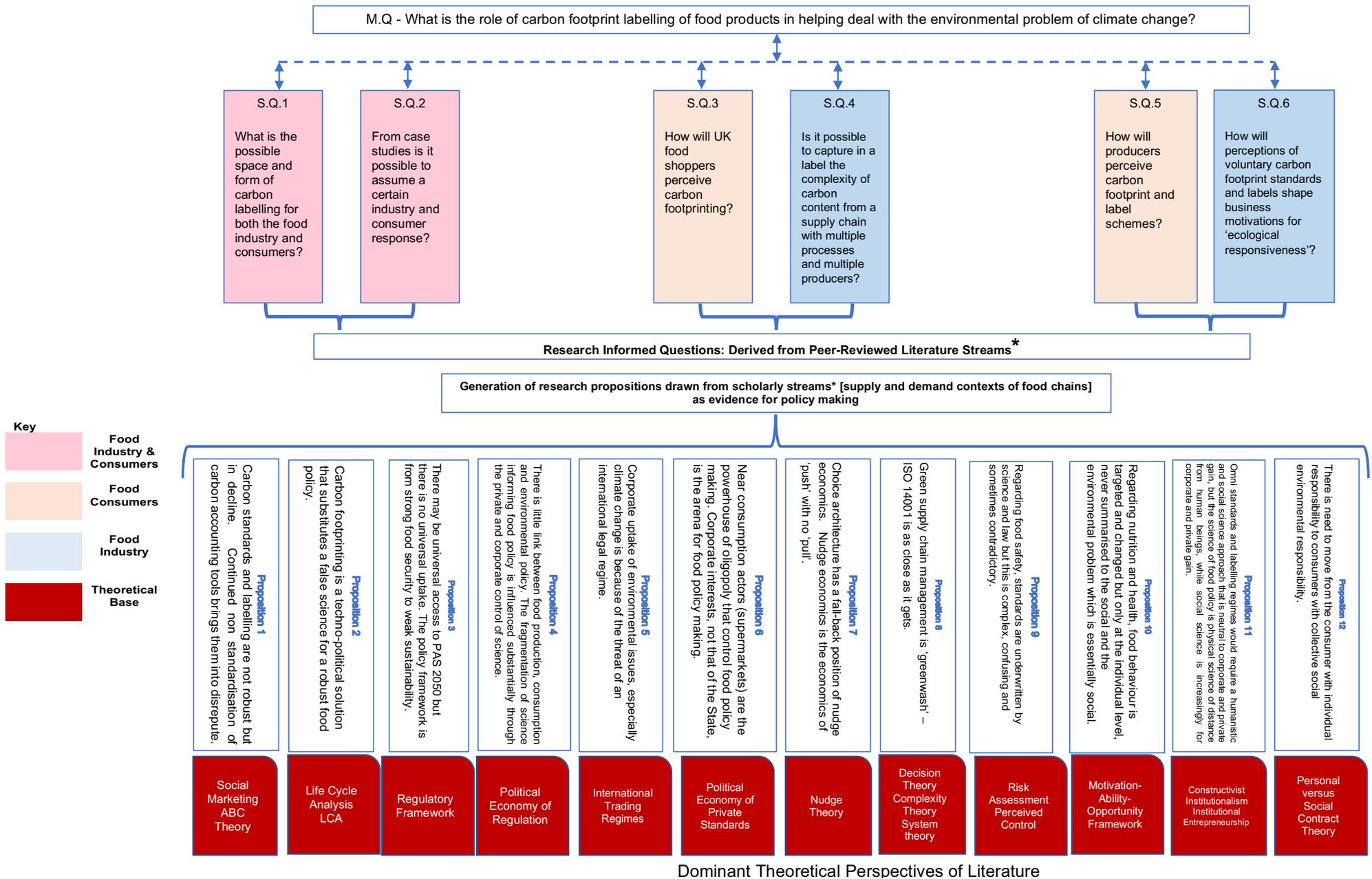


Figure 4 Linkage of Research Questions for the Totality of the Research Inquiry

*multi-stakeholder and regulatory frameworks for food labelling standards (behavioural and organisational theories) and the food labelling contexts of food safety, nutrition and health, and omni/meta standards

The literature reviews in Chapters 2 and 3, while they look to each of the sub-research questions and sub-themes defined above, essentially explore these streams of literature in a non-linear fashion given the nature of the overlapping and often multi disciplinary and interdisciplinary issues under scrutiny. As such, the literature review in Chapter 2 produces an overview that suggests, for the UK food system, a disorganised approach to the issue of behavioural change at both the supply and demand side. As a consequence, Chapter 3 seeks to explore parallel contexts that might inform policy and thus behavioural change in the food sector. Chapter 4 lays out the methodology of case studies in both the supply and demand chain that would address the issues of carbon footprint and carbon labelling. Chapter 5 presents material from the demand response to carbon footprint labelling and Chapter 6 presents case material from the supply chain. Chapter 7 discusses the results from the consumer survey in Chapter 5 and findings from the interviews outlined in Chapter 6. Chapter 8 discusses the limitations of this research study and offers an overall conclusion.

In sum, the research within this thesis explores food labelling (both from a consumer behaviour point of view and from a supplier perspective) particularly focusing on the uptake/issues around carbon analysis and labelling. The content provides a critical holistic overview of voluntary carbon footprint based carbon labels combining empirical data from supply and demand side case study analyses to explore the associated implications and issues relating to behavioural change. More specifically, it is the first look at carbon footprint labelling in the total food production system, that is the stage of production (conventional and alternative), manufacturing and distribution and retail as well as consumers (end-users). It explores the limits of nudge economics via marketing by drawing on the parallel contexts of labelling for food nutrition, food safety and omni-standards. It provides evidence from empirical case studies of both supply and demand in the UK food sector. This research supports the view that consumers say they are willing to change but provides little evidence of change behaviour. On the supply side, the research reinforces the view that market share, profit taking and shareholder value are more dominant imperatives than environmental performance to many food supply chain businesses. Most importantly, it shows that labelling for changing the common good is much more difficult than labelling for individual change.

* * *

Chapter 2 – Literature Review

2.1 Introduction

The simple research question that lies behind this inquiry is '*What role does carbon footprint labelling play in helping deal with the environmental problem of climate change in food product chains?*'. As such this study examines whether or not carbon labelling can change producer and consumer behaviour. However, the simpleness quickly unravels as it becomes apparent that labelling cannot be understood without the context of the voluntary regulatory system, namely, the PAS 2050 life cycle accounting method and practice standard for carbon footprinting. This also underpins carbon footprint labels should businesses opt to label their food products.

Accordingly, this chapter looks at the voluntary regulatory system and labelling within a context of the overall supply and demand factors that underpin the food industry. It ends with some consideration of factors behind sustainable food production and consumption. The author adopts an exploratory, supply chain approach (Walker and Jones, 2012) that allows for the analysis of the response by both the supply (food-supply-chain businesses) and demand (food consumers) stages of food supply chains to carbon footprinting and labelling based on PAS 2050.

Because the range of literature is so wide, in terms of both conventional business school paradigms and the parallel contexts of food labelling (food safety, nutrition and health, ethics and omni/meta labelling standards), the literature reviews in Chapter 2 and 3 broadly lay out the argument of each school. However, each school has a major flaw or gap (Taylor, 2016). These flaws and gaps are derived from the scholarly literature streams in both Chapters 2 and 3 as a series of suggested propositions, each of which is numbered and presented against the associated literature in relevant sections and summarised in total, at the end of Chapter 3. The numbered propositions will then be addressed in reviewing the case material derived from the empirical stage of this study and placing this research in the context of the total literature.

Each body of literature examined is firstly only partial and even within that partiality there are demonstrable gaps. The gaps are captured by the propositions. Such an approach is less strident than arguing a dialectic (Taylor, O'Brien and O'Keefe, 2016). Cumulatively, the propositions allow an alternative weaving of the story of carbon footprinting and labelling at a theoretical level. See Figure 5 on the following page.

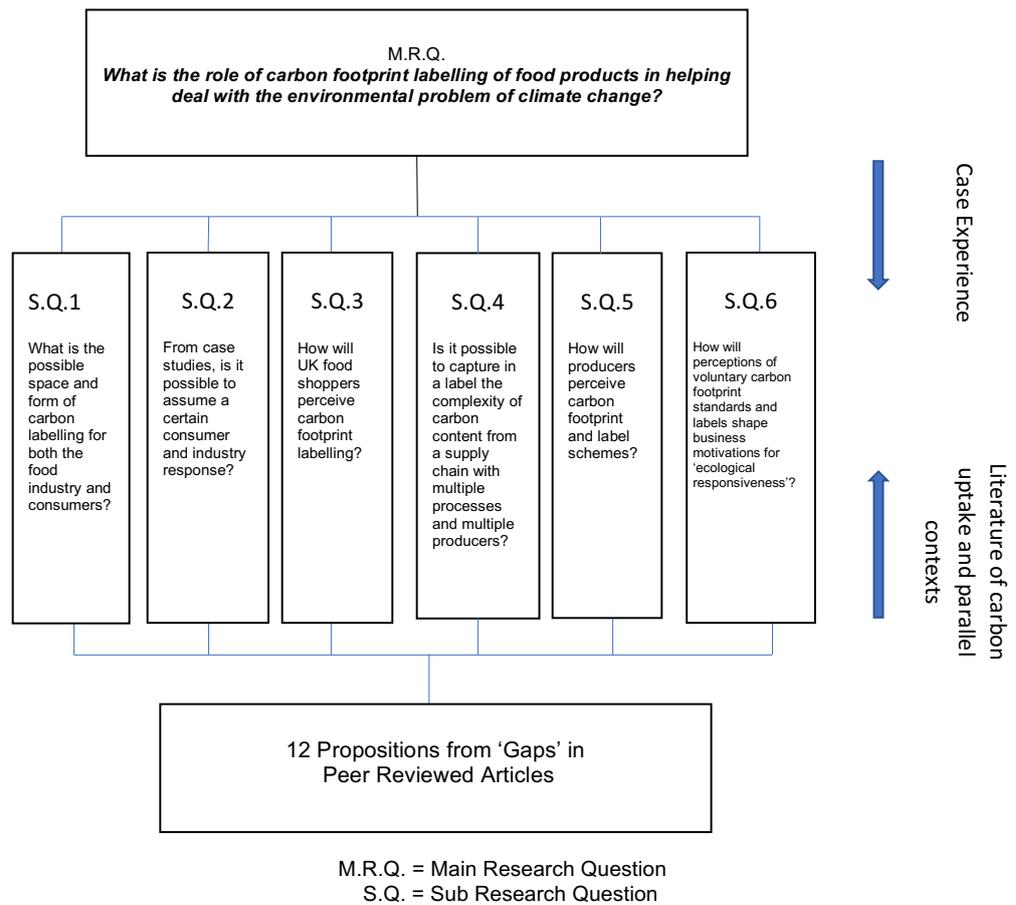


Figure 5 Linking the Main Research Question, Sub Research Questions and Research Propositions

The academic literature recognises the increasing and sustained interest in the development of carbon footprint standards and carbon footprint labels respectively (Liu et al., 2016; Guenther et al., 2012; Upham et al., 2011; and Vandenberg et al., 2011), which is reflected more widely in the growing interest in the 'greening' of businesses (Jacobs, 2013) and their supply chains (Reisch et al., 2016; Sarkis et al., 2011; McKinnon, 2010; and Senge, 2010). It also recognises the call widely made for more multi-level, multi-perspective and multi-disciplinary social, environmental and economic research inquiry into twenty first century challenges such as climate change (Geels et al., 2015).

Essentially, while the PAS 2050 carbon footprint standard and corresponding carbon footprint labelling scheme, underpinned with LCA methodology for data gathering, (ultimately forming the numeric carbon equivalent output of the standard), it is part of a wider suite of UK NGO-inspired voluntary multi-stakeholder labelling initiatives for sustainable production consumption (Upham et al., 2011; and Hartlieb and Jones, 2009). These are aimed at the social and environmental impact

of production and trade, seeking to transform markets of specific products through engagement with business (Saunders et al., 2009).

This research inquiry draws broadly upon the meta theory of Keynesian Economics with its emphasis on demand management and looks more specifically towards Nudge theory (Scrini and Parker, 2016; Guthrie et al., 2015; Hansen and Jepsen, 2013; and Thaler and Sunstein, 2008) within the context of choice architecture in carbon footprinting and labelling as a potential lever for social behavioural change. Such practice-based standards underpinning these labels are frequently developed in the name of advancing decarbonisation and ultimately, sustainable consumption through a choice architecture and behavioural stimuli as policy tools to 'nudge' social change (Reisch et al., 2016; Guthrie et al., 2015; Hansen and Jepsen, 2013; Sunstein and Reisch, 2013; Galizzi, 2012; Hartlieb and Jones, 2009).

However, the academic literature on carbon footprinting standards and labels specifically is still emerging albeit rapidly and seemingly in punctuated bursts where much of the discourse is contentious and mixed (Scrini and Parker, 2016). For instance, McKinnon (2010) cite scepticism of the potentialities for voluntary carbon footprinting standards within the logistics and supply chain domains of industry, arguing it cumbersome and too narrow in focus, open to misinterpretation, riddled with associated complexities attributed to its life cycle focus approach to calculation as well as it being time and capital intensive. Conversely, Hartikainen et al. (2014) are more positive regarding the possible benefits of an LCA process based standard for carbon footprinting and labelling in terms of its potential to drive consumer change provided certain market conditions for such labelling schemes exist given the importance of identified antecedents to behavioural change.

Food supply chain businesses that now operate in the second decade of the twenty first century also differ in terms of strategic orientation and behaviours relating to motivations for ecological responsiveness (Glover et al., 2014). Specifically, while initial LCA product carbon footprinting focused naturally on GHG emissions, footprinting is increasingly used to capture and address numerous environmental concerns Freidberg (2014). Ongoing simultaneous diffusion of carbon footprinting and labelling uptake has yet to catch up with the more mature stringent mandatory legislative frameworks for food safety. An example is the CRC formerly known as the Carbon Reduction Commitment (CRC) which covers large, energy-intensive organisations.

The environmental policy 'vacuum' of weak regulation for carbon footprinting and associated labelling is the space in which a broad range of alternative market-based labelling schemes and initiatives in the name of 'greening' or 'sustainability' have emerged (Guthrie et al., 2015; Van Kleef and Dagevos, 2015; Temple and Fraser, 2014; Dendler, 2014; Grunert et al., 2014; Hawley et al., 2013; Lang et al., 2013; Sirieix et al., 2012; Campos et al., 2011; Tzilivakis et al., 2012; Engels et

al., 2010; and Hartlieb and Jones, 2009). The 'vacuum' contrasts with stronger regulatory regimes for firms beyond the food sector.²

In terms of addressing the climate change argument, there is evidence that the Keynesian national demand stimulus (that government should lay out capital gained from taxation to stimulate market conditions for change) has changed the basis of electricity production in the UK (Carbon Brief, 2017; Economist, 2017; Financial Times, 2017; and Guardian, 2017). This inevitably has an effect on the inputs to the food industry but it is almost impossible to quantify due to the scale, heterogeneity and breadth of the Food Industry (Upham et al., 2011). Instead, attention is placed on addressing a number of research gaps identified within the academic literature (Freidberg, 2014; Jensen, 2012; Guenther et al., 2012; Upham et al., 2011; Steenblik and Moise, 2010; Hartlieb and Jones, 2009 and Finkbeiner, 2009) specifically behavioural change contexts with respect to the public, that is food consumers and food chain businesses. For instance, Steenblik and Moise (2010) and Finkbeiner (2009) suggest as more governments adopt carbon footprint labelling standards, the precedents created and lessons learned will be of utmost importance in shaping future policies aimed at reducing food-related emissions. Freidberg (2014) urges caution related to such life cycle based labelling regimes and suggests any derived label could possibly hide more than it reveals. Freidberg (2014) suggests that the LCA process underpinning carbon footprint labels, while standardised, remains open to interpretation by more powerful food industry actors who are increasingly likely to utilise any such voluntary standard as a techno-political tool to govern their own, often diverse strategic forms of sustainability. She further suggests that motivations for adoption and use amongst food industry actors of voluntary carbon label regimes is a gap not addressed in the literature streams concerning carbon footprinted products. This is corroborated in an earlier review of carbon footprint literature by Jensen (2012) who shows that between 2006 and 2010 only four carbon labelling articles were published in academic journals. Sundarakani et al. (2010) point more specifically to the supply chain management and operations and logistics journals, substantiating the absence of research concerning carbon footprint labelling regimes for individual products.

² The CRC Energy Efficiency Scheme is a UK government scheme. It's designed to improve energy efficiency and cut carbon dioxide (CO₂) emissions in private and public sector organisations that are high energy users. The Environment Agency administers the scheme for the UK and regulates the scheme in England. The Scottish Environment Protection Agency, Northern Ireland Environment Agency and Natural Resources Wales regulate the scheme in their own countries. Energy already covered under climate change agreements and the EU Emissions Trading System is not included in CRC. Some public bodies must take part in CRC regardless of how much electricity they use. These are called mandated participants and they include all UK central government departments and devolved administrations (CRC, 2013 and Gov.UK, 2017).

2.2 Robustness of Carbon Standards and Labelling: Standardisation of Accounting Tools

Upham et al. (2011) essentially advocate carbon labelling as a potential mechanism in reducing carbon footprint impact that could influence food consumers to make more informed choices when shopping for a lower carbon food basket. Upham et al. (2011) examined Willingness to Pay in the context of decision making for product selection via three focus groups conclude:

At this stage it is too early to judge whether increased public exposure to a carbon-related symbol will, in a small way, help to foster the conditions in which more substantive emissions reduction becomes more politically acceptable, or, conversely, whether it will foster the misguided belief that such action is already underway (Upham et al., 2011) p.355

However, the authors highlight that in simply communicating a product's carbon footprint or reduction commitment, responsibility is placed upon the food consumer to understand and respond positively to such labels. This is put forward as a highly contentious proposition given the competing demands on shoppers' attention in a market place dominated by multifarious labelling schemes. Sorensen (2009) echoes this perspective highlighting that food consumers shop quickly and habitually and marketing efforts (such as carbon labelling) are typically screened out by food consumers. Scrinis and Parker (2016) who examine food labelling and the voluntary and regulatory dialogues concerning the politics of nutritional policy 'nudges' point out the dynamic competitive space between public health-driven nudges and corporate-driven nudges. Here, the authors recognise the power of food corporations in influencing consumer choice and more specifically, the influence on dietary patterns or dietary choices, which is most strongly exercised by the food industry. Nevertheless, little is known as to the nature of consumer choice in the context where food corporations' power to influence dietary patterns and dietary choices prevail. Guenther et al. (2012) also call for further research concerning consumer attitudes and comprehensibility of carbon labels but additionally identify a gap in understanding business motivations for uptake, use and adoption. Cohen and Vandenberg (2012) emphasise the complexities and difficulties in predicting the potential impact of carbon labelling in the market but supports the need for more research concerning consumer awareness and attitudes but also the motivations for industry adoption. A recent review of carbon labelling standards by Liu et al. (2016) shows little has changed in terms of the lacuna of research concerning consumer awareness and the increase in 'green' consumers not to mention business motivations for uptake and use.

In the UK a number of frameworks have been developed at the national level that advocate specific theoretical approaches within a policy context, including most pertinently and in the context of this thesis, DEFRA's *Framework for Pro-Environmental Behaviours* (DEFRA, 2008). This report on *'Innovative Approaches to Sustainable Consumption and Production'* broadly follows a social marketing methodology and *'sets out a framework for DEFRA's work on pro-environmental behaviour'* (*Ibid.*, 2008 p.3). The authors of this report acknowledge the 'magnitude' of the subject matter and concede the report provides *'only a relatively brief summary of the behaviour change evidence base and framework'* (DEFRA, 2008, p. 14).

However, although 'environmental attitudes' of people were studied, this was at a national level encompassing multifarious sectors. In addition, much of the market-research undertaken to support findings had also been undertaken prior to development and the launch of PAS 2050 and ahead of entry of The Carbon Trust's carbon footprint labels based on PAS 2050 methodology at the end of 2008. Dolan et al. (2012) and Chatteron (2011) explicitly advocate the application of theories within a policy context. Indeed, a number of such frameworks have been developed, mainly at a national level and targeted at particular sectors such as transport and energy (EC, 2012).

The 'social-marketing' approach by DEFRA (2008) reflects the position of earlier work by Rex and Baumann (2007). Rex and Baumann (2007) conclude that within the realm of 'green marketing research', studies are inclined to focus on the individual characteristics of what are termed as 'green' consumers and their proportionality in terms of the concentrations of such consumers within population segments.

Shove (2010) raises a number of questions about the relationship of social theory and policy and the potential for social science to make a significantly greater contribution to the challenges of climate change. Commenting on climate change policy and associated theories of social change, Shove (2010) essentially scrutinises the relationship between theories of change and modes of governance. The limitations of social marketing approaches for policy change are heavily critiqued by Shove (2010). According to Shove (2010) social change is thought to be largely dependent upon values and attitudes (the A). These are thought to drive types of behaviour (the B) that individuals choose (the C) to embrace. Together, this is termed the 'ABC' framework. 'A' stands for attitude. 'B' is for behaviour and 'C' is for choice. A major criticism of this approach to social change is the assumption that social attitudes, behavioural change and agency in the context of 'choice' is most pertinent to society and reliant on the nature of 'demand' ultimately placing the responsibility for 'green behaviour' change upon individuals whose collective attitudes and actions are assumed will make a difference (Shove, 2010). Here it is suggested that framing climate change as a problem of human behaviour tends to marginalise and in multiple ways prohibit meaningful and serious engagement with other forms of analyses particularly those grounded in theories of practice and transition. Shove (2010) also cites the UK's *A Framework for Pro-environmental Behaviours* produced by DEFRA (DEFRA, 2008) as an example of one of a 'slew' of reports released in the UK dealing with behaviour, lifestyle and climate change. Other reports of note include "*Creatures of habit: the art of behavioural change*" (Prendergast et al., 2008); "*I will if you will*" (Sustainable Consumption Roundtable, 2006); "*Changing Behaviour Through Policy Making*" (DEFRA, 2005); "*Motivating sustainable consumption*" (Jackson, 2005); and "*Driving public behaviours for sustainable lifestyles*" (Darnton, 2004). But as noted earlier, perhaps the onus on individual behavioural response is insufficient to generate change given it is evident that focus on individual responsibility and behaviour is implied in each of the titles alone.

Similarly, much research regarding food labelling relates to health and nutrition although environmental issues are increasingly gaining attention (Dendler, 2014; Grunert et al., 2014; Siriex et al., 2012; Tzilivakis et al., 2012; and Engels et al., 2010). While eco-labelling, particularly, carbon footprint labelling, may play a significant role in influencing behavioural change (Upham et al., 2011), White et al. (2009) caution that labelling alone is no panacea to the question of carbon and consumer behaviour. This is corroborated with research conducted by Upham and Bleda (2009) and another study by Berry et al. (2008). Each used a qualitative methodology encompassing focus groups, self-reporting attitudinal surveys and participant observations to study public perceptions. The evidence from both studies found that low consumer appeal tends to be associated with confusion in label interpretation and shifting degrees of consumer scepticism. Berry et al. (2008) argue that carbon footprint labels are not a panacea to a low-carbon food basket as much of the value derives from measuring, acknowledging and actively reducing footprints. These early studies recognise the need for further research to gain insights regarding the motivations for food business uptake, and consumer awareness of carbon labels.

Peattie (2010) proposes that the development of more environmentally sustainable consumption and production systems is dependent on consumers' willingness to engage in 'greener' consumption behaviours. Peattie (2010) also suggests that the emergent picture of 'green consumption' is a process that is heavily influenced by consumer values, norms and habits. However, it is highlighted that these are inherently heterogeneous, context dependent and complex.

Given this backdrop to research in green production and consumption, Peattie (2010) explicitly states that: "*There are opportunities for future research that provides greater interdisciplinarity and challenges our assumptions and expectations about consumption and the nature of the consumer-society.*" Peattie (2010) p.195.

Theoretical and empirical research have a propensity to examine environmental regulatory influence on the efficacy of competition in product markets. Indeed, Heyes (2009) provides a critique of such research where the underpinning query is whether environmental regulation is bad for competition and concludes summarily that such regulation can advantage large firms over small firms and consequently augment concentration. In this vein, a number of carbon labelling papers have emerged, within the environmental science and policy realms, critiquing namely the potential adverse effects of carbon footprint labels (developed and implemented in countries such as the UK) on exporting nations (Baddeley et al., 2009; Edwards-Jones et al. 2009; and Saunders et al., 2009). Earlier work in the U.S. by Appleton (2007) substantiates this position. While the legitimacy of objectives such as environmental protection exists, such schemes are suggested by Appleton (2007) to further protectionism and in so doing present a number of policy issues. These encompass:

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1. Non-neutrality (the notion that private labelling schemes often support commercial interests);
 2. Effects on developing countries;
 3. Evaluation of relevant criteria - the relevance of a generally accepted methodology for the assessment of a product's life cycle; and
 4. Effectiveness – private labels often focus on narrow issues and have been criticised as ineffective in addressing broader environmental problems.

In light of the above, it is reasonable to ask: Are 'green consumers' willing to pay a premium for a product's green credentials? Evidence to support such assumptions is drawn upon by Heyes (2009) from a number of self-reporting, attitudinal consumer surveys to suggest that consumers have modified purchasing behaviour in response to eco-labels. These surveys include a study by Tiesl et al. (2002) where (in the U.S.) a significant willingness to pay a premium for canned tuna bearing Dolphin-Friendly labels was shown. Vandenberg et al. (2011), in their discussion of carbon labels, also refer to Tiesl et al. (2002) and the notion that in some cases, labels can influence product selection and consumption although it is recognised that greater levels of clarification and understanding of the impact of labels that provide information on a 'collective' good such as climate is needed.

Heyes (2009) further state that environmental regulations can benefit large firms and stimulate greater rates of concentration, largely at the expense of small firms. Consequently, it is inferred that environmental regulations can actively discourage entry at the strategic level dependent on firm size and provide the basis for predatory behaviour by incumbents. This distinction between business size and assumptions of multiple levels of fiscal strength, and thereby market influence, are not focused upon in the relatively few papers specifically critiquing product carbon footprinting and labelling either by McKinnon (2010) or Vandenberg (2011).

Certainly, McKinnon (2010) questions the validity of resultant benefits to both consumers and businesses of carbon footprint labelled products suggesting lack of 'willingness to pay' and scepticism as to the effectiveness of carbon footprint labels to drive behavioural change towards decarbonisation efforts. McKinnon (2010) advises that it would be more beneficial for management time and resources to be allocated to alternative decarbonisation initiatives.

A number of potential net benefit effects of carbon footprint labelling for businesses and their respective supply chains are suggested to exist by Vandenberg et al. (2011). These extend to the reduction of emissions, their associated costs, reputational enhancement and demonstrative compliance for governmental policy measures that support carbon emissions reductions. Vandenberg et al. (2011) suggest that businesses often overlook the potential of substantial supply chain efficiencies to be gained as well as opportunities to reduce costs and emissions.

Warning of the illusory effect of immediate impacts of consumer choices is given as businesses, it is suggested, tend to favour responding to more generic concerns regarding brand reputation even if consumers demonstrate limited willingness to pay for lower carbon products (Black, 2010).

In concluding the first section of this review, the literature regarding carbon standards and labelling suggests that it is not a robust process (Cohen and Vandenberg, 2012; Bockell et al., 2011; Newell and Vos, 2011; Swinburn et al., 2011; Brenton et al., 2009; Creese and Marks, 2009; and Saunders et al., 2009). There are suggestions that uptake by food industry actors may decline in favour of alternative 'efficiency' measures for the environment (McKinnon, 2010; Baddeley et al., 2009; Edwards-Jones et al. 2009; and Saunders et al., 2009).

Indeed, the ongoing transition from such a nascent corporate response to climate change issues has nevertheless led to new foci on carbon, structural adjustments of food supply chains and LCA assessment methods. Publication of the Stern Report in 2006 and the IPCC's FAR in 2007 re-affirm this position. Since these seminal publications, together with Goodall (2008), Okereke et al. (2012) as well as Jensen (2012) provide useful insights with respect to the number of peer-reviewed papers published in the context of climate change, global warming, carbon footprint literature and more specifically, product carbon footprint literature. The following sections outline these principal findings in the context of product carbon footprints and carbon footprint standards more generally.

2.3 Carbon Footprinting: Literature Gaps

Jensen (2012), conducted a literature review on product carbon footprint (PCF) literature from 2006 to 2010. Their findings were based on searching the scientific library database EBSCO Host Research Database, including Emerald, Science Direct, and SpringerLink in order to identify methodological contributions and developments with respect to carbon footprinting (CFP) and PCF. Their search identified 115 articles using the key words "carbon footprint" and "Product Carbon Footprint". From their review, it was established that as points of discussion/concern, CFP and/or PCF are comprehensively covered by environmental journals. This is illustrated in Table 2 where the number of articles discussing or concerning CFP and/or PCF rises from 1 in 2006 to 49 in 2010. This research study specifically looks at the uptake of carbon standards and labelling essentially the year 2010. The literature search is relevant to this date even though later references are used to corroborate the findings of this research and discussed towards the end of Chapter 3.

Table 2 Number of Articles Relating to CFP and/or PCF Issues from 2006 to 2010

Journal	2006	2007	2008	2009	2010	Total
International Journal of Life Cycle Assessment				2	7	9
Ecological Economics			1	3	2	6
British Medical Journal		1	2	1	1	5
Environmental Science and Policy				3	2	5
Environmental Science and Technology		1	2	2		5
Journal of Cleaner Production				3	2	5
Remaining Journals	1	5	15	24	35	66
Total	1	7	20	38	49	115

Source: Jensen (2012)

However, contributions to the discussion of CFP as a method for measuring product level emissions within supply chains in operations and logistics journals are conspicuously absent (see Table 3). Sundarakani et al. (2010) also substantiate the notable scarceness of efforts to model carbon emissions in SCM and operations management literature.

Table 3 Number of Articles Relating to CFP and/or PCF in Operations and Logistics Journals from 2006 to 2010

Journal	2006	2007	2008	2009	2010	Total
Journal of Cleaner Production				3	2	5
CIRP Annals – Manufacturing Technology				1	1	2
International Journal of Production Economics					2	2
Transportation Research				1	1	2
International Journal of Physical Distribution & Logistics Management					1	1
Journal of Intelligent Manufacturing				1		1
The International Journal of Logistics Management			1			1
Total	0	0	1	6	7	14

Source: Jensen (2012)

Figure 6 is a useful graphic in that it classifies and gives overall context with respect to the 115 articles found by Jensen (2012) in peer-reviewed journals covering the period from 2006 to 2010. Only four carbon labelling articles were identified.

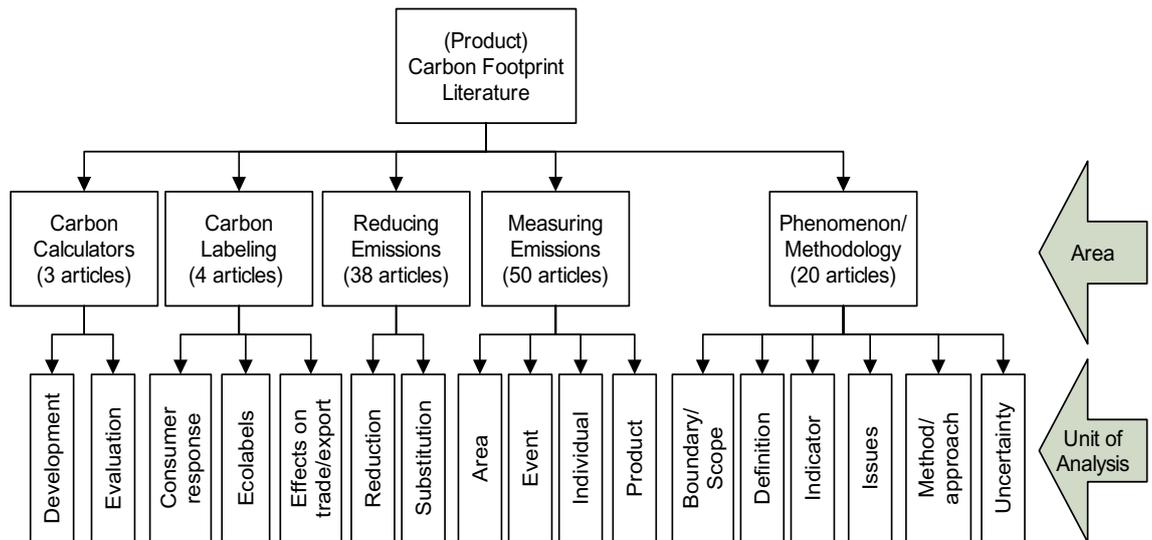


Figure 6 Classification of Carbon Footprint Literature
Source: Jensen (2012)

McKinnon (2010) draws upon case study evidence within a logistics context to discuss and critique the advantages and disadvantages of voluntary product level carbon footprinting and labelling in a supply chain context with no specific focus on a particular sector. It is the first paper specifically relating to product carbon footprinting to be published in the logistics/supply chain literature. While he concludes that carbon auditing and labelling is a “*wasteful distraction*”, it is acknowledged that market research on the behavioural response to carbon labelling is at an embryonic stage and points to the scarcity of research in this field especially within the logistics and supply chain literature. To date, this continues to be the case aside from a research paper focusing on a ‘last mile’ perspective in the comparative analysis of carbon footprints of conventional and online retailing of non-food items (Edwards et al., 2010). This paper, as with the McKinnon (2010) paper was also published in the International Journal of Physical Distribution and Logistics Management, a closely aligned journal that also addresses supply chain orientated research.

Few studies examining the motivations for supply chain businesses to either pursue or not adopt carbon footprinting (using the PAS 2050 standard) were found to exist at the time of writing. Numerous gaps identified within the peer-reviewed literature relate particularly to a number of discussions and reviews of drivers and conflicts in the development of carbon footprinting standards amongst other environmental standards used to identify environmental impact (Espinoza-Orias et al., 2011 and Steenblik and Moise 2010). For example, in their critical discussion of the challenges faced in the development of carbon footprint methodologies, Finkbeiner (2009) also makes this call for further research given its perceived contemporary but importunate relevance. Finkbeiner (2009) unusually emphasises that such challenges remain traditional despite the perception of carbon

footprinting being 'new' giving rise to continual difficulties to standardise carbon footprint measurement and calculations.

"...There are surprisingly many people out there that obviously think that carbon footprinting is a new thing. They obviously are not aware of the fact that it has been around for decades—just being called differently, i.e. the result of the life cycle impact category indicator global warming potential (GWP). However, carbon footprinting (CFP) is really fashionable these days. Like with all fashion, not all that glitters is gold."

Finkbeiner (2009) p.93

Whether a carbon footprint standard (PAS 2050) will aid progress to decarbonising and streamlining supply chains is a question that needs to be addressed as Steenblik and Moise (2010) highlight in their paper:

"Ultimately, however, as more and more countries adopt limits on GHG emissions, their governments will be compelled to address emissions from agriculture, and that will mean that some form of accounting will be required. The precedents created, and the lessons learned, from these initial forays into carbon-related standards, will thus be of utmost importance in shaping future policies aimed at reducing agriculture's carbon footprint."

Steenblik and Moise (2010) p.6

The carbon issue is one that takes place within national and international policy regimes but the variance of methodologies to count carbon, particularly the inconsistency of LCA methods has led to a degree of scepticism as to the interpretation, application and efficacy of LCAs (McKinnon, 2010; Edwards-Jones et al., 2009 and Nereng et al., 2009). For example, the carbon reduction challenge is associated with a series of carbon accounting tools; though dissimilar non-standardised methodologies have evolved, leading to mixed uptake rates as well as wide variations in comparing, benchmarking, verifying, labelling, and communicating claimed standards (Vandenbergh, 2011 and Brenton et al., 2009). Table 4 outlines the principal PCF standards that exist. The PAS 2050 column is highlighted in green for ease of reference.

Table 4 Overview of PCF Standards

	ISO 14040/14044	PAS 2050	ILCD HANDBOOK	PRODUCT STANDARD
Type	Standard	Specification	Detailed guidance	Standard
Organisation	International Standards Organisation	BSI, Carbon Trust and DEFRA	European Commission's Joint Research Centre	WRI, WBCSD (GHG Protocol)
Publish date/Status	Published in 1997, revised in 2006	Published in 2008, revised in 2011	Published in 2010	Second draft published in 2010, final in 2011
Context	International	UK but use is expanding in Europe	International	International
Focus	Complete LCA	PCF	Complete LCA	PCF

Source: Jensen (2012)

Invariably, as can be seen in Table 4 above, the GHG PCF standards encompass a fair degree of variance. These differences generally relay to (i) the type of standards available; (ii) the

organisation/s that develop and publish them; (iii) the *historical* nature of the standards' development; (iv), the *context* of delivery and use; and (v) where the *focus* is placed.

Comparisons of currently available standards with respect to PCF are summarised in Table 5 below. As before, the PAS 2050 column is highlighted in green.

Table 5 Comparison of PCF Standards

Area/Standard	ISO 14040 (2006) & ISO 14044 (2006)	PAS 2050 (2008)	ILCD Handbook (first edition 2010)	Product Standard (second draft)
Unit of analysis	Functional unit (product)	Functional unit (product)	Functional unit (product)	Functional unit (product)
Type of PCF	Bottom up/process analysis	Bottom up/process analysis	Bottom up/process analysis	Bottom up/process analysis
Modelling Framework	Not specified, attributional or consequential	Attributional	Attributional and consequential	Attributional
Data timeframe	Time-related coverage as data requirement implies historical data	Historical, fact-based, and measurable data	Historical, fact-based, and measurable data	Historical, fact-based, and measurable data
Data sources	Data can be measured, calculated and estimated but must be quantified and fulfil purpose	Primary data for process owned, operated or controlled by the focal company (supplier if company does not contribute 10 per cent to the upstream GHG emissions)	Generally primary data for own and specific supplier processes, can be average or generic. Remainder is average in attributional and short/long-term marginal in consequential	Primary data for all processes under the control of the reporting company. Primary or secondary data for all other processes
Handling of the multifunctional process problem	(1) Division of unit process into two or more subsystems (2) System expansion (3) Allocation based on physical relationship (4) Allocation (e.g. on economic value)	First approach. (A) Division of unit process into two or more subsystems Second approach. (B) System expansion Third approach. (C) Allocation based on economic value	First approach. Subdivision of multifunctional processes Second approach. System expansion or substitution Third approach. Allocation (e.g. on economic value)	1. Process subdivision 2. Redefining the unit of analysis 3. System expansion 4. Allocation 4.1 Physical 4.2 Economic 4.3 Other

Source: Jensen (2012)

At the time of writing, there is not a system of carbon labelling or footprinting that is mandatory for food products in the UK. However, there are a number of efforts worldwide in developing carbon footprint tools. These include six worldwide carbon footprint initiatives outlined in Table 6 below.

Table 6 International Carbon Footprint Initiatives

Carbon Footprint Initiative	Developers	Adopted Approach	Name of Carbon Footprint Scheme
Publicly Available Specification (PAS) 2050	Developed in the UK by the Carbon Trust, the Department for Environment, Food and Rural Affairs (DEFRA) and the British Standards Institute (BSI). It was launched in October 2008 and revised in 2011	Based on an LCA approach. The use-phase is now included into the boundaries of calculations	PAS 2050
Japanese Ministry of Economy Trade and Industry (METI)	Linking with the voluntary carbon labelling trial METI released “ <i>The General principles for the assessment and labelling of Carbon Footprint of Products</i> ” in April 2009	Based on the Product Category Rules (PCRs)	Japanese CF METI Programme
Affichage environmental des produits de grande consommation (Environmental labelling of consumer goods)	The French Ministry of Ecology and Sustainable Development introduced a voluntary environmental labelling scheme. Includes GHG emissions, a ‘reference of good practices’ named BP X30-323 which has been developed by AFNOR and ADEME.	BP X30-323 defines the general principles of environmental labelling and a methodology for calculations	BP X30-323
International Organization for Standardization (ISO)	The ISO is working on a new standard for “ <i>Carbon Footprints of Products</i> ” for the quantification and communication of GHG emissions associated with goods and services	The standard builds largely on the existing ISO standards for life cycle assessments (ISO 14040/44) and environmental labels and declarations (ISO 14025)	The new standard, called ISO 14067 , is composed of two parts: the first one is about quantification and the second deals with communication. In comparison to the existing LCA standards it contains further provisions for the uniform quantification of GHG emissions
WRI (World Resource Institute) and the WBSCD in the US have developed two standards under the Green House Gas Protocol Product/Supply Chain Initiative	1. Product Life Cycle Accounting and Reporting Standard 2. Corporate Accounting and Reporting Standard: Guidelines for Value Chain (scope 3) Accounting and Reporting	GHG Protocol Product Standard	The GHG Protocol Product Standard

Source: Bockel et al. (2011)

However, the rising number of voluntary standards as Baddeley et al. (2012) recognise and Bockel et al. (2011) infer in their reference to the French carbon footprint labelling scheme, could

eventually and most likely through the process of adoption diffusion become mandatory. This raises a number of concerns in a number of different contexts:

1. What, why, where and how labels work?
2. How will consumers perceive labels?
3. What multifarious ways and complexities associated with the *mechanics* of carbon label schemes will need standardising and a certain degree of alignment for national and international applicability?; and
4. How will producers and governments perceive carbon footprint and label schemes?

Despite the concerns raised in points 1 to 4 above, the Greenhouse Gas Protocol is widely recognised as an international accounting tool for businesses and governments to measure, quantify, and manage GHG emissions, though its use is not mandatory. The Protocol is a publicly available initiative that provides a platform for the dissemination of GHG standards (WBCSD, 2009).

So far, the literature streams discussed in the preceding sections demonstrate willingness to create a 'level playing field' through a series of standardisation efforts in policy making for carbon footprinting standards and/or labels whether via LCA, third party certification, and/or the pursuit of due process certification requirements for labelling for communication. However, these have failed to galvanise a coherent or 'like for like' series of carbon footprint standard accounting methodologies and practices to date. In this sense and in the context of the previous paragraphs, the literature implies that in fact, carbon standards and labelling are not robust but in decline. Widespread efforts to 'harmonise' carbon standards have instead led to the continual non-standardisation of carbon accounting tools which ultimately brings them into disrepute. As such, the first proposition of this literature review outlined below reflects on the tensions raised previously.

Proposition 1

Carbon standards and labelling are not robust but in decline. Continued non-standardisation of carbon accounting tools brings them into disrepute.

However, the big question that the literature above does not address is the issue of collective social environmental responsibility. The emphasis on individual consumer choice detracts from identifying the climate change problem as one requiring a wider community response (Matusbaugh, 2005). Inquiry to the perspective of voluntary carbon footprinting and labelling amongst food businesses supplying food products to the 'market' is pertinent. In this context, the following section considers the multiple perspectives of carbon footprinting with a specific focus on the conceptualisations and perspectives related to LCA underpinning carbon footprint labelling schemes.

2.4 Carbon Footprinting: Multiple Perspectives and the Role of LCA

Carbon footprinting and labelling schemes in the UK are not only driven by an overarching policy imperative to decarbonise food systems but are looked upon as models of good practice around the World (Alves and Edwards, 2008). Widespread popularity with governments, many 'big brand' retailers and manufacturers of LCA approaches for measuring, calculating and communicating the carbon footprint of goods and services has led to LCA footprinting approaches speedily becoming the 'gold standard' requisite in the production of footprinting efforts that account for 'whole' supply chain impacts premised on notions of developing a 'level playing field' for standardised systematisation of process and practice. In this sense, however, as Freidberg (2015) indicates, the LCA production process is not always simply a matter of straightforward methodological application for, as a technique, LCA is open to multiple interpretations and variances in methodological approach (Plassmann et al., 2010 and Wiedmann and Minx, 2008) and perspective (Garnett, 2013). Moreover, in attempts at sourcing vital information LCA practitioners must traverse the ever increasingly complex relationships with corporations involved in footprinting goods and services (Freidberg, 2014).

Freidberg (2014) points out, the power of LCA as a governance technique is largely associated with the quantitative generation of "science-based" information analogous to the more qualitative and discursive claims regarding the 'comprehensiveness' of LCA based carbon footprint and labelling efforts. Here it suggested that footprinting food in the name of sustainability amounts to a form of techno-politics. Techno-politics in this sense is understood as the '*use of technology and technological expertise to pursue political goals broadly understood.*' (Freidberg, 2014 p.179). The academic literature is dominated by scholarship on states and their experts in national or global contexts (Hecht, 2011; Mitchell, 2002 cited by Freidberg, 2014 p.179) but little is known of the techno-political influence on environmental governance via the food product. Freidberg's (2014) study focuses on the "big brands" in food production and retailing (Dauvergne and Lister, 2012 cited by Frediberg, 2014 p.179). It examines how corporations together with and sometimes in mutual collaboration, engage in techno-political projects though their strategies for sustainability. It is argued that such companies tend to utilise LCA parameters and metrics to govern supply chains and seek legitimacy of that governance to improve comprehension and formulate interpretations of 'sustainable food' suited to individual bottom line interests of the governing corporation in question. Rationale for this focus is premised on the recognition that LCA is not the only tool for such purposes. Ultimately, the distinction of food footprinting as techno-political is made premised on its power to increasingly influence broader interpretations of sustainability (including efforts to mitigate and adapt to climate change through carbon footprinting) at the organisational and strategic level within "*big brand*" food businesses. The footprinting of food in this sense is fast becoming the basis for corporate and government initiatives aimed at sustainability (Freidberg, 2014), frequently on the basis of social marketing approaches for social change.

However, given LCA is commonly perceived as a quantitatively robust science based and holistic foundation for footprinting, through the retail market (Bumpus and Liverman, 2008 and Berry et.al, 2008), carbon footprint label use is emerging as a form of governance to govern and drive consumer behaviour towards decarbonisation (Newell and Vos, 2011). On the other hand, the possibility for diversity in interpretation, implementation, practice and communication means corporate 'transparency' of LCA carbon footprinting efforts could also obscure as much as they reveal (Freidberg, 2014). In light of the debates outlined above, the second proposition of this review suggests that:

Proposition 2

Carbon footprinting is a techno-political solution that substitutes a false science for a robust food policy.

Given the diversity of carbon footprint methodologies and the pluralistic growth in the familiarity, increasing use and exposure of the term 'carbon footprint', the next section considers some of the challenges associated with climate change, faced by the food sector. It then describes the fundamental components of the food sector and its food chains.

2.5 The Food Sector and Food Chain Stages

Lang (2009) in his paper entitled '*Reshaping the Food System for Ecological Public Health*' underscores the central assumption that health ought to be and is central to food and agricultural policy citing that evidence for more integration is almost irrefutable (Lang, Barling and Caraher, 2009 and WHO, 2003). It is argued that new dietary guidelines will require the integration of health, environment and other criteria, which should all contribute towards a definition of sustainability appropriate for the twenty first century.

A number of unprecedented challenges exist for the food sector in a twenty first century setting. These tend to relate to 'acute' policy issues surrounding climate change, the finite nature of energy supply, limitations related to food production capacities and the challenges of water stress across food supply chains (Lang and Barling, 2013). The food sector as it has matured since the second wave of industrialisation in the 1950s is largely associated with intensive, techno-centric modes of food production. Decarbonising economies, principally via decoupling economic growth and energy has become an economic, environmental and competitive concern in many sectors (Sundarakani et al., 2010), not least the food sector (Foresight, 2011 and Cholette and Venkatt, 2009).

Arguably, no other sector is more essential than that of food (Garnett, 2009) but it is here where the associated implications of the CCA to food industry actors are beginning to drive the development of standards and practices within wider policy goals in environmental improvements both at the national and international levels (Creese and Marks, 2009). Attempts to account for the interdisciplinary and overlapping nature of climate change plus its inevitable linkages to food

systems continue to attract attention as the agency, corporate and government response increasingly feature stakeholder involvement in policy formation (Bulkeley and Owens, 2009).

James and Friel (2015) provide a useful diagrammatic outline provided in Figure 7 below of the principal sectors of a food system and its food chain, encompassing production to distribution/retail and consumption together with the main food subsystems (industrial, alternative and civic) with the macro issues of environment, health and equity as desired outcomes. The sectors of the food chain range from production through distribution to consumption. They are underlain by a series of subsistence of governance including industrial structures, alternative commercial structures and civic organisation. These structures of governance have to deal with a series of externality problems of health, environment and equity. These three systems of the food chain, the governance of the food chain and externalities are examined in this thesis. A whole system perspective, one that considers the inextricable linkages between food chain stages, its heterogeneity, multiple actors at multiple levels, and need for integrative, multi-disciplinary, interdisciplinary and trans-disciplinary perspectives is a call increasingly made within the food science, nutritional science, health and nutrition and public health literatures (Lang and Heasman, 2015; Mayes and Thompson, 2014; Reisch et al., 2013; Scrinis, 2013; Lang, Barling and Caraher, 2012; Storey et al., 2008; and Haines et al., 2009). Nonetheless, much of the academic literature and policymaking for food chain resilience and sustainability remains heavily siloed.

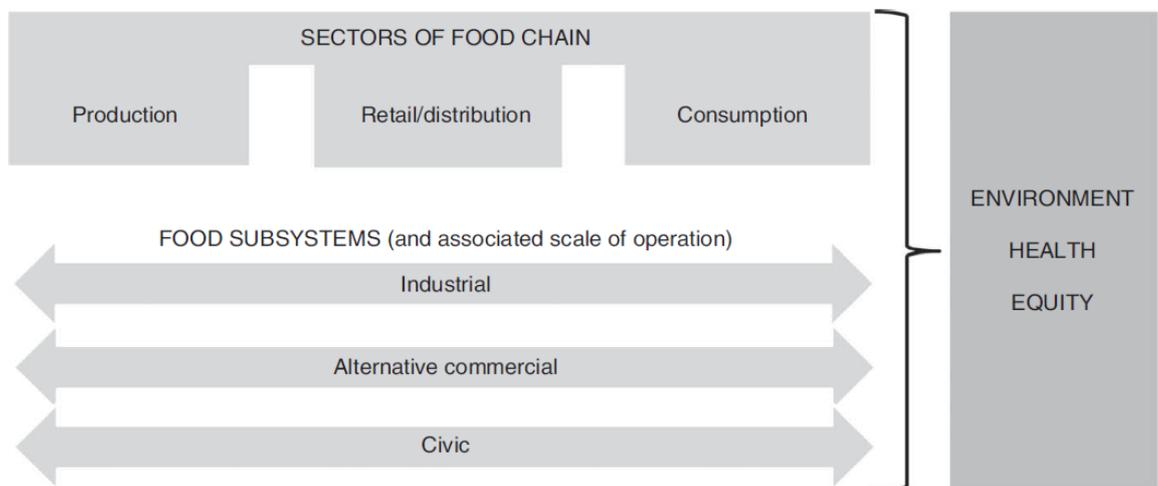


Figure 7 Whole system diagram illustrating the interrelationship between the food sector, its subsystems involved in delivering environmental change, health and equity outcomes

Source: James and Friel (2015)

For environmental change Seuring (2011) asserts an integrative whole system approach that considers the phases of food supply and demand is imperative as food consumers are an integral

aspect of the food sector as are its food supply chain businesses. As Sundarakani et al. (2010) highlight, customers as well as businesses involved in the design and operation of supply chains are increasingly concerned with reducing carbon emissions and 'green' supply chain management practices. Increasing interest in the development of green supply chain management capabilities relates to the integration of environmental thinking into supply chain management that could include multiple aspects of complete 'end-to-end' chains such as product design, selection of suppliers, material procurement, manufacturing, packaging, distribution and end-of-life management of products, that is disposal. Because the total food chain is so complex, it is difficult to produce any uniform method that is scientifically validated at each and every point of the chain.

Given the complexity and heterogeneity of the food sector, its numerous phases, scale and actors (civic-society, supply chain, government groups and consumers), the legislative definition for food businesses within the context of the contemporaneous UK political climate is outlined. Appendix 1 contains sections specifically outlining current UK legislative labelling regulation. The following sections also consider the role of food chain businesses in fostering sustainable food systems more broadly.

2.6 Legislative Definition and Context of Food Businesses

For clarification, this thesis draws upon the definition of businesses within food supply chains as 'food businesses' from the EC General Food Regulations 2004 and The UK Feed and Food Law (178/2002).

“‘food business’ means ‘any undertaking, whether for profit or not, and whether public or private, carrying out any of the activities related to any stage of production, processing and distribution of food’. This would include seasonal and sporadic businesses. The expression ‘stages of production, processing and distribution’ is defined in Article 3.16 and covers all stages from and including primary production (as defined in Article 3.17) up to and including sale or supply to the final consumer. For example, the activities of farmers, importers, manufacturers, wholesalers, distributors, transporters, retailers and catering outlets are covered.”

FSA (2012)

Food businesses operate within national and increasingly within the realms of international policy regimes (Reisch et al., 2016 and Kloeckner, 2012). Businesses are becoming increasingly aware of the nature of functioning within a globalised business world with interdependent routes of supply (Lang and Barling, 2012). Hence, internationally binding climate change agreements may become pertinent to business operations' functionality and effectiveness. Alongside, transparency for food safety, health and quality assurance, decarbonisation, efficiency gains and energy dependency are factors many businesses will need to consider (Garnett, 2013; Okereke et al., 2012; and Foresight, 2011).

Yet, finding a sustainable pathway for food sector businesses and food supply chains to deliver to consumers is inherently problematic despite sustainability objectives fast becoming a focal point

for governments, non-governmental organisations, national and international organisations (Lang and Heasman, 2015; Rettie et al., 2014; and Lang and Barling, 2013). These parallel the constancy of calls for food businesses to generate a meaningful and substantial sea change towards a sustainable food sector despite the difficulties associated with clearly defining a transparent understanding of 'sustainability' issues. This can be confusing for consumers as Berry et al. (2008) highlight:

"...sustainability trade-offs are often complicated and, in many cases, not fully understood. There is a danger that simply providing information may increase consumer confusion and ultimately lead to a backlash against the goal of sustainable consumption."

Source: Berry et al. (2008, p.5)

A sustainable food sector in this context is conceptualised as one which holistically encompasses food commodities' multiple phases from the point they are sourced, produced, packaged, stored, distributed, sold and consumed (Wallgren and Hojer, 2009). This perspective, as Berry et al. (2008) and Freidberg (2014) put forward, means that simply communicating climate change impacts (via carbon footprint labelling for example) is not the panacea to a low-carbon food basket as much of the value derives from measuring, acknowledging and actively reducing footprints. This viewpoint acknowledges the vital role of the business response and the influence within supply chains to advocate consistency and effectiveness in reducing carbon consumption to eradicate the 'worst offending' products from their shelves (Berry et al., 2008). However, it also assumes consumers understand and want climate relevant information in the form of carbon footprint labels and that market demand is strong enough to warrant such efforts (Finkbeiner, 2009).

Food systems are widely known to produce carbon/GHGs at all stages of relative supply chains, from inputs, agricultural production processes through to processing, manufacture, storage and distribution to retail and consumers (Garnett, 2009 and Foresight, 2011). The UK Government's Foresight Report of 2011 recognises the increasing impetus for change in the global and national food system and the wide range of measures likely to be adopted until 2050 as being driven from four directions:

- Market mechanisms for global carbon reduction;
- Compliance with specific emissions regulations;
- Market responses to changes in public attitudes and behaviour with regard to low-emissions food; and
- Corporate behaviour in the mitigation of climate change.

Foresight (2011)

This is significant given the food system as a whole is the UK's biggest employer, and food and drink production comprises the biggest manufacturing sector (DEFRA, 2015 and Lang and Teasman, 2015). Similarly, food and drink is the EU's largest manufacturing sector, generating a not insignificant revenue figure of €1,048bn in 2012, employing directly approximately 4.24 million people serving approximately 500 million consumers. Although large companies are relatively important employers, more than 90% of the food companies in Europe comprise small to medium sized enterprises³ (SMEs) that account for 64.3% of all EU food and drink employment (Lang and Heasman, 2015).

Certainly, all businesses will have access to PAS 2050 as it is publicly available but principal determinants for its uptake may vary dependent on the demand for a commodity produced, the type of commodity, cost of administration and the position of companies within given supply chains (Cohen and Vandenberg, 2012; Upham et al., 2011; McKinnon, 2010; Finkbeiner, 2009; Hogan and Thorpe, 2009; Berry et al., 2008). This indicates that while such standards imply universality of access, there is little guarantee of uptake for such voluntary standards. The policy framework for food appears to be 'plastic' particularly given the move from a focus on food security has yet to shift substantively towards transformative change in the broader context of sustainability.

Following on from the legislative definitions of food businesses and the potential role of food businesses in fostering lower carbon and sustainability imperatives, the next section looks to the function of policy in the macro contexts of food nutrition and sustainability.

2.7 Food Nutrition and Sustainability: Food Policy

The UK food-related policy landscape is characterised by numerous policies, many of which have been driven by EU Directives aimed at the agriculture and land use sectors (Garnett, 2008). Despite this agricultural policy focus, there has been a growing emphasis on 'food' in policy (Garnett et al. 2015 and Barling, 2007), twinned with a growing foci on the self-regulation of food systems incorporating market-based and market-led imperatives designed to ameliorate the adverse environmental impacts of food systems at production, processing and retail stages (Fuchs et al., 2011). As a result, this is generating a contemporary emergent form of more complex analysis and policy direction. Lang and Barling (2012) explain it was the year of 2008 that marked a point of departure in the old discourse on food security and insecurity. It is acknowledged uncertainty remains as to whether a clear analysis will supersede or replace it. This has occurred in parallel to a growing call to increase investment in agricultural research and development, new technologies, and to consider, manage and reduce waste and improve supply chain efficiencies (Foresight,

³ A small company is defined as having 10-49 employees; a medium company 50-249; and a large company as one with more than 250 employees (Lang and Heasman, 2015 p.190).

2011). As such, the food system faces a series of significant challenges (social, environmental and economic).

Lang et al. (2012) from a food security and sustainability perspective assert that the 2007-2008 food crisis occurred at a time when the global food system was already under tremendous stress with key indicators moving towards the wrong direction. They cite the case of biofuel production as an example and explain that while biofuel production exacerbated food production and supply, biofuel production did not itself create the crisis (Evans, 2008 cited by Lang and Barling, 2013). From this viewpoint, simply raising food production to tackle food insecurity is not only simplistic and inadequate but necessitates more nuanced and subtle questioning such as 'how'? With what focus, prioritising whom and at what cost to finance, people, the environment and land use? Who should shape and drive change, government, commerce or civil society? In what system of governance should these be combined, scale and level: local, national or international levels? While these broad questions are outside the scope of this research inquiry, they demonstrate the challenges policy makers face in addressing unsustainable food systems.

The difficulties in integrating policymaking and development on nutrition and sustainability are not new. Lang and Barling (2013) present a wealth of substantive evidence and describe some policy thinking at national, European and international levels of governance focused on particular policy 'hotspots' such as meat and dairy, sustainable diets and waste. To gain insights as to the environmental impact of food systems, the authors suggest that nutrition science ought to "*draw upon traditions of thinking which have recently been fragmented*". They assert that although the discipline of life sciences dominates at present; the perspectives of life sciences, social and environmental are all essential for policy engagement and clarification to occur.

The contemporary establishment of policies and institutions are largely a response to rising concerns regarding food supply and productivity resulting in the increasing amalgamation and super imposition of policies surrounding food safety and quality, the environment and health (namely obesity) and climate change reflecting the lack of joined-up policy making and integration at the wider policy level (Lang and Rayner, 2007 and Lang and Barling, 2013). Food systems consequently harbour a diverse range of environmental and social interactions. Unsurprisingly, the multiplicity of perspectives and differing world-views expressed within the narratives of food system literature prevail (Garnett et al., 2015 and Geels et al., 2015). These have led to multifarious policy challenges that require a joined-up, direct and pragmatic response for a lower carbon future. To address such complexity of approach, this research inquiry focuses on examining evidence for policy making (specifically in this case, for voluntary carbon footprinting and labelling) by drawing upon the streams of literature concerning food policy perspectives, voluntary policy mechanisms, private governance and policy tools designed for sustainable food consumption. This is because as Lang and Barling (2013) claim, despite the growing general scientific consensus that the food

system generally both illustrates and is a key element in the global environmental and sustainability challenge, less unanimity exists on how to address the enormity of this through policy. Here, it is maintained that while processes have begun at national and international levels, they are not yet receiving adequate political attention or support. This is partly because the environmental perspective on food systems raises some serious questions about notions of progress generally and for food in particular.

Lang and Barling (2013) p.1 ask: “*Can we really eat what we like, have ever more, and more cheaply?*”. This is (and perhaps intentionally) is immediately thought provoking given the citation of evidence from data of the Global Footprint Network (2010) footprint analyses, the findings for which are startling. These data support that respectively, the U.S and the EU consume resources (energy, land, materials) far above the rate of a single planet’s limits. The U.S. consumes resources as though it inhabits five planets and Europe, three. Here, food again is a salient factor relative to consumption. As such, complexity is inevitable given the considerable implications for nutrition science and potential challenge of contradictory foci in addressing environmental impact and dietary advice. Similar to nutritional and dietary advice (Guthrie et al., 2015), PAS 2050 based carbon footprint labelling is underlain with a ‘scientific’ standardised life cycle method that could, theoretically, reduce complexity and better harmonise food chain efforts in measuring and reducing carbon impact by stimulating market actors to change business behaviour to lower carbon production and supply of food products (Upham et al., 2011).

The challenge of sustainability is believed to not only apply to the restructuring of societal definitions of progress, consumer expectations and the rights to food but equally to the “*tasks demanded of nutrition science itself*”. The gravity of such a statement is acknowledged by the authors who reiterate that, as proposed elsewhere (Lang, Barling and Caraher, 2009) and Rayner and Lang (2012), from a policy perspective, food nutrition is not a homogenous stand-alone issue and thereby poses particular difficulties for policymakers across the board, whether at the governmental, market, or civil society level.

Mayes and Thompson (2014) in their analysis on biopolitics, ethics and nutritional scientism maintain public health advocates, government agencies, and commercial organisations increasingly use nutritional science to guide food choice and diet as a way of promoting health, preventing disease, or marketing products. Similarly, Lang and Barling (2013) highlight how nutrition science, analogously to other scientific traditions, embody a series of different intellectual traditions with each proffering a different set of emphases for public policy making.

In practice, this means focus is largely placed on the price mechanism and engagement/responsibility placed upon consumers (Hansen and Jespersen, 2013 and Galizzi, 2012). This is despite the fact that as Lang and Barling (2013) assert, farmers in both developed

and developing countries recognise the power of consumers is comparatively weak and disparate against the power of retailers or food chains' traders, buyers and contracts. Maxwell and Slater (2003) point out the oligopolistic, monopolistic and rent-seeking issues within the food system alongside persistent market failure. The authors refer to Lang's analysis of concentration in input supply and marketing who find that, while this in itself does not prove uncompetitiveness, it does raise questions to do with power along the global supply chain and the scope for regulatory intervention at the nation-state level.

Shove (2010) points to the increasing role of the State in 'supporting' private or self-regulation/market mechanisms specifically for social and environment impact. She refers to the surge in interest regarding carbon footprinting and carbon labelling schemes towards the end of 2010 in the UK but expresses caution with respect to the efficacy of such 'nudge' approaches within 'choice' architectures either in the form of labelling or process based standards for industry given the enormity and complexity of the social and environmental challenges inherent with a heterogeneous food system.

However, the 'State' is now no longer considered the key arena for decision making in food policy formation (Scrinis and Parker, 2016 and Fuchs et al., 2011), a situation unlikely to change markedly in light of the UK's Brexit vote to leave the EU (Lang and Schoen, 2016). It is corporate interests that now play a key role in food supply and it is these interests that are becoming ever more conspicuously present within intergovernmental policy regime formation, implementation and control (Scrinis and Parker, 2016; Lang and Barling, 2012; and Fuchs et al., 2011).

Indeed, Lang and Barling (2013) explain that while in the early 2000s, governments remained reluctant to enter this sensitive policy terrain, food companies realised otherwise. Okereke et al. (2012) also point out, the matter of climate change modifies business capacities and questions the view that 'green' issues are merely a niche market and opportunity for product differentiation (Okereke et al., 2012). Lang and Barling (2012) articulate this seemingly oxymoronic industry response ordinarily vilified for its lack of will to engage meaningfully with social justice and the environment:

"There is now a paradox in the food policy world: companies, often depicted as the enemy of environmental and social justice, are now engaging. Some see this as 'light green' or 'greenwash', others as essential (Monbiot 2000; Porritt 2005)."

Source: Lang and Barling (2012) p. 318

While governments appeared to downgrade their interest, Lang and Barling (2013) state that new corporate level concern grew resulting in a number of industry led initiatives citing that some

retailers⁴ in the UK ‘overtly’ adopted ‘choice-editing’ within their overall strategies, effectively making choices for consumers before they could select between products. In addition, while more recent moves have begun to focus on the case for auditing of food in terms of ‘embedded’ water (Hoekstra and Mekonnen, 2012), biodiversity and land use (GFN, 2010) given the “*current definition and measurement of (un)sustainability of food are dominated by climate change thinking and data, exemplified in CO₂ and CO₂ equivalent (CO₂e) measures*” (Lang and Barling, 2013 p. 7). While initial footprint analyses of food and diet have concentrated on these measures, Lang and Barling (2013) note caution as to whether carbon footprinting can be stretched to address the social and ethical issues now needed.

Essentially for policymakers, the debates surrounding ‘farm versus food system’ focus include labour efficiency, the role of ‘big’ business, Western levels of food consumption, the sustainability of diets (the integration of human and environmental health), the nutrition transition symbolised by higher levels of meat consumption, dairy and soft drinks and power politics and relations are factors framing a broader food system challenge. While the old productionist paradigm is said to have accepted a culture of ‘choice’ mostly dependent on and largely shaped by price where reduction of price was the goal; the emergent agenda is concerned with addressing other factors equally. The worry here is that the integration of other issues such as climate change and social justice, water stress and land use would fundamentally alter food systems and make them more expensive (Richards et al., 2013 and Mutersbaugh, 2005).

However, while there are also visible political efforts in the design of more sustainable systems of production and consumption (Vittersø and Tangeland, 2015) the focus of much of this work has been on maximising efficiency in prevailing systems of production and supply and the reduction of negative effects of individual products and services (Glover et al., 2014). Little consideration in political terms is placed on the need to decrease aggregate consumption of scarce or polluting resources. Interestingly, Reisch et al. (2016) point out that both global and national policies continue to disproportionality expect to decouple economic growth from negative environmental and social impacts transpiring in doing little to move from a ‘Business as Usual’ approach to transformative, less carbon heavy and more sustainable systems of production and supply (Liobikiene and Dagiliute, 2016). So far, the literature also demonstrates a gap in linking food products, consumption and the environment in policy-making and uptake. This appears largely to be attributed to the multiple scientific perspectives that inform food policy, further exacerbated by the voluntary nature of

⁴ Marks & Spencer plc (2009) About Plan A: Plan A is our Five Year, 100 Point Plan. London: Marks & Spencer plc. <http://plana.marksandspencer.com/about>

resultant private standards, which are largely championed and supported by the food industry. Here, the food industry function as key stakeholders, ultimately shaping and influencing policy-making for self-regulation in a neo-liberal market economy paradigm. In light of the evidence outlined in the preceding sections, the third proposition suggests that access to PAS 2050 is not necessarily a barrier to stakeholder engagement and practice. Additionally, while the focus of food policy has shifted considerably from a strong focus on food security, this has moved towards a 'weak form of sustainability'. In this vein, Proposition 3 is detailed below:

Proposition 3

There may be universal access to PAS 2050 but there is no universal uptake. The policy framework is from strong food security to weak sustainability.

In light of the scale of the 'food' policy problem outlined above and with respect to policy making for food system sustainability at the national, international and supranational levels, the following sections consider the role of self-regulatory market mechanisms for the environment within a supply chain management context. This is important in understanding the context of voluntary market mechanisms within the food chain dynamic.

2.8 Voluntary Market Mechanisms as Private Governance for the Environment

In the context of self-regulation and/or market-led initiatives (as put forward by Fuchs et al., 2011)⁵ it is useful to consider the potential of the PAS 2050 carbon footprint standard and associated labelling scheme in driving behavioural change amongst industry stakeholders across the food supply chain spectrum, given its voluntary mandate and supply chain applicability. Mueller et al. (2009) show evidence from a supply chain perspective that such environmental standards are passed upstream in the supply chain on a practical basis, "*while the normative implications and stakeholder requirements might not even be integrated into the standard at all*" (p. 509). For furthering corporate social responsibility (CSR) in supply chains, such standards, Mueller et al. (2009) contend, seem necessary to drive related measures.

Motivational behaviours at the organisational level for policy uptake, specifically, independently verified (third party⁶) life cycle based footprint labelling, and carbon reduction standards in food chain

⁵ Fuchs et al. (2011) suggest private retail standards are a form of private food governance.

⁶ The International Institute for Sustainable Development (IISD) has classified labelling initiatives into a series of label 'types': "*Type I is a multi-attribute label developed by a third party; Type II is a single-attribute label developed by the producer; Type III is an eco-label whose awarding is based on a full life-cycle assessment.*" IISD (2013) p.1

businesses have not featured in the academic literature to date (Liu et al., 2016). Instead, for instance, much of the supply chain management literature streams have examined voluntary environmental certification standards such as ISO 14001, quality standards such as ISO 9000/1 and practice based labelling imperatives such as the Forest Stewardship Council (FSC) certification process as instruments towards CSR in supply chains (Chkanikova and Mont, 2012; Sharfman et al., 2009; Arimura et al., 2008; Berkhout et al., 2008; Melnyk et al., 2003; and Walton et al., 1998). This is based on the assumption that such standards increase legitimacy among stakeholders. However, only a few studies about the empirical legitimacy of environmental and social standards exist, namely regarding the ISO 14001 EMS (Potoski and Prakash, 2013; Marimon et al., 2012 and Arimura et al., 2011). This thesis adds to this lacuna of research with respect specifically to voluntary industry regulations such as the ISO 14001 series.

For example, strong world-wide and cross-sectoral uptake of the voluntary ISO 14001 standard for environmental management is also thought-provoking given the delicate political landscape under which its formation came about. As mentioned at the outset of this thesis, the very creation of the nationally and internationally applicable but voluntary ISO 14000 and 14001 series was the consequence of a formal request at a forum of the 1992 United Nations (UN) Rio Conference on Environment and Development that requested ISO to create an Environmental Management System (EMS) standard. Marimon et al. (2012) explain that while the process to establish the ISO 14000 and ISO 14001 series was controversial, once sanctioned, there was a clear consensus for adoption among the three major economic blocs at the time (mid 1990s). Immediate support by the United States was attributed to its administration of the time who appeared concerned that the European equivalent developed in 1993 entitled the Eco-Management and Audit Scheme or EMAS (also voluntary, internationally applicable for all types of public and private sector organisations) could potentially become a technical barrier to free trade. This was largely due to the history of the quality ISO standard, ISO 9001 that had been developed in the 1980s. In addition, Japan's strong administrative support accelerated the diffusion of ISO 14001 (Arimura et al., 2011) and by the European Community (EC) which had the head start in terms of having the largest number of companies certified in accordance with the ISO 9000 quality series, the structure of which shared close commonality in configuration and dissemination of uptake advocating economic gains/profits for both companies and stakeholders.

Indeed, in Japan, Arimura et al. (2011) found that government advocacy for non-state, voluntary industry-led environmental standards; specifically, ISO 14001 directly resulted in augmented uptake across the manufacturing sector and simultaneously positively influenced further pursuit in the uptake of green measures to improve environmental performance. Marimon et al. (2012) whose study over ISO 14001 uptake looked to the rate of diffusion of adoption in all sectors of OECD countries on the other hand, attribute the broad global uptake and comprehensive adoption of ISO14001 across all sectors to the broad acceptance by market actors of the practice/process based

standard leading to comprehensive and evenly distributed diffusion rates in market sectors. However, such evidence should Bansal and Roth (2000) suggest be contextualised against the stark cultural differences across a number of dimensions. For instance, it is cited that the cultural management contexts of governmentality is more paternalistic in Japan than in the UK which is more 'individualistic' in approach.

Evidence from a study by Mueller et al. (2009) through a 'legitimacy' lens identifies which criteria are important for selection, implementation and improvement in order to achieve a company's aim, but also to strengthen the legitimacy of social and environmental standards within a supply chain governance context. Strong evidence exists that supply chain management has an impact on the diffusion of both quality and environmental standards (Sarkis et al., 2011; Albuquerque et al., 2007; Corbett, 2006; Corbett and Kirsch, 2001). In this regard, it could be argued that the same would hold true for social standards. However, the literature shows that the usefulness of such standards depends on their acceptance by both customers and suppliers to agree appropriate conduct (Terlack and King, 2006) and therefore ensure legitimacy both among the companies in the supply chain partners as well as towards other stakeholders (Hervani et al., 2005).

Fuchs et al. (2016) expand upon the issue of private governance arguing the centrifugal force of 'power' in its role in influencing social change. Here, they contend the value in adopting a 'power' lens in sustainable consumption research and policy making is essential given politics and power are part and parcel of the human condition (Arendt, 1959). Yet to date, little attention to the role of power in sustainable consumption and 'absolute' reductions research and governance is evident in the scholarly research. The authors' state the case that given this lack of clarity regarding the function of 'power' in sustainable consumption and absolute reductions literatures; these have "*little choice but to develop an explicit, differentiated and comprehensive analysis of power dynamics in consumption (Fuchs, 2013a; Zeno bio Gunneng, 2006)*" (Fuchs et al., 2016 p.299).

They provide illustrative examples of how various forms of power are important to the maintenance of the current, unsustainable system and to understanding how the system responds to challenges and (re)stabilises itself. In this study Fuchs et al. (2016) p. 302 examine "*...how power is exercised at different stages of the supply chain, for instance to keep meat prices low and thus maintain and expand meat consumption, as well as the forms of power that make the system resistant to political, societal and economic challenge*".

The call here is that policies for sustainable consumption and reduction ought to include effective strategies to change those basic conditions and action despite the sensitive nature of such food policy terrain. As such, there is much need to understand more holistically the perspectives of food chain actors including the food industry, NGOs and consumers.

Scholastic discourse demonstrates that evidence from behavioural and social science is often not incorporated into policy design. Such 'mainstreaming' and generic normative value attributed to ecological responsiveness simply reinforces the focus of policy makers upon technological innovation where the aims broadly centre on production and product efficiency (Garnett et al., 2015). Consequently, emphasis is commonly placed upon improving environmental 'efficiency' through use of certain process-based standards that underpin many food labelling schemes (including PAS 2050 carbon footprinting) generally designed and advocated by policy makers, the food industry and academia typically from the agricultural sciences (Garnett et al., 2015 and Mont et al., 2013). As such, alternative foci on "*social innovation, alternative value-creation models and sufficient consumption*" Mont et al. (2013 p.13) are superseded by a growing emphasis on production and product efficiency principally via technological innovation.

In terms of consumption, Mont et al. (2013 p.13) underscore, that in the main, research concerning food consumption largely "*demonstrates that policy makers do not routinely make the link between environmental issues and consumer behaviour or incorporate evidence on consumer behaviour into their decision-making*". This environmental food policy design problem is not unique (Garnett et al., 2015) as it is largely borne from misconceptions and myths about consumer behaviour that perpetuate a mainstream discourse on sustainable consumption (Mont et al., 2013). However, the mainstream discourse of sustainable consumption in policy arenas simply encourages policy makers to focus on technological innovation for production and product efficiency where environmental impacts are largely dependent and/or attributed to consumption patterns (Jacobs, 2013).

Chkanikova and Lehner (2015) point out that for food sector businesses particularly, sustainable market development through the promotion of 'sustainability' in production and consumption practices is increasingly considered a 'market' challenge to be handled by private actors over governments. They refer to the food sector as an example of such tendencies where NGOs and academia are said to increasingly consider the influential role of retailers in transforming their operational sustainability credentials as well as the potential to remodel supply chains and influence consumers (Scrinis and Parker, 2016). Earlier research by Fuchs et al. (2011) concurs with the notion of the pivotal role of private actors in terms of rulemaking, monitoring compliance, and enforcement. Here, it is recognised that the Food Industry and its retail corporations through the creation of governance institutions such as private standards, CSR initiatives and public-private or private-private partnerships (PPPs) have become major players in the governance of the global food system. This is reflective of the burgeoning academic literature streams concerning CSR and PPPs across the domains of green supply chain management, marketing, consumer behaviour and food policy to name but a few (Scrinis and Parker, 2016; Fuchs et al., 2016; Bocken et al., 2014; Marimon et al., 2012; Pelozo and Shang, 2011; Sarkis et al., 2011; and Hartlieb and Jones; 2009).

Fulponi (2009) in her examination of the principal determinants that drive major food retailers from countries within the Organisation for Economic Co-operation and Development (OECD) ultimately recognises the 'buyer' power of consumers, the influential role of corporations and the growing voice of civil society organisations. Development of private standards for food safety and quality by corporations are increasingly shifting towards additional standards for labour, environment and animal welfare. This is principally driven by an overall strategic orientation to maintain customer loyalty and market share to protect against potential legal liabilities as well as retain and enhance reputational credibility (Mueller et al., 2009). However, the democratic justifiability of such approaches to governance within the global food sector; specifically, where private retail standards act as a form of private food governance, is viewed with a deal of scepticism (Reisch et al., 2016; Fuchs et al., 2013; and Hartlieb and Jones, 2009). This could perhaps be symptomatic of the inevitable consequence of market capitalism (Richards et al., 2013).

Indeed, Fuchs et al. (2011) highlight global food and agricultural governance is increasingly being created not only by inter-governmental actors but also by private actors. Here, the move away from traditional command and control regulation towards alternative forms of regulation such as self-regulation, co-regulation, and management based regulation and other private systems of food governance are suggested to be associated with highly ambivalent implications for the broader sustainability of the global agri-food system. The authors argue such forms of private retail standard development, implementation, dissemination and practice occur within the private sphere of food governance. Yet, such private retail governance institutions inherently lack democratisation given private actors are not subject to or legitimised by elections a *demos*.

Freidberg (2014) echoes this broad conundrum where the surge in interest and of carbon footprint and life cycle development within the food sector especially, is increasingly amounting to a form of 'techno-politics' driven by corporations' own interpretations and motivations embedded within their own strategies for sustainability. Chkanikova and Lehner (2015) suggest such forms of private retail standards including eco-branding, third party verification and certification can be explained as private institutional arrangements '*that motivate and enable sustainability governance by retailers both upstream and downstream in the value chain.*' While private eco-branding is put forward as a retail-driven institutional arrangement for governing sustainability issues in the value chain; the principal limitation of such a 'complementary' form of governance in delivering sustainability improvements to the 'market' is the need for rigorous third-party certification – an arguably expensive and contentious component of any governance regime (Richards et al., 2013 and Mutersbaugh, 2005).

Insights from the work of Mutersbaugh (2005) are useful in this sense as the evidence from their research supports the assertions put forward by Chkanikova and Lenher (2015) as well as Fuchs et al. (2016) and Fuchs et al. (2011). In examining the harmonisation of standards and standard

setting, Mutersbaugh (2005) ask whether globalised standards embedded in multilateral institutions promote a fundamentally new form of globalisation and whether these in themselves create unique spatialities as maintained by Peck and Tickell (2002). The contention is given as a qualified yes. Here, the work of Karl Polanyi (2001) is cited to highlight the growing shift towards the formation of new spatialities where globalised standards have increasingly morphed to also provide new forms of 'governmentality' as well as modern areas of social action:

"...What is new to the contemporary era is a shift in the institutional location of inspectability to multilateral institutions...Globalized standards provide economic liberalism with an ability to reach well beyond currency management and directly affect the practice of everyday work. Although the gold standard had extreme (and harsh) local effects, the standard itself did not stipulate particular activities that had to occur at dispersed local sites, nor, for that matter, did it require (or 19th-century international institutions acquire) an apparatus of global reach to ascertain whether scattered groups were in compliance with the standard. Globalized standards provide a new means of governmentality, yet also a new arena of social action." Mutersbaugh (2005) p. 2033

Essentially, in examining specifically, the case of voluntary standards for US organic and fair trade certified coffee producers, Mutersbaugh (2005) found that such standards are fundamentally private and contract based. NGO involvement, partnership and administration tends to include global trade institutions including for instance, the World Trade Organisation (WTO), national governments and industry groups within a stakeholder 'rubric'. It is noted that while goals vary in standard setting, instead of focusing on working towards more rigorous labour rights and protections for workers and the environment, the most dominant and common call by many participants, is for the mainstreaming of these standards. This would typically include for instance, all major coffee marketing agents, together with a common code (a series of minimum environmental and labour standards) that are negotiated and agreed by all stakeholders. As such, participants generally avoid revising globalised standards in favour of the development of voluntary standards embedded in 'social-contracts' that espouse long contract terms, preferential client status and transparent price premium systems.

Matthews (1993) p. 26 cited by Deegan (2002) p. 292 state:

"The social contract would exist between corporations and individual members of society. Society as a collection of individuals provides corporations with their legal standing and attributes and the authority to own and use natural resources and to hire employees. Organisations draw on community resources and output both goods and services and waste products to the general environment. The organisation has no inherent rights to these benefits, and in order to allow their existence, society would expect the benefits to exceed the costs to society."

Indeed, as food supply chains have become more globalised in nature, they have in turn become inextricably linked with financial markets at the local, national, and international levels (Richards et al., 2013 and Levy, 2008). Additionally, they are increasingly influenced and to varying degrees, affected by world trade regulation (Pouncy, 2011), European legislation, nation-state regulatory regimes as well as private food governance schemes (Baines, 2014; Fuchs et al., 2011 and Manning and Baines, 2004). Uptake and development of self-regulatory mechanisms, namely industry

standards and eco-labelling schemes have grown in juxtaposition with the prominence of food manufacturing and processing sectors in modern food economies where technological and logistical improvements have predominantly become associated with the generation of high externalities (Fuchs et al., 2011 and Bleda and Valente, 2009).

As such, supply and demand aspects of food are almost continuously interlinked with the political economy in question as well as the social, geographic, and demographic nature of given societies (Daniels, 2004). The literature shows that food supply chains are also inherently heterogeneous and can encompass a range of networked entities up and down supply chains at the local, national, and international level (Mollenkopf et al., 2010 and Jack, 2007). The globalised nature of supply chains also means that food businesses operating within international markets are also at risk of exposure to volatile national and international market forces (Mollenkopf et al., 2010 Ericksen, 2008; Mutersbaugh, 2005; and Vasileiou and Morris, 2006). Given these factors, twenty first century businesses are increasingly concerned with developing supply chain capabilities to facilitate the adoption of proactive environmental policies (Christopher, 2013 and Sarkis et al., 2011). Yet the corporate response is not exclusively or collectively aligned towards negating potential environmental regulatory compliance in times of climate change. It extends to the wider imperative of seeking competitive advantage where bottom line profits endeavour to incorporate inevitable 'win-win' elements of social, economic and environmental gains whilst simultaneously, improving financial performance (Senge, 2010; Walker et al., 2008; Ferguson and Toktay, 2006; Mutersbaugh, 2005; and Porter and Van de Linde, 1995).

What this detailed overview points to is the severe fragmentation of science informing food policy. That fragmentation is generated because of emphasis on individualisation in social science and, more importantly, corporate control of the agenda of biophysical science (Mayes and Thompson, 2014). As such, there is little link between food production, consumption and environmental policy. The fragmentation of science informing food policy is because of private and corporate control of science - Proposition 4. As such, Proposition 4 is detailed below.

Proposition 4

There is little link between food production, consumption and environmental policy. The fragmentation of science informing food policy is influenced substantially through the private and corporate control of science.

Further, the corporate uptake of environmental issues, especially climate change is largely precautionary and due to the threat of an international legal regime - Proposition 5.

Proposition 5

Corporate uptake of environmental issues, especially climate change is largely precautionary due to the threat of an international legal regime.

In light of the role of private governance and 'power' as key influencers in food policy making for sustainable food consumption, the following paragraphs look at the role of supermarket retail power in UK food supply chains.

2.9 Supermarket Power in UK Food Supply Chains

Typifying contemporary UK agri-food supply chains is the increase in supermarket power, reflected in the rise of 'buyer power' and respective influence of 'near consumption end actors' (Barling, 2007). As such, modern food economies in the UK are increasingly characterised by a growth of food supply consolidation where food producers tend to be less powerful than processors or retailers (Baines, 2014; Anselmsson and Johansson, 2007; Manning et al., 2006; Lang et al., 2005; and Lang, 2003).

Indeed, traditionally, much of the UK food sector is characterised with this ongoing increase in highly consolidated and vertically integrated supply chains that also increasingly compete against one another (Burch et al., 2013 and Christopher, 2013). However, these supply/commodity chains include a number of production and processing food businesses upstream who may be economically dependent on multiple downstream supermarket retail giants (Spence and Rinaldi, 2014; Nereng et al., 2009; Barling, 2007; Thankappan and Flynn, 2007; Manning et al., 2006; Caraher, 2004; Blindel and Hindley, 1999 and Walton et al., 1998).

Burch et al. (2013) cite Lang and Heasman (2004) to illuminate how the management and organisation of UK agri-food chains are typified by the power and control of supermarkets. Such control it is stated is exercised by '*no more than a handful*' of retail corporations. The authors add that in 2004 four retail corporations controlled 75% of all sales in the supermarket sector in the UK (Lang and Heasman, 2004 cited by Burch et al., 2013). This is corroborated by Dowler et al. (2007) who recognise that given the dominance of supermarket power in the UK, food commodity purchases predominantly take place in multiple retailers with 75% of all food being purchased from Tesco, Sainsbury's, ASDA and Morrisons. Little has changed over the last decade (Burch et al., 2013). This is despite the entry and rapid rise of the German retailer, Aldi. Indeed as proffered by Richards et al. (2013) and Baines (2014) producers of raw commodities upstream of a supply chain continue to be increasingly vulnerable to the oligopolistic market power held by supermarket retailer chains whose market share expanded as a result of the expansion and consolidation of global food retailing.

The point by Dowler et al. (2007) is significant as they infer that 75% of the UK population shop for groceries at one of the 'big four' supermarkets. In a well documented and widely cited UK Government Report Foresight (2011), the supply of food in the United Kingdom is described as being largely shaped by the local, European Union, and global markets.

From a supply chain perspective, 'greening' supply chains known as 'green supply chain management' is a response to the twenty first century dilemma of climate change where an increasing onus is placed upon supplier businesses to simultaneously meet demand and act responsibly to minimise adverse environmental impact (Glover et al., 2014; Sarkis et al., 2011; Senge 2010 and Walker et al., 2008). In part, this is the imperative of PAS 2050. However, in reality, the academic literature indicates it is the retailers or chain 'captains' that possess the balance of control (Glover et al., 2014; Manning et al., 2013 and Barling, 2007). As mentioned previously, Fuchs et al. (2011) state that private retail standards are a form of private food governance that have significantly expanded over the last couple of decades, particularly in the food sector. Indeed, supermarkets increasingly bypass wholesalers in favour of direct contracts with farmers resulting in supermarkets imposing their own 'terms' as Richards et al. (2013) indicate, in the form of private regulatory standards, which are 'voluntary'. Fuchs et al. (2011) in their paper outline the most prominent private retail standards and initiatives (on p. 355) within contemporaneous private retail food governance. These include The British Retail Consortium Global Standard for Food Safety (BRC); The International Food Standard (IFS); Safe Quality Food (SQF); The Global Food Safety Initiative (GFSI); The Global Partnership for Good Agricultural Practice (GlobalGap); The Marine Stewardship Council (MSC); and The Ethical Trading Initiative (ETI).

Returning to an earlier publication by Matusbaugh (2005) which is first mentioned towards the end of the previous section, it is possible to draw upon the examination in its study of the U.S. 'green labelled' organic and fair trade certified coffee producers. More specifically, the examination analyses the impact of the 'harmonisation' of standards on associated agro food networks which reveals four shifts associated with the nature of globalised food chains (an increase in the importance of multilateral institutions; changes to standards language; displacement of network-specific standards; and a shift away from relational standards) and more specifically, point to the role and influence of ISO standards via the International Organisation for Standardisation. Two single seal initiatives, Social Accountability in Sustainable Agriculture (SASA) and the Sustainable Coffee Partnership (SCP) are scrutinised. The rules for these agree that fair-trade, organic, and environmental concerns should be combined in a single label. However, each scheme differs fundamentally in approaches to implementation and certification. SASA prefers that standards be embedded in regulatory frameworks, independent of networks. The SCP proposal, though less well developed, has put forth a notion of private, contract-based voluntary standards along the lines of ethical supermarket labels (Freidberg, 2003b).

Polanyi's (2001) observation is referred to which describes the characterisation of such standards as market-managing initiatives which unite diverse partnerships of social and state actors. Both the SCP and SASA initiatives comprise social-justice and environmental groups joined to varying degrees with industry and state actors. These relationships afford the respective initiatives with vital

measures of transnational institutional support and social acceptance; yet they also limit their scope. This is because the ISO and the WTO are known to be inherently involved in the formation of certification language and its introduction into agro food standards such as the SCP and SASA practice based standards just mentioned. However, the provision of certification is directly attributed to the accumulation of wealth within food chain networks by hampering the level of inter-organisational social relations in the field. This is because certification changes, largely, the central framework of value production so much so that farmers (upstream producers) become consumers of certification standards. It is recognised that political and economic impacts, particularly in the global south or less developed countries cause such standards to develop as a locus of '*social struggle, pitting trade liberalization against socioecological protections, as evidenced by alternative social accountability initiatives*' (Maturbaugh, 2005) p. 2034.

It is argued that while NGOs have teamed up with producer organisations to 'search for the Nth rent' (Kaplinsky, 2004) in an attempt to overcome the multiple dilemmas associated with rent earnings largely consumed by compliance with globalised standards; such initiatives have done little to overcome such difficulties. In fact, such multi-stakeholder initiatives are further exacerbated and hemmed in by oligopolistic market structures that stymie equitable distribution of certification costs, in turn, generating an earnings crisis, particularly in coffee, simultaneously adversely impacting environmental, and social justice in the food chain, principally at the cost of upstream producers, distributors, wholesalers and manufacturers.

With reference to value-chain rent theory, it is further maintained that the shift to globalised standards has transformed rent relations in ways that benefit certain actors, namely food retailers and jeopardise the earnings of others. Further, globalised standards with international reach are said to increase the costs of standards compliance, the full burden of which tends to fall upon non-powerful or 'weak' upstream producers, to the point at which farmers, in particular, see little economic advantage to certified-organic and fair-trade production. Maturbaugh (2005) p. 2040 further cautions that: "*...in a sense, globalized standards, particularly certification standards, create a barrier to entry so formidable that all of the rent income earned by market entry is spent in scaling the barrier.*"

The ability to reach upstream elements of a food chain tends to mean that supermarket retailer profits generally easily benefit from such minimal certification costs because these certification standards only require a transparent chain of traceability up to the retailer's gate. As such, retailers do not bear the brunt of certification costs even though coffee-chain profits are disproportionately concentrated in coffee import and retailing sectors.

The top five importers control 40% of global trade and the top ten control 60%, with even greater levels of concentration in coffeehouse markets.

“Coffee profits are increasing in the retail sector as consumers discover and pay more for higher quality coffees, yet village-based producers reap no benefit and pay the costs of certification. In short, globalised standards, as currently constituted, cause rents to be consumed in meeting standards requirements, reduce the possibility of cost-reducing cooperation, and reinforce the broader terrain of inequality by constraining the work of certification to producers and distributors, leaving retailers with cost-free rents.”

Maturbaugh (2005) p. 2040

In sum, it is contended that any such social-accountability standards that seek to ‘fight standards with standards’ by championing the consolidation of strong labour and environmental protection under a single label strategy can be successful. However, the coalitions who design and disseminate such standards must overcome a Polanyian⁷ double bind (Polanyi, 2001) for, in order to build the broad alliances necessary to extend the reach of protective standards, policy makers and the broader coalitions at play should consider corporate interests that prefer weaker, contract-based standards.

The literature strongly indicates that the concentrated power of the UK food sector is essentially oligopolistic where differentiation occurs from individual supermarkets on the supply chain. In this oligopoly, it means that buyer power of retail giants is hegemonic (Glover et al., 2014). Glover et al. (2014) in their examination utilising institutional theory to explore the role of UK supermarkets in the development of legitimate sustainable practices across UK dairy supply chain organisations’ (relating to the consumption of energy and energy efficiency planning), found that supermarket retailers are generally the dominant players as supermarkets exert pressure on other smaller organisations across the supply chain. This hegemonic power can be occasionally challenged by government regulation or consumer boycott but these are small and infrequent interventions. As such, throughout the food chain there is evidence of alienation where both the food producers and the food suppliers feel isolated from decision making. The issue of power in the food industry requires a significant new research into the political economy of nutrition. Beyond alienation is the disappearance of wholesalers in the food supply chain as supermarkets directly address producers (Richards et al., 2013).

⁷ *“Polanyi’s work viewed economic liberalism as a social movement which, wielding the gold standard as a policy instrument, sought to realize a form of spatiality later popularized by Foucault, namely, Bentham’s panopticism, in which ‘inspectability’ becomes the hallmark of an economy based upon state-enforced private accumulation (Foucault, 1979; Polanyi, 2001 [1944], page 146).”* Maturbaugh (2005) p. 2048

The quote below illustrates the power of the British Retail Consortium which serves as a club for the oligopolistic retailers countering any claims to producer input or consumer opinion.

“...Private standards also vary in form. For example, by retailers’ organizations, such as the British Retail Consortium (originating in the UK, but widely used elsewhere). While private regulation is intended to institute a more robust food safety system, the proliferation of private standards holds a number of disadvantages at the farm level. In particular, farmers have raised concerns that they are subject to excessive regulatory burden and financial costs in complying with numerous public and private standards.”

Burch et al. (2013) p.236

These points on power, hegemony and alienation are not new. They were essential to many campaigns beginning in the 1960s and perhaps best captured in the seminal publication: ‘Twelve Myths: Food First: Beyond the Myth of Scarcity’ (Lappé, F. and Collins, 1978).

Bockel et al. (2011) state, contemporary initiatives such as carbon footprinting and labelling are often supported by large commercial players and/or governments. Given the introduction of the UK Climate Change Act in 2008 and The Carbon Trust’s PAS 2050 carbon footprint standard in 2008, these cumulatively have galvanised interest in environmental and sustainability issues within all sectors of the economy as well as food retail markets. Further, voluntary carbon footprint and label standards such as PAS 2050 which is governed by The Carbon Trust, carbon footprinting and labelling based on LCA methodology can also be framed as a private retail governance standard that supermarket retailers are able to demand of their suppliers.

Bockel et al. (2011) also emphasise that commonly, carbon footprint accounting efforts tend to be linked with mandatory or voluntary emissions reduction initiatives where voluntary schemes are aimed at industries preparing for future mandatory compliance on national legislative GHG emissions reductions. For instance, Bockel et al. (2011) point to the French carbon footprint labelling scheme as a precursor to the probable future introduction of mandatory carbon labelling rules on a whole host of commodities including food which would be applicable to French as well as imported goods although it remains unclear as to when such compulsory rules will be introduced. See the French governmental report by Ceci-Renaud and Khamsing (2012) for more detail. Nevertheless, it is recognised by Bockel et al. (2011) and the aforementioned French governmental report by Ceci-Renaud and Khamsing (2012) that carbon footprinting and labelling regulation rather than a singular approach in terms of the production of low carbon commodities may facilitate the transition to a ‘market-friendly’ carbon reduction economy. It is also highlighted that such governmental initiatives are often responded to positively by the private sector, citing Japan as an example. Here retailers who participate with such schemes tend to emphasise the significant role of the Japanese government as an agent for change. Arimura et al. (2011) similarly found that Japanese businesses respond well to governmental advocacy of voluntary environmental standards such as ISO 14001.

To summarise the above, the proposition derived from the issues regarding supermarket and retailer power in food chain dynamics suggests that: Near consumption actors (supermarkets) are the powerhouse of oligopoly that control food policy making – Proposition 6.

Proposition 6

Near consumption actors (supermarkets) are the powerhouse of oligopoly that control food policy making. Corporate interests, not that of the State, is the arena for food policy making.

The next section introduces the notion of ‘nudging’ for behavioural change via choice architecture as a tool for food policy making in a food environment dominated by voluntary private initiatives and market mechanisms (Fuchs et al., 2011).

2.10 Policy Tools for Food System Sustainability

Generally, policy makers concerned with food system sustainability have three principal types of instruments at their disposal. These include information based, market based and regulatory tools (Lorek et al., 2008 cited by Hartlieb and Jones, 2009). However, this tool box has grown to include ‘nudging’ instruments such as choice architecture underpinned with behavioural economics as behaviour change interventions (Michie et al., 2011). Here, choice architecture is a mechanism in which an individual or organisation ‘designing’ the choice in question can manipulate a default outcome with a desired outcome (Hansen and Jespersen, 2013; Sunstein and Reisch, 2013 and Thaler and Sunstein, 2008). Nudging is sometimes referred to as ‘behaviourally informed’ social regulation (Hansen and Jespersen, 2013 and Sunstein, 2011). This policy approach has been integrated into various political applications, including consumer policy (OECD, 2010a). In the food and health area, particularly, nudging consumers towards more sustainable or healthier choices through labelling for instance, is a common approach to manipulate choice and behavioural change (Scrinis and Parker, 2016 and Hansen and Jespersen, 2013). Other, simple nudge examples judged as ‘quite successful’ and provided respectively by Just and Wansink (2009) and Reisch and Gwozdz (2013) include that of moving soda machines to more distant, less visited parts of a school or locating a salad bar in the middle of a cafeteria where everybody passes by.

From a societal perspective, the proliferation of certification and labelling initiatives is often explained in the context of the emergence of new forms of non-governmental regulation resulting from significant changes in the structure of markets and politics and consequent changes in the strategies of governments, civil society and the private sector (Horne, 2009; Mueller et al., 2009 and Haufler, 2003). One of these outcomes is the apparent privatisation of regulation arising from a decrease in state capacity and an increase in corporate power (Chkanikova and Lehner, 2015). With globalisation and economic liberalisation and market integration the private sector is strengthened and the capacity of national governments limited (Bendell, 2004; Haufler, 2003; Scholte, 2000; Strange, 1996). This decrease of state capacity and the dominance of the neo-liberal policy paradigm means governments opt for deregulation, liberalisation and decreased state spending (Bartley, 2003) with the free trade agenda limiting the available policy options

significantly. The neo-liberal mindset also fuels the preference of policymakers for 'soft regulation' which is perceived as more tangibly desirable, more flexible, innovative and pragmatic than the conventional, traditionally sluggish, antiquated, or innovation-adverse 'command and control' approaches (Scrinis and Parker, 2016; Utting, 2005 and O'Rourke, 2003). More generally, national bureaucracies seem unable to cope with the newly emerging social and environmental consequences of industrial growth (Jacobs, 2013).

As outlined in previous sections, non-state regulation comes in several forms: market-based mechanisms, private voluntary initiatives or public disclosure systems. However, as each promise to address some of the demands of corporate accountability brought forward to governments by civil society groups without extra state commitments, having to increase budgets or staff for example, private regulation becomes an increasingly attractive alternative (Galizzi, 2012 and O'Rourke, 2003). Such arrangements might also imply some scope for more morality in business regulation. Hartlieb and Jones (2009) maintain that market actors who adopt voluntary controls make moral choices to do so, instead of merely complying with state diktats. However, for ethical, environmental and socially oriented labelling schemes the reality is more complex than autonomous moral choices.

Evidence from the academic literature points to a growing number of public and private initiatives involved in communicating sustainability related information relaying environmental and/or ethical credentials to consumers introducing logos, on-pack labels and campaigns within stores (Grunert et al., 2014). An example of such a PPP initiative can be drawn from the work of Panjwani and Caraher (2014). The authors examine 'the Responsibility Deal' launched in the UK in March 2011. This is a formal public-private-NGO partnership initiated and led by the UK Government to address a series of public health objectives such as limiting excessive alcohol, salt and calorie consumption. The Responsibility Deal is organised into five networks with specific foci on food, alcohol, physical activity, health at work, or behaviour change. Each partner organisation pledge voluntary actions in agreement with the networks which are designed to achieve public health goals. The argument for a voluntary approach in this context is that it allows pragmatic actions to be thrashed out and agreed upon more quickly, effectively and at a lower cost than mandatory legislation to meet public health objectives. It is symptomatic of a trend in the last decade where collaborative voluntary approaches are favoured over legislative approaches for compliance. However, despite the UK Government's leading role, tensions over the involvement of the private sector prevail.

It was 'big' business that pledged, vocalised, promoted and advocated their own response to the complexity of the food sustainability-climate change-health challenge (Lang and Barling, 2013). Indeed, Panjwani and Caraher (2014) state that while coalitions of large multinational food and drink business pledged to reformulate their products and market them responsibly, such business

led and self-regulated voluntary initiatives have met with scepticism from the public health community, including notably the World Health Organisation.

The argument against industry involvement in such collaborative policy making, dissemination and practice suggests that such PPP approaches afford industry the opportunity to influence the development of public health policy to its own ends doing little to achieve set public health objectives (Galizzi, 2012 and Hawkes and Buse, 2011). A series of empirical studies concerning voluntary agreements between government and business by Panjwani and Caraher (2014 p.164) who study the Responsibility Deal; Kraak et al. (2012) and Bryden et al. (2013) who also critique the benefits and risks of PPPs in addressing global malnutrition, conclude that partnership is more effective than working independently but to little overall effect in terms of achieving wider public health objectives. Similarly, Hornibrook et al. (2015) report on the lack of impact of carbon labelling. Using loyalty card data from the largest UK supermarket retailer, Tesco, the authors produced empirical data for the uptake of carbon labels displayed on 'own brand' products, implying consumer trust of the supermarket's own brand but ultimately find a relatively weak consumer response to carbon labels in general. The empirical data along with data generated from a series of focus groups by market segmentation, indicates poor uptake is due to a lack of understanding and awareness of carbon labelling across all consumer groups, constraining social factors and the heterogeneous nature of consumers. The research however, assumes a model of organisational change emanating from individual behavioural choice. The study stops short of explicitly distinguishing the environmental challenges in the context of carbon footprinting as a social problem requiring a social solution.

In this sense, the carbon footprint problem co-existing with the food industry problem is quintessentially one of complex social change which cannot be easily addressed by 'Nudge' economics. This uptake of 'nudge' economics can in theory combine the agendas of the private sector government and civil society but it depends on the problem being amenable to individual behavioural change leading to better social outcomes (Guthrie et al., 2015). Scrinis and Parker (2016) provide a path breaking paper on the politics on nudging behavioural change with particular reference to front-of-pack (FOP) nutritional labelling. The 'Nudge' economics quote they use is essentially seen as a third political way between the individual behaviour paradigm underlying neo-liberal economics and the role of government where both approaches are deemed to be the main driver for social change.

The focus is on the architecture of the intervention, suggesting that a combination of labelling and spatial placement can nudge people towards different behaviours. In general, their examples come from a range of nutritional problems where labelling includes the UK's multiple traffic light (MTL) labelling scheme and the Australian Health Star Rating (HSR) system. The MTL label in the UK essentially deals with four negative food inputs associated with obesity. These are namely two

kinds of fat: salt and sugar but as Lang points out, the architecture of food outlets is too complicated for the MTL to work. Moreover, the point of entry or marketing attack is based on individual behaviour. Whereas, the problem labelling seeks to address is a social problem of herd immunity from obesity.

The adoption and use of labelling may act as a lever to force companies into action because for instance, the purpose of the label can be used to drive companies into competition so that the carbon footprint is lowered across a sector or product line (Upham et al., 2011). Certainly, some food supply chain businesses producing and supplying products with questionable nutritional content may want to embrace carbon labelling to counter the effect of other labels such as nutrition traffic lights. This could be a reason why policy makers go for labelling (Scrinis and Parker, 2016). Indeed, Freidberg (2014) highlights that LCA based carbon footprinting and labelling could potentially obfuscate as much information as it reveals leading to the questionable motivations for adoption of carbon footprinting and labelling schemes whether at the product or company level. However, footprinting may not necessarily lead to labelling for a number of reasons including primarily, the numerous tools available to food businesses for green supply chain management (Sarkis et al., 2011) as a business tool, the adoption of which could lead to businesses preferring to exercise choice editing in their chains (Scrinis et al., 2016; Temple and Fraser, 2014; Grunert et al., 2014; Tzilivakis et al, 2012; Arimura et al., 2011 and Sarkis et al., 2011). The response of industry to the growing environmental problem of climate change and unsustainable consumption has been mixed although, the food industry has moved quickly to pledge actions to improve the health profile of its products (Swinburn et al., 2011). Suggested proposition, 7 is derived from the preceding scholarly debates and detailed next:

Proposition 7

Choice architecture has a fall-back position of nudge economics. Nudge economics is the economics of 'push' with no 'pull'.

In consideration of the above, the following sections discuss the field of green supply chain management and sustainable supply chain management and outline some of the principle organisational theories utilised in this multi-disciplinary research domain.

2.11 Green Supply Chain Management and Organisational Theories

The inchoate and multi-disciplinary field of green supply chain management (GSCM) has grown rapidly in recent years attracting increasing and continued interest from both academia and industry (Holloos et al., 2012). Sarkis et al. (2011) in their organisational theoretic review of green supply chain management literature assert that the continued academic growth and further development of this emergent field as well as its advancement in development requires that new knowledge and insights be generated. Similarly, Beske et al. (2014) and Carter and Easton (2011) who conducted a systematic review of the sustainable supply chain management (SSCM) literature published

principally in logistics and supply chain management journals, find that SSCM, much like GSCM has evolved from a perspective and investigation of individual research issues in social and environmental disciplines generally through to a corporate social responsibility perspective. This is followed by an increasing conflation and convergence of perspectives of sustainability such as the triple bottom line (TBL) plus the emergence of SSCM as a theoretical framework (Holloos et al., 2012; Carter and Rogers, 2008; Seuring and Müller, 2008; and Sheu, 2008).

To date, the most comprehensive review of the use of organisational theories to better understand GSCM is that of Sarkis et al. (2011) who provide an extensive critical theoretical review of the principal theories utilised to investigate GSCM issues. The authors recognise the challenge of conceptualising GSCM and acknowledge the numerous variations of its definition and terminology over the last decade. For clarification, the term GSCM used in this thesis derives from the definition provided by Sarkis et al. (2011) which is broadly understood as the integration of environmental concerns into the inter-organisational practices of supply chain management.

In the main, the concept of GSCM is characterised using some of the following most widely adopted terms:

- Sustainable supply network management (Cruz and Matsypura, 2009; Young and Kielkiewicz-Young, 2001)
- Supply and demand sustainability in corporate social responsibility networks (Cruz and Matsypura, 2009 and Kovács, 2004);
- Supply chain environmental management (Sharfman et al., 2009);
- Green purchasing (Min and Galle, 1997) and procurement (Günther and Scheibe, 2006);
- Environmental purchasing (Zsidisin and Siferd, 2001 and Carter et al., 2000);
- Green logistics (Murphy and Poist, 2000) and environmental logistics (González-Benito and González, 2006); and
- Sustainable supply chains (Linton et al., 2007 and Bai and Sarkis, 2010).

Inextricable linkages exist between the above terms of GSCM and the related disciplinary areas concerning more specifically, 'sustainable' food supply chain management (Roth et al., 2008). As such, there are various perspectives that can be applied at a number of levels relating to organisational behaviour (Sarkis et al., 2011) within the broader field of GSCM/SSCM. The organisational theoretic review by Sarkis et al. (2011) focuses on GSCM studies that have applied an organisational theoretic lens to underpin their studies, especially with respect to adoption and diffusion of GSCM practices.

The nine theories reviewed include: Complexity; Ecological Modernisation; Information; Institutional; Resource Based View; Resource Dependence; Social Network; Stakeholder; and Transaction Costs Economics theories. These are contextualised, the general concepts provided, examples of GSCM related studies and theoretical applications as well as suggestions provided and presented in Table 7 below. More specifically, the assumptions pertaining to each of these theoretical positions are explored; the salient and fundamentally important features of the given theory highlighted; associated assumptions of the dominant perspective presented; and the limitations, weaknesses; as well as strengths for each in the context of sustainable food supply chain management proposed. The authors also identify particular GSCM adoption and practice phenomena or characteristics that can be tied to various organisational theories. Overall, findings support that a substantial opportunity exists for an extension of GSCM research in employing a myriad of organisational theories.

Table 7 Organisations Theories applied to GSCM research

Theory	General conceptualisation	Current GSCM related study and theory application	Future research and theory application
Complexity theory	As complexity increases, firms find it more difficult to plan and predict their organisational actions, e.g., GSCM implementation. It is necessary for firms to be sensitive and responsive to their environments with co-evolution and interdependencies in adapting to the system (Crozier and Thoenig, 1976).	<p>1) The difficulty for implementing GSCM can be intensified by the complexities associated with broader organisational complexities, such as size and relationships (Vachon and Klassen, 2006b).</p> <p>2) Complexities inherent in closing the loop for a supply chain have been observed (Guide and Wassenhove, 2009; Matos and Hall, 2007).</p> <p>3) For managing a supplier system, Choi and Krause (2006) identified supply base complexity as a key area of managerial consideration.</p>	<p>1) How to reduce the uncertainty that arises from implementing the GSCM activities and guide system function.</p> <p>2) The adaptive complex systems relationship to an inter-organisational learning theory in GSCM</p>
Ecological Modernisation (EMT)	As a systematic eco-innovation theory, an EMT is geared towards jointly achieving industrial development and environmental protection through innovation and technological development, or 'modernity' (Jänicke, 2008; Murphy and Gouldson, 2000). At least two dimensions of an EMT can influence GSCM research and practice, new politics of pollution and technological innovation.	<p>1) To motivate GSCM related practice, proper institutional arrangement and a legal framework by government are needed (Kassolis, 2007).</p> <p>2) The practice of GSCM is consistent with the concept of environmental innovation from the EMT view (Zhu, Sarkis et al., 2010).</p> <p>3) Innovation typically occurs in the upper echelon of a supply chain.</p>	<p>1) A consensus on theoretical foundation for EMT at the GSCM level is necessary.</p> <p>2) Innovation diffusion mechanisms and relationships between large and smaller suppliers and customers for GSCM need further investigation.</p>

Theory	General conceptualisation	Current GSCM related study and theory application	Future research and theory application
Information theory (information asymmetry and signalling theory)	Unequal environmental information exists between industry and customers. Managing under this information asymmetry environment may require 'signalling' and other information theoretic approaches (Simpson et al., 2007).	<p>1) If the natural environmental influences occur further upstream in the supply chain, it becomes more important to collect information from suppliers (Erlandsson and Tillman, 2009).</p> <p>2) Organisations are more likely to certify their practices such as ISO 14001 certification when information asymmetries with their stakeholders (e.g., customers and suppliers) are high (Jiang and Bansal, 2003).</p>	<p>1) Whether coordination, closeness, congruence, and collaboration result in reduced information asymmetry and improved environmental performance and image need further study.</p> <p>2) There is significant opportunity to study satisficing and dynamic signalling theory application to GSCM practices.</p>
Institutional theory	Institutional theory examines how external pressures influence organisational actions (Hirsch, 1975). Within institutional theory, three forms of isomorphic drivers exist namely, coercive, normative, and mimetic (DiMaggio and Powell, 1983).	<p>1) Coercive pressures mainly originated from governments are key drivers for environmental management practices (Kilbourne et al., 2002).</p> <p>2) Normative pressure from consumers have driven the adoption of GSCM practices (Ball and Craig, 2010), while exports and sales to foreign customers are two important drivers that prompt manufacturers on the adoption of GSCM practices.</p> <p>3) Imitation plays a significant role for companies in developed countries to implement GSCM practices (Aerts et al., 2006).</p>	<p>1) It is unclear how external and internal factors interactively promote GSCM practices?</p> <p>2) How to identify core companies along supply chains and how can governments exert pressure on such companies?</p> <p>3) Why do heterogeneous responses to GSCM implementation from institutional pressures exist?</p>
Resource based view (RBV)	The resource-based model of competitive advantage suggests that competitive advantage may be sustained by harnessing resources that are valuable, rare, imperfectly imitable, and non-substitutable (Barney, 1991).	<p>1) Extension of RBV to the competitive advantages across the supply chain can also be applied to greening of supply chains (Gold et al., 2010).</p> <p>2) Internal organisational resources mediate the relationship to external forces (institutional forces) and GSCM practices adoption (Sarkis et al., 2010).</p>	<p>1) Knowledge management and learning theoretical perspectives those focus on inter-organisational learning and knowledge sharing for GSCM practice diffusion.</p> <p>2) The development of scales that are capable of measuring the various competitive dimensions of value, rarity, inimitability, and non-substitutability are still in need of development for GSCM.</p>
Resource dependence theory (RDT)	RDT suggests that, in the supply chain, member firms should depend and collaborate to seek higher performance gains in the long-run instead of pursuing short-term benefits at the expense of others. One important assumption of the RDT is that firms cannot be fully self-sufficient with regards to strategically critical resources for survival.	<p>1) In GSCM, eco-design of products and materials recovery are exemplary organisational resources requiring supply chain partnership to effectuate performance benefits (Shang et al., 2010; Zhu and Sarkis, 2004; Zhu et al., 2005).</p> <p>2) From the RDT perspective, customer and supplier relationships are important linkages for firms to reduce the uncertainty surrounding their operating environment (Carter and Rogers, 2008).</p>	<p>1) Relationship between resource dependency and GSCM performance is fertile for investigation.</p> <p>2) It is not clear how to facilitate and improve GSCM resources acquisition process considering the dependency of upstream and downstream supply chain partners.</p>

Theory	General conceptualisation	Current GSCM related study and theory application	Future research and theory application
Social network theory (SNT)	An SNT considers organisational outcomes as a function of the social relationships between organisations or individuals in an organisation (Jones et al., 1997). An SNT has been described as having two major elements namely, density and centrality (Rowley, 1997).	1) GSCM studies on buyer–supplier relationships for performance improvement can be explained or constructed around using an SNT lens (Seyfang, 2007). 2) Using the notion of density from an SNT, it is observed that organisations with a greater number of locations, customers, suppliers, and general awareness in the public are likely to be under greater pressures to adopt GSCM practices and have less control on whether to adopt or not to adopt (Maignan and McAlister, 2003).	1) The role of an SNT on the diffusion of GSCM from proactive companies to lagging companies. 2) Whether employees in an organisation accept, understand, and implement GSCM, across organisational boundaries, is important.
Stakeholder theory	Stakeholder theory suggests that companies produce externalities that affect many parties (stakeholders), which are both internal and external to the firm. Externalities often cause stakeholders to increase pressures on companies to reduce negative impacts and increase positive ones.	1) Specific stakeholder influences on green purchasing (Bjorklund, in press; Maignan and McAlister, 2003); life cycle analysis (Matos and Hall, 2007); environmentally oriented reverse logistics (Sarkis et al., 2010); 'closing the loop' for GSCM (Zhu et al., 2008) and general GSCM or green logistics practices (Chien and Shih, 2007; Gonzalez-Benito and Gonzalez-Benito, 2006). 2) Identifying and investigating roles of various stakeholders within GSCM practices has also been studied (de Brito et al., 2008; Gunther and Scheibe, 2005).	1) Significant investigational opportunities still exist with respect to the roles stakeholder theory and pressures have on GSCM technology and innovation diffusion (Vachon, 2007). 2) Internationally focused stakeholder theory may also be more relevant as the globalisation of supply chains has caused the stakeholder sphere to continue expanding, implications for environmental standardisation along supply chains may be investigated.
Transaction cost economics	Transaction cost economics focuses on how much effort and cost is required for two entities, buyer and seller, to complete an activity (economic exchange or transaction) (Williamson, 1981).	1) Formal modeling study utilising transaction costs and dynamics within mathematical programming and optimisation model frameworks occurs in a number of environmental supply chain studies (Cruz, 2008, 2009; Cruz and Matsypura, 2009; Cruz and Wakolbinger, 2008; Sheu et al., 2005; Yang et al., 2009). 2) Whether voluntary environmental initiatives standards are more likely to diffuse across a supply chain, if it improves the transaction costs of a relationship (Rosen et al., 2002). 3) The use of the asset specificity and organisational action related to GSCM is another explanatory dimension of transaction cost economics (Delmas and Montiel, 2009).	1) Exchange hazards investigation with GSCM may also be fertile ground for future investigation. 2) Many dimensions of this theory will help to investigate relationships, investments, and organisational structure decisions in GSCM.

Source: Sarkis et al. (2011) p.4-5

In terms of challenges to successful sustainable supply chain management, Abbasi and Nilsson (2012) cite uncertainty, complexity, operationalisation, cost and mindset and cultural change as issues of concern. With such a continuation in the growth of complexity, businesses find it more challenging to plan for and predict various organisational actions in attempts to make supply chains

'greener' or more 'sustainable'. These latter terms are of course in themselves infinitely complex and contentious and are reflective of a wide-ranging response leading to a growing surge in the foci of this lexicon in the academic literature.

In an organisational theoretical context, complexity relates to the heterogeneity and diversity of business practice and what this encompasses such as technological advancements, dynamic change, customers, suppliers and governmental regulations (Beske et al., 2014; Sarkis et al., 2011; and Chakravarthy, 1997). Indeed, a vast range of environmental and social metrics are utilised by organisations in attempts to better understand how to 'green' their supply chains (Hassini et al., 2012). This wide-ranging adoption of differing metrics to address sustainable supply chain management issues reflects the extensive nature of issues 'sustainability' can encompass in different organisations.

An extensive literature review by Hassini et al. (2012) focuses on examining the vast number of metrics used for issues dealing with sustainability, concluding sustainability metrics are indeed wide ranging. This research evidences that sustainability metrics for sustainability could extend from measuring pollution volume discharges to a water course to decisions on investment to community development projects but the authors caution that while the complexity of the prevalence of multifarious variables prevail under the umbrella and catch all term of 'sustainability'; this is often belied with overly simplistic bureaucratic responses in themselves pointed to as "often insufficient". More recently, a literature review by Alexander et al. (2014) who also examine conceptualisations of sustainable supply chain management (SSCM) using decision theory, show that strategic decisions tend to be unstructured requiring multiple factors and uncertainty and change to be considered especially given strategic decisions tend to be longer term; meaning it may take some time before the fruition of 'successful' outcomes. Strategic decisions in this context tend to be of significant importance, have a low frequency of occurrence and are non-repeating and thus unstructured. Evidence from the literature shows the breadth of topics sustainability can encompass in different organisations, mean according to Alexander et al. (2014), that such simple bureaucratic responses are frequently inadequate in addressing the complexity of the prevalence of multifarious variables inherent in the term 'sustainability'. In the context of decision theory, French (2012) and French et al. (2009) discuss this notion of sense making further through the lens of the 'Cynefin Framework', essentially a knowledge management sense making framework. Snowden's (2003) Cynefin framework for sense making is a relatively new addition to the canon of 'Decision Theory' building on mathematical theories of complex and chaotic systems (Alexander et al., 2014). This demonstrates that different decision contexts require different decision methods.

Indeed, environmental issues extend to a multiple range of stakeholders, bring uncertain implications for competitiveness to the fore that extend to matters of national as well as international importance where competition and globalisation of markets are continually on the rise (Cao and

McHugh, 2005). Attempts to apply theories of organisational change in the mid-twentieth century tended to concern the study of human organisations and the application of concepts of systems theory that was primarily focused on equilibrium and stability and the control of negative feedback to ensure their preservation (Reitsma, 2003 and Manson, 2001). System theory concepts tend to view organisations as continually interacting within their environment. Here the organisational environment encompasses a set of relationships between agents, and/or stakeholders as well as numerous factors that may extend beyond the control of a given organisation (Mason, 2007).

These system theory concepts are recognised in a seminal publication by Bansal and Roth (2000) who examine why companies go 'green'. Here, the authors explain utilising organisational theory and theoretical development, a model that describes corporate ecological responsiveness through the identification of motivations for the adoption of ecological initiatives as well as the identification of underlying factors that ultimately lead to each motivation. In this sense, corporate ecological responsiveness is defined by Bansal and Roth (2000) as:

"a set of corporate initiatives aimed at mitigating a firm's impact on the natural environment. These initiatives can include changes to the firm's products, processes, and policies, such as reducing energy consumption and waste generation, using ecologically sustainable resources, and implementing an environmental management system. Our concept of corporate ecological responsiveness refers not to what a firm should do, but to the initiatives that reduce the firm's "ecological footprint" (Hart, 1997)." (Bansal and Roth, 2000, p. 717).

The authors propose that applying a single paradigm to corporate ecological responsiveness is insufficient in order to gain theoretical insights. Thus, applications of organisation theory within research on organisations and natural environment necessitate and facilitate the bridging of theories that are often treated in silo.

The creation by Bansal and Roth (2000), of a preliminary model of ecological responsiveness with an initial conceptual archetype of the antecedent conditions of corporate ecological responsiveness is the basis upon which an advanced model of ecological responsiveness was later developed. The preliminary model with its many omissions is outlined in Figure 8 below. In this preliminary model, the motives indicate that businesses may be likely to be "...*ecologically responsive to comply with legislation, to build better stakeholder relationships, to acquire economic wealth and competitive advantage, and to maintain ecological balance.*" (*Ibid.* (2000) p. 718.

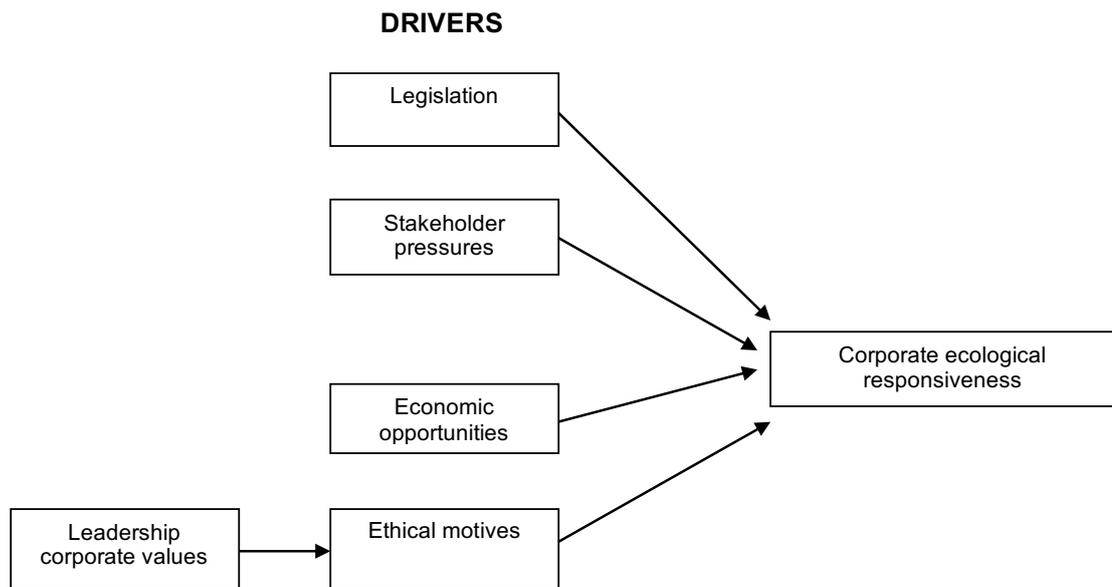


Figure 8 A preliminary model of ecological responsiveness
 Source: Bansal and Roth (2000) p. 718

Building upon the model above, development of a “*robust model of ecological responsiveness*” (Bansal and Roth, 2000 p. 719) was undertaken utilising development of empirically grounded theory, an analytic induction methodology (Glaser and Strauss, 1967 and Yin, 1989) together with an iterative process of data collection and theory generation underpinned with a preceding review of literature to develop a set of hypotheses for testing. Data collected included case studies of UK food retailers and key informant interviews with environmental managers, environmental directors or senior managers. According to the authors, choosing a single case study approach enabled them to challenge and comprehend specific emergent issues such as differences in business motivations. For instance, it was found that family-owned businesses are motivated differently from businesses with non-related shareholders (Bansal and Roth, 2000, p.721) although it is recognised that analysis of data from a single case study does not build reliability in terms of extending theory, single case study analysis in this context helped to confirm whether organisational ownership represented a theoretical difference and warranted further consideration.

They found that three contextual dimensions influence the dominant motivations of companies. These include issue salience, field cohesion and individual concern. See Figure 9 below. Three fundamental motivations for ecological responsiveness include competitiveness, legitimation, and ecological responsibility. The authors found that these three motivations were influenced by three contextual conditions; comprising field cohesion, issue salience, and individual concern.

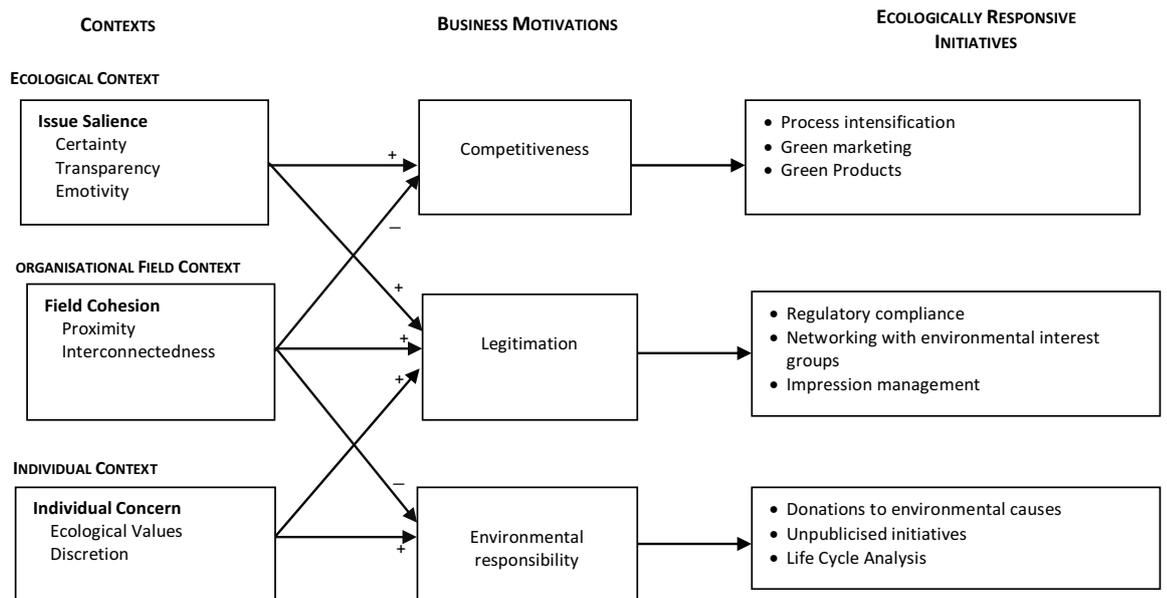


Figure 9 An advanced model of ecological responsiveness
 Source: Bansal and Roth (2000) p.729

Bansal and Roth (2000) make the assumption that both dominant and mixed motivations were viable and might lead to high responsiveness. Second, it is assumed that the notion of equifinality could be applied to the ecological setting. The authors cite the classic publication of Katz and Kahn (1978) who assert that "a system can reach the same final state [for instance, the same level of organizational effectiveness] from differing initial conditions and by a variety of paths" (1978: 30). In this sense, equifinality, according to Gresov and Drazin (1997) in its context exists as articulated in earlier research by Van de Ven and Drazin (1985) p. 335 who proffer that equifinality is a "feasible set of equally effective, internally consistent patterns". The rationale therefore as put forward by Bansal and Roth (2000) is that multiple ecological responses are possible in the lens of equifinality meaning that rather than specifying any single response, an attempt is made for the identification of consistent configurational patterns. A key assumption made is that ecological responsiveness essentially demonstrates a level of configurational equifinality as defined and classified by Gresov and Drazin (1997). This condition is characterised by incompatible functional demands on an organisation and an unconstrained range of responses. Here, the authors find that a business's ecological agenda often competes with other functional agendas for resources.

Further, the multiple contextual conditions and motivations are said to permit a wide range of possible initiatives or organisational responses. The expectation, therefore, in this study is that multiple configurational profiles could lead to ecological responsiveness. More specifically, three

profiles that lead to high responsiveness because of the coherence or consistency of the pattern: the caring profile, the competitive profile, and the concerned profile.

For instance, a manager who seeks to achieve any one of the configurational profiles outlined above, could choose appropriate contexts or change the existing contexts (Drazin and Van de Ven, 1985 cited by Bansal and Roth, 2000). Choosing the appropriate contexts assumes that the manager responds only to salient issues, selects to operate within cohesive fields, and appoints managers who exhibit ecological concern. Alternatively, the manager can magnify the influence of the existing contexts. For example, training staff about the ecological effects of organisational activities can heighten individual concern. Improved research into the ecological impacts of issues, such as carbon and climate change, will increase issue salience. Field cohesion may be increased through more active involvement by industry associations to encourage collaborative research efforts and voluntary disclosure of ecological impacts.

Ultimately, the evidence of this study shows that few businesses are motivated by ecological responsibility. However, given the conceptualisations and environmental mechanisms present across organisations, Bansal and Roth (2000) suggest that such research on organisations and the environment is relevant for management practice.

While the question of why businesses 'go green' has been investigated, this does not extend to examination of the rationale for the voluntary adoption of environmental standards such as EMSs', ISO 14001, PAS 2050 carbon footprinting, carbon labelling and other more contemporary forms/types of sustainability initiatives pertinent to the food sector. It is also constrained to the 'retail' or downstream element of a supply chain. However, the model developed by Bansal and Roth (2000) provides a useful set of insights to further examine twenty first century food businesses' motivations for 'ecological responsiveness'.

As highlighted by Richards et al. (2013), many conventional upstream UK food supply chain businesses operate at a minimum to the UK's BRC standards and the BRC also strongly advocate EMS and ISO 14001. As such, it is not well understood why upstream food businesses would incur the extra time and expense to carbon footprint their operations and seek certification for carbon footprint labelling purposes (Burch et al., 2013) given like ISO 14001 and EMSs, carbon footprinting and carbon labelling are not governed by mandatory legislature.

However, the predecessors for carbon footprint adoption - ISO 14001 and EMSs are more broadly adopted and now uptake is commonplace amongst UK food supply chain businesses since ISO 14001's publication in 1996 (Marimon et al., 2012 and Mueller et al., 2009). Like carbon footprinting and labelling ISO 14001 and EMSs remain voluntary standards, increasingly perceived as driven by market regulation (Fuchs et al. 2011). In the context of food chain businesses, governmentality,

agency control and power exercised within and across respective chains is widely critiqued in the literature (Fuchs et al., 2016; Spence and Rinaldi, 2014; Burch et al., 2013; Richards et al., 2013; and Mueller et al., 2009) but little attention has been given to the motivations for adoption of carbon footprinting and carbon labelling initiatives particularly in light of the increasing level of collaboration amongst food industry actors, non-governmental organisations, academia and government agencies in the development and dissemination of a mushrooming number of 'green' policy initiatives.

This review of green supply chain management literature suggests that the ISO 14000/1 series is best practice at the moment but even this can be criticised as merely 'greenwash' – Proposition 8.

Proposition 8

Green supply chain management is 'greenwash' – ISO 14001 is as close as it gets.

Considering the increasing role of ecological footprint tools including carbon footprinting standards and labels for policy and marketing (Ibanez et al., 2008 cited by Liu et al., 2016) the following section looks to the phenomenon of sustainable food consumption in international and UK country contexts.

2.12 Sustainable Food Consumption

At the global level, the food 'problem' as Garnett (2013) and Lang and Barling, (2013) explains relates to a number of issues in times of climate change: a mushrooming global population, growing urbanised societies often switching dietary preferences towards carbon heavy intensively produced foods such as meat and dairy products that simultaneously depend upon a finite resource base leading to overly consumptogenic and obesogenic societies (Mont et al., 2013 and Reisch et al., 2016) in a world where food insecurity, food poverty, unequal access to food and its distribution persist (Lang and Barling, 2012).

In the UK specifically, a visible business production and supply response to growing public concern, at least for food shoppers is the proliferation of voluntary ethical, social and environmental certification labelling initiatives for food, covering a broad range of issues concerned with social justice (e.g. Fair Trade), animal welfare (e.g. Freedom Foods) and environmental sustainability (e.g. Carbon Footprint Label) (Hartlieb and Jones, 2009).

Indeed, how food is produced, what kind of food is produced, how it is processed, packaged, sold and consumed and disposed of in times of climate change, means that inevitably processing, packaging and distribution systems will all face directly or indirectly, the issue of carbon footprinting (Christopher, 2013 and Garnett, 2013).

Marsden (2013) warns of the pitfalls for food businesses of entrepreneurial and innovative policy interventions embedded in voluntary policy regimes such as carbon footprinting:

“...even where innovation breaks through there is a danger that it can be narrowed and diluted to a more reductionist approach, achieving little more than streamlining current processes and structures rather than generating radical system change. This is, for example, evident in current corporate retailer-led chains where growing public concerns and niche developments are pressing for innovations with regard to improvements in carbon reduction and nutritional standards. The logical response of the dominant regime to these issues is to incorporate them very much as just another type of process-product innovation, rather than creating a wider platform for changes in systems and structures of provision...”

Marsden (2013) p.125

Yet as Fuchs et al. (2016) highlight, although sustainable consumption should not be narrowed down to ‘absolute reductions’ these are needed to achieve sustainable consumption outcomes. Here, the authors call for greater attention on the dynamics of power in food systems citing that real sustainable consumption will only emerge through collective action, careful organising and focused exertion of influence in policy making and implementation within and across food chains and the broader systems of production and supply. Indeed, increasing public consciousness and disquiet of the environmental impacts of global and national food systems means that despite the continual volatility of both the markets and regulatory change, supply chain actors will be required to demonstrate how they are responding to the carbon threat (Senge, 2010 and Kasterine and Vanzetti 2010). There are tensions. For instance, Plassman et al. (2010) and Edwards-Jones et al. (2009) highlight the potential adverse impact of carbon footprinting labelling regimes on developing countries and their food exports and Saunders et al. (2009) contrastingly outline the possible difficulties and tensions for developed country exporting nations such as New Zealand, the economy, like that of many developing countries of which is heavily reliant on the export of food. These studies seek to address the overall question: What will the implications of such regimes be for businesses operating within globalised food chains? Certainly, for food businesses, early engagement and knowledge of carbon legislative regimes and regulatory frameworks could contribute towards elements of comparative advantage in terms of market differentiation and energy efficiency (Senge, 2010 and Unruh and Ettenson, 2010).

In the UK, the centrality and focus placed on consumers and their rights were propelled more forcefully into the public sphere in advent of the formation of the Consumer Council in 2006 (Lang and Barling, 2013). Hartlieb and Jones (2009) state, almost all food policy interventions in the UK for public health and the environment tend to be multi-stakeholder initiatives. Indeed, the PAS 2050 carbon footprint standard and development of the corresponding carbon label were formed as multi-stakeholder initiatives including, governmental, industry, NGOs and the general public.

Mayes (2014) shows that food industry and public health experts are frequently in conflict, particularly regarding food labelling policies and regulation. He notes the rise as does Chkanikova and Lehner (2015) in market-regulation, self-regulation over regulated labels. Regulated labels are typically met with suspicion by food corporations and perceived as a threat to free market enterprise. In contrast, public health and consumer groups largely advocate regulated and easy to read labels as essential for consumers in order to exercise autonomy and make healthy choices in the face of aggressive industry marketing. Mayes (2014) draws upon Michel Foucault's lectures at the *Collège de France* and examines the food label through the lens of governmentality. Here, it is argued that the normalising effect of neoliberal governmentality within which both the food industry and public health bodies exist, these in combination operate to reinforce individuals as 'healthy consumers'.

An extensive review of the contemporary issues and policies concerning sustainable food consumption by Reisch et al. (2013) highlight that on the production side, the EU agricultural sector is a highly regulated market in which regulatory and market-based instruments already in place tend to target production. They cite the reformed Common Agricultural Policy (CAP) and the financial support to producers via its subsidies as possibly stimulating a stronger push for the increased availability and affordability of organic food products over a host of other instruments ordinarily associated with sustainable food consumption.

On the demand side, national governments are noted as generally playing a weak role in managing the effects of over consumption. Instead, the main driver behind any regulatory 'command and control' instruments in the domains of food consumption and production have focused on food quality and safety measures. This, the authors argue is primarily because such command and control regulatory measures are necessary in the face of time pressures and doubts regarding the effectiveness of voluntary agreements. As such, regulation tends to focus on food safety issues, the protection of consumer health (for example, through hygiene standards) and economic interests (for example, through competition regulation). For instance, health risks result from the presence of unwanted substances in food products, including pathogenic organisms, toxic substances (such as pesticides and heavy metals), and contaminants. In the UK and Europe, the most serious food-safety issue is food-borne illness from food poisoning and poor hygiene. Because food risks are socially channelled and mediated, there is often a wide gap between perceived health risks and objective risks (Grunert and Wills, 2007 and Millstone, 2007).

With regard to food sector sustainability, governments and their administrations come into play mostly as organisers of (public) certification, standardisation, and inspection, as evidenced by the state led labelling of organic and regional foods in approximately half of EU countries (Organic Europe, 2011). Such labels constitute an important tool for raising consumer awareness about the health and environmental aspects of food and for facilitating informed decision making (Scrinis and Parker, 2016 and Hall and O'Connell, 2013). Nevertheless, in terms of changing buying decisions, the

effectiveness of voluntary labelling is limited (Galizzi, 2012 and Larceneux et al. 2012). The main impact seems to be on the supply side since such labels have proven valuable marketing tools in saturated markets (Van Kleef and Dagevos, 2015; Tzilivakis et al., 2012; and Grunert and Wills, 2007).

Reisch et al. (2013) also note that while a number of governments launched initiatives to tax certain food types such as 'junk' food/fast food products or food components such as those focused on in the Danish 'fat tax' (introduced in 2009 and redacted in 2012 over competition concerns), many of the dominant policy instruments in food sectors focus on information based and education oriented tools. These are focused primarily on awareness raising and frequently accompanied by voluntary strategies reliant on self-commitment, co-operation and networking. Table 8 below outlines some such policy instruments in the name of promoting sustainable food systems.

Table 8 Framework of Policy Instruments to Promote Sustainable Food Systems

Instruments/ Issues	Information-based	Market-based	Regulatory	Self-committing
Health	Publicly question current meat and dairy consumption levels Integrate food-related SCP considerations into formal curricula ^d	Increase VAT on meat products or fat (fat tax, junk food tax)	Limit advertising and other forms of stealth marketing for unhealthy food and drink	Reduce the number of meat dishes in public sector cafeterias Increase share of organic and vegetarian food in public sector cafeterias Establish voluntary agreements with retailers and main industry players on choice editing Public Health Responsibility Deal in England (a voluntary initiative and formal public-private-NGO partnership initiated and led by the English government to address specific, target-based public health objectives, such as reducing excess alcohol, salt and calorie consumption)
Organic food	Develop national organic labels Highlight environmental consequences of individual food purchasing choices Integrate food-related SCP considerations into formal curricula ^d	Provide subsidies for farms during conversion and those involved in organic production Support marketing of organic products and foodstuffs Implement tradable nitrogen quotas ^a Place a tax on harmful pesticides ^a Lower VAT for organic products	Simplify distribution of organic products and foodstuffs ^a Introduce "green accounts" for farmers ^a	Increase share of organic food in public sector cafeterias Increase range of organic food available in retail markets
GHG emissions	<ul style="list-style-type: none"> Highlight environmental consequences of individual food-purchasing choices, e.g., via Carbon Labelling or the Nutrient Density to Climate Impact (NDCI) index Promote food-waste reduction Integrate food-related SCP considerations into formal curricula^d 	Tax food products with high emissions, e.g., higher VAT on meat and dairy products. Introduce CO ₂ taxes Implement tradable nitrogen quotas ^a Promote organic farming ¹ Voluntary third party certified Carbon Footprint labelling of Food products	Develop CAP in a more sustainable direction. Introduce production quotas on meat and/or animal products. Develop and implement clear sustainability targets ^d	Increase range of regional food available in retail markets.
Food waste	Design and carry out awareness campaigns, including school programmes	Initiate taxes or fees on food wasted in production and in the retail system Introduce pay-as-you-throw (PAYT) schemes for households	Critically test existing food-safety standards ² Eliminate legal barriers that can lead to wastage ² Develop monitoring plans to ensure voluntary agreements are followed ^e	Increase range of regional food available in retail markets Voluntary agreements on "buy one get one for free" campaigns

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¹See, ISO, 2012; Smedman et al. 2010. According to a recent report, organic dairy farms produce much lower levels of GHG emissions than conventional farms (Benbrook et al. 2010). Similar advantages—with the exception of land use—have been found in organic crop farming (Nemecek et al. 2011).

^a Additions are from Eionet, 2010; ^b Tukker et al. 2009; ^c Verburg, 2010; ^d EEA, 2008; ^e Danish Ministry of the Environment, 2009; ^f Epstein et al. 2010.

Source: Reisch et al. (2013)

The contemporaneous UK landscape of food policy continues to recognise the importance of strategies to drive toward more sustainable food systems (Lang and Heasman, 2015 and Clonan et al. 2010) but equal significance is increasingly attributed to finding low carbon and resource efficient patterns of consumption is translated primarily through carbon footprinting (measuring carbon consumption in terms of carbon equivalents) and labelling (communicating a commitment to reduce carbon and carbon content) initiatives that use life cycle approaches (often referred to as 'farm to fork' or 'cradle to grave') to account for the number of carbon consumption phases involved in a product or service (Liu et al., 2016; Freidberg, 2015; Garnett, 2009 and White, 2007).

With respect to the policy dimension and in the broader contexts of voluntary standards and labelling, more specifically carbon footprinting and labelling, it is also important to ascertain the behavioural change contexts of industry and consumers at the organisational and consumer levels (Reisch et al., 2013). Yet, as Hartlieb and Jones (2009) highlight, with the introduction of consumer supported ethical attributes including that of carbon, two inexorably linked but contrasting tendencies are created. Firstly, any implementation of a labelling scheme involves the development of a narrow instrumental and technical logic that manifests into a specific function. For instance, to supply consumers, in the form of a label with information regarding the qualities of products or production and supply processes. In a similar vein to Marsden (2013) who advocates transformative systemic change through state supported intervention, Hartlieb and Jones (2009) maintain such reductionist efforts tend to result in the gradual mainstreaming of ethical initiatives citing Fairtrade as an example. This, they argue means corporations' strategies may simply serve to subsume ethical goals within a business participant's competitive and profit oriented logics.

Secondly, such foci on the arguably amoral and technical process of the latter means ethical issues are frequently consigned to a less manifest socio-political dimension tied to the broader issues of 'private' or 'civil society regulation'.

Rettie et al. (2014) conversely argue that while marketing forces are frequently criticised for encouraging unsustainable consumption, the potential role of marketing in stimulating the adoption of more sustainable consumption behaviours could be significant. This echoes the role of marketing as conceptualised and advocated by Jones et al. (2011) and Peattie and Peattie (2009).

Peattie and Peattie (2009) p. 261 assert that, '*Creating meaningful progress towards sustainability requires more radical solutions than just the development of new products and product substitutions amongst consumers*'. A systematic literature review by Pelozo and Shang (2011) examines how CSR activities can create value for stakeholders with a focus on consumers and how these have been represented in the CSR literature. The literature shows a number of deliberate and precise generalisations in CSR research, and an increased focus on the source of stakeholder value provided by CSR activities. The authors suggest that a focus on CSR activities as a source of self-

oriented value for consumers provides an opportunity for marketers to create differentiation and augment what is a dominant emphasis on other-oriented value in CSR research. Rettie et al. (2014) suggest the role of marketing as a vehicle of social normalisation as one such radical solution. This would involve repositioning unsustainable behaviours as not normal and repositioning greener behaviours as normal.

The contention made is that 'effective' marketing solutions could counter criticism that marketing has fostered an unsustainable consumerism and counter accusations of 'greenwash'.

The UK research study by Rettie et al. (2014) employed a qualitative research methodology comprising six focus groups (each demographically segmented for generalisability) from across the UK and pictorial stimuli. The authors conclude that in invoking an environmental marketing approach, marketing can act as a function encouraging the social normalisation of pro-environmental behaviours that could potentially contribute to sustainability objectives in which the adoption of greener consumer behaviours is encouraged by repositioning them as 'normal'. The authors acknowledge that in some contexts, the idea of normalisation is relevant to Labelling Theory. Here it is maintained that if what is normal is prescriptive, what is not normal may be deviant. As such, the stigma resulting from a deviant label may encourage members of that group to adopt out-group norms (Tannenbaum, 1938). Theoretical perspectives are drawn from consumer behaviour and psychology and interpretative labelling theory. Here, the contention is that consumers are more likely to adopt behaviour and products that they think are normal and that what is regarded as normal changes over time. New activities and products that are initially seen as different, and as outside normal behaviour, can eventually become mainstream and accepted as normal, in a process of 'social normalisation'.

Hartmann and Ibanez (2006) suggest that often, researchers' findings concerning the effect of attitudes on planned or actual behaviour frequently find results to be contradictory, inconclusive or both (Hartmann and Ibanez, 2006; Kalafatis et al., 1999; Eagly and Kulesa, 1997; Bech-Larsen, 1996; Schlegelmilch et al., 1996; Stone et al., 1995; Smith et al., 1994; Finger, 1994; Hopfenbeck, 1993; Cope and Winward, 1991; Hines et al., 1987; Dunlap and Van Liere, 1978; Kinnear et al., 1974 and Maloney and Ward, 1973). A more recent study by Hartikainen et al. (2014) also suggests that intended behaviour may not necessarily translate into actual behavioural change citing a study by Rööös and Tjärnemo (2011) where a large gap between intentions of consumers to purchase organic products existed. However, strong intentions to buy organic products were double that of actual purchase transactions. Such findings correspond with an extensive review and analysis of published research on organic food consumption by Hughner et al. (2007) who cite a study by Magnusson et al. (2001). Their findings from a sample of 2000 Swedish citizens indicated that between 46 and 67 per cent of the population (depending on the food category) claimed to hold positive views of organic produce. Only four to 10 per cent of the same sample of

consumers indicated actual intention to purchase organic foods (Magnusson et al., 2001 cited by Hughner et al., 2007). Later research in the UK by Young et al. (2010) on the micro purchasing processes of self-proclaimed 'green' consumers' purchases of technology products also points to the phenomenon of stated preferences, willingness to pay and the resultant 'attitude-behaviour gap' or 'value-actions gap' concluding:

- i) the existence of significant gaps between expression of environmental awareness, intentions and translated behaviour;
- ii) incentives and single issue labels could help consumers focus their restricted efforts;
- iii) increasingly busy life styles hinder people's green efforts and therefore reliance on 'green' consumers as agents of change for consumer products is misguided;
- iv) for retailers, green consumers are more likely to purchase products if a range is available rather than 'one-off' products. Consumers are also more likely to trust and purchase green products available from larger retailers; and
- v) rather than simply providing 'green advice' to consumers, more coherent sustainable production and consumption policies are needed as is a more cohesive governmental response across government departments. In essence, a stronger more transparent level of regulation is suggested in order to underpin the credibility of 'green' efforts and to prevent 'greenwash' particularly on issues such as climate change.

Indeed, extensive empirical evidence of an attitude-behaviour or 'green gap' (Black, 2010), exists in which pro-environmental attitudes are not always reflected in sustainable behaviours. Young et al. (2010) noted that, although 30 per cent of consumers claim to be very concerned about the environment, behaviour therein may be influenced by social norms and ideas of what is normal.

Vandenbergh et al. (2011) in their discussion of carbon footprint labelling schemes illuminate this dilemma where complex problems that such schemes attempt to address should not, it is proffered, be considered to function as a panacea in terms of shifting consumer behaviour towards low-carbon alternatives. Yet, the notion of carbon footprinting and labelling food as a mechanism to generate a transition to a lower carbon future fundamentally rests on the view that consumer-purchasing habits will switch to low-carbon alternatives and these will be available.

2.13 Conclusion

This chapter has sought to explain food the industry's potential responses against the threat of climate change. There are two sides to the equation: supply and demand. On the supply side, the difficulties of driving voluntary market mechanisms such as the environmental standard, ISO 14001 up the supply chain to farmers/producers has been noted (Marimon et al., 2012 and Arimura et al, 2011). On the demand side, it has been noted that consumers generally seem to respond to issues of price and quality not environmental concerns (Guenther et al., 2012). For many, the climate change issue is abstract and not such an environmental concern as weekly bin collection or pot

holes in the road (Kuh, 2012 p.1566). Because of the constant instability and turbulence in the markets not least because they are driven by competition, there is need for governance of those markets in order to stimulate demand so that problems of price inflation, unemployment and therefore falling profits can be addressed. It is an external input approach to a self-regulating market (Chkanikova and Lehner, 2015). This is more than likely due to the comparatively early stage of carbon footprinting and labelling of products and their respective supply chains, limiting industrial experience and explicates the relatively low level of research on the behavioural response to carbon labelling. The rest of this thesis explores these issues in more detail. The reason for this is that in the main the UK food industry itself makes claims to environmental improvements including the importance of carbon labelling but there is little evidence to date to verify these claims. This is not unusual in the context of a food industry welded within an overarching neo-liberal economic setting (Mayes and Thompson, 2014). This has culminated in the continuing rise of food industry self-regulation typically through the design of standards to promote success and avoid public health failures (Sharma et al., 2010) such as obesity, and food related non-communicable diseases in the form of voluntary public-private-NGO partnerships.

Chapter 2 has taken a critical analysis of the major theoretical schools that inform organisational and behavioural change in food consumer studies. The weaknesses of these literatures have been summarised into a series of propositions which, together with propositions that emerge from the parallel contexts in Chapter 3, accumulate to become the totality of the scholarly streams that will be addressed by case study material.

For Chapter 2 these propositions are:

1. Carbon standards and labelling are not robust but in decline. Continued non standardisation of carbon accounting tools brings them into disrepute.
2. Carbon footprinting is a techno-political solution that substitutes a false science for a robust food policy.
3. There may be universal access to PAS 2050 but there is no universal uptake. The policy framework is from strong food security to weak sustainability.
4. There is little link between food production, consumption and environmental policy. The fragmentation of science informing food policy is influenced substantially through the private and corporate control of science.
5. Corporate uptake of environmental issues, especially climate change is because of the threat of an international legal regime.
6. Near consumption actors (supermarkets) are the powerhouse of oligopoly that control food policy making. Corporate interests, not that of the State, is the arena for food policy making.
7. Choice architecture has a fall-back position of nudge economics. Nudge economics is the economics of 'push' with no 'pull'.

8. Green supply chain management is 'greenwash' – ISO 14001 is as close as it gets.

Chapter 3 provides a review of literature that examines the parallel contexts of food safety, health, nutrition and health, and omni-labelling as well as the associated theoretical disciplinary literatures from the domains of public health, policy and consumer behaviour.

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Chapter 3 – Parallel Contexts

3.1 Introduction

Chapter 3 provides a review of policy implementation drawing from the parallel contexts of labelling for food safety, health, nutrition and omni-labelling from a consumer perspective. These terrains of inquiry overlap with the public health, nutrition and food safety streams of literature often from a psychological-sociological and environmental perspective. The following section charts a route through these debates that fundamentally underpin the contexts of consumer choice and behaviours, and organisational change.

3.2 Parallel Contexts:– Food Safety, Nutrition and Health, and Omni Labelling

A number of reviews of peer-reviewed literature have been undertaken looking at food safety and sustainability practices (Glover et al., 2014); the use of food safety messages on food labels (Hall and Ossess, 2013); global food supply chain design and food safety risk management (Speier et al., 2011).

Other significant studies include a systematic review of nutrition labels on pre-packaged foods (Campos et al., 2011); a review of food labels (Temple and Fraser, 2014); a study on the science on front of package labels (Hawley et al., 2013); the role of front of pack nutrition labelling looking at a consumer perspective on key issues and controversies (Van Kleef and Dagevos (2015); the effect of fiscal policy on diet, obesity and chronic disease (Thow et al., 2010); sustainability and food (Fabbrizzi et al., 2016); food sustainability and consumption, policies and challenges (Reisch et al., 2013); European research on consumer response to nutrition information on food labels (Grunert and Wills, 2007); food safety policy making (Millstone, 2007); private eco brands and green market development looking at the value of third party certification schemes in implementing sustainability in food chain governance (Chkanikova and Lehner, 2015); big brand sustainability, governance prospects and environmental limits (Dauvergne and Lister, 2012). In addition, a study by Cairns et al. (2013) provides a retrospective summary examining the evidence on the nature, extent and effects of food marketing to children. The marketing of food is shown to have a direct effect on the nutritional knowledge, preferences, purchase behaviours, consumption patterns and diet related health among children. However, marketing practice continues to heavily promote low nutrition food and drink products to children. A collective review of evidence on marketing practice indicates little movement towards policy aims having been achieved during 2003 to 2012. The authors show there is a gap in the evidence base on how substantive policy implementation can be achieved and urge for a greater emphasis on translational research as a priority for future policy relevant research. Another, is a systematic review of Decision Theory in sustainable supply chain management (Alexander et al., 2014) which concludes by advocating the use of Decision Theory as a useful approach for unstructured decision contexts commonly found in sustainable supply chain management (SSCM) including corporate social responsibility and ethics.

More holistic research attempts concerning the interrelated nature of environmental impact, diet, health and sustainability of food in urban food systems (Rothwell et al., 2016) is emerging. Nonetheless, the scholarly literature remains fragmented despite the obvious linkages. Many of these issues are dominated by narratives of singular phenomena such as 'food safety' (Hall and Ossel, 2013). Health risks also result from the presence of unwanted substances in food products, including pathogenic organisms, toxic substances (e.g., pesticides and heavy metals), and contaminants. In Europe, the most serious food-safety issue is food-borne illness from food poisoning and poor hygiene. Policy interventions are in the main aimed to counter externalities associated highly with carcinogenic and coronary diseases with a plethora of different initiatives at different levels. However, the observation by Caraher and Coveney (2004) that much of the UK food policy landscape is dominated by major public health issues concerning non-communicable diseases, namely cancer and coronary diseases seem to have sustained over a decade later. The result is that even with calls for mandatory regulation to counter food risk health, there are challenges/tensions between the regulators, government and the food industry that persist.

3.3 Food Safety Labels

According to Raspor (2008) Fischer et al. (2006) and Redmond and Griffith (2005), consumers have been the least studied element of the food chain. As such there is wide interest in examining how consumers access and utilise food safety information provided on food labels derived from a series of food standards. While the evidence is noted as contradictory in terms of consumer use, consumers are believed to consider food labels. For instance, an observational study by Grunert et al. (2010a) on the use of nutritional information labels in three major UK retail supermarkets found that only 27% of respondents looked at food labels. Whereas, self-reported use of labels tends to be higher. For instance, an Australian study by Grimes and colleagues (2009) found that out of a sample of 474 consumer surveys, 69% of consumers claimed to look at the salt content of food when shopping. However, in the national and global contexts of food safety policy making, Millstone (2007) indicates that risk management decision making and risk assessment do not necessarily lead to a more egalitarian or democratic legitimisation of the science behind any given food safety policy regime, leading to multiple 'dysfunctional hierarchies' performing within individual food safety policy siloes. Essentially, Millstone (2007) critically examines whether food safety policy making can be both scientifically and democratically legitimised. A 'co-evolutionary model' of the relationship between scientific considerations on the one hand, and political and ethical considerations on the other was developed. This was a direct attempt to provide a more accurate and adequate representation of how in practice, politics, ethics, and science interact in food safety policy-making for food standards. Global mandatory regulatory regimes (e.g. Codex Alimentarius⁸) as well as a series of governmental

⁸ The Codex Alimentarius, or "Food Code" is a collection of standards, guidelines and codes of practice adopted by the Codex Alimentarius Commission. The Commission, also known as CAC, is the central part of the Joint FAO/WHO

intervention/regulations were considered. While it is acknowledged that it is almost impossible to capture up-stream as well as down-stream interactions between science; it was found that ultimately, scientific representations of food safety risks are framed by prior evaluative judgments, even if risk assessors and risk managers choose not to acknowledge the case.

From a consumer perspective, an extensive and comprehensive literature review of studies investigating consumer responses to labels communicating food safety related messages by Hall and Ossiess (2013) begins by explaining that food labelling regulations set the minimum requirements for relevant information that must be contained on food labels for consumers. However, the response of consumers to food safety labels is differentiated and labels are utilised by consumers to varying degrees. The review covers studies from 2001 to 2010, the details of which are included in Table 9 on the following page. Of the 21 studies presented in Table 9, the majority (16) were conducted in European countries (including 8 studies in the UK), with one conducted in Canada (Alton Mackey and Metz, 2009) and two in Australia and New Zealand (FSANZ, 2008 and FSANZ, 2003). Many of these studies did not address the issue of food labels on specific food products but the use of food labels more generally, although a small number (six) did, and these were either meat (Gellynck et al., 2006; Verbeke and Ward, 2006; Bernués et al., 2003 and Riordan et al., 2002), fish (Pieniak et al., 2007) or perishable products (Terpstra et al., 2005). The target groups of participants and respondents were most frequently adults over the age of 16 or 18, and a number of studies (five) specifically targeted the individual who had responsibility for most of the household food shopping (GFK Social Research, 2009; Alton Mackey and Metz, 2009; Pieniak et al., 2007; FSANZ, 2003 and Bernués et al., 2003).

In terms of the approaches taken by researchers to investigate the issue of peoples' use of food labels, these were all based on self-reported use, with the exception of one study that was an observational study (Ipsos Mori, 2010). The range of research techniques used to elicit this information was, however, varied, and encompassed focus groups (Alton Mackey and Metz, 2009; Pieniak et al., 2007; OCTA, 2006; OPTEM, 2005 and TEEC, 2003), interviews (TNS, 2008; Pieniak et al., 2007; Verbeke and Ward, 2006; Terpstra et al., 2005; TNS, 2004; Bernués et al., 2003; and FSANZ, 2003), workshops (FSA, 2006), online surveys (FSANZ, 2008) and questionnaires (GFK Social Research, 2009; Gonzalez-Roa and Calatrava-Requena, 2008; Gellynck et al., 2006; Redmond and Griffith, 2005 and Riordan et al., 2002).

Table 9 Food Safety Label Research Studies

Food Standards Programme and was established by FAO and WHO to protect consumer health and promote fair practices in food trade. Source: FAO (2016)

Author, date	Location	Population Sample Type	Study Approach	Food Product(s)	What did the study investigate?
Ipsos Mori, 2010	UK	Food consumers	Observational study	No specific food product considered	Consumer use of food labels
Alton Mackey and Metz, 2009	Canada	Primary food purchaser, over 50 years old	4 focus groups and typographical assessments (n=50)	29 labels from different products	Ease of reading labels, use of safety information on food labels
GFK Social Research, 2009	UK	Largely principal shoppers of households (56%)	Survey (n=3219)	No specific food product considered	Consumer attitudes towards food issues. Expiry dates on food labels
FSA, 2008	UK	Food consumers	10 workshops with 8-10 participants	No specific food product considered	Consumer use of food labelling including expiry date, cooking and storage instructions
FSANZ, 2008	Australia and New Zealand	Food consumers	Online survey (n=2000)	No specific food product considered	Consumer attitudes towards and acknowledge of food issues including using of food labels
Gonzalez-Roa and Calatrava-Requena, 2008	Spain	Consumers from urban, rural and metropolitan areas	Survey (n=1500)	No specific food product considered	Use of label information including calories, preservatives, additives, expiry date, origin, ingredients, quality marks, nutrition, genetically modified health claims
TNS, 2008	UK	Adults aged 16 and over	Face-to-face interviews (n=2627)	No specific food product considered	Consumer attitudes, knowledge, self reported stated behavior and awareness of food products. Use and understanding of food labels
Pienak et al., 2007	Spain and Belgium	Women who purchase and cook fish for their household	6 focus groups interviews (n=48)	Fish	Consumer attitudes towards information about fish (including traceability and labelling)
Verbeke et al., 2007	N/A	Consumers	Review	N/A	Examines consumer responses and behavior to food safety and risk information.
Gelynck et al., 2006	Belgium	Used consumer data from three previous studies	Surveys (3) Convenience sampling (n=452 – total for the three surveys)	Meat	Consumer interest and trust in information provided on labelling on meat
OCTA, 2006	Spain	Food consumers	Focus group, survey (n=2000)	No specific product considered	Consumer use and opinion of food labels
Verbeke and Ward, 2006	Belgium	Meat consumers	At home interviews (n=278)	Meat	Consumer interest in information on beef labels
OPTEM, 2005	28 European countries	Adults aged 25 to 60	Focus group	No specific food product considered	Consumer attitudes to food labels
Redmond and Griffith, 2005	UK	Adults aged 16 and over	Self-administered questionnaire with attitudinal statements (1100 responses)	No specific food product considered	Factors that influence the efficacy of consumer food safety information communication. Consumer receptivity to food safety advice. Labelling issue included in questionnaire.
Terpstra et al., 2005	The Netherlands	Consumers segmented by 3 household types: consumers with children under 4 years old; with children over 4 years old or no children and over 60s	At home interviews and participant observation (n=33)	Perishable products including meat, sliced cold meat, vegetables, fruit juice, leftovers, cheese and dairy	Examined behaviour, motives and knowledge of consumers regarding storage and disposal of perishable food products.
TNS, 2004	UK	Adults aged 16 and over	Focus group	No specific food product considered	Consumer attitude, knowledge, stated behavior and awareness of food products. Use and understanding of food labels.
FSANZ, 2003	Australia and New Zealand	Main grocery shoppers and non-grocery shoppers	Face-to-face interview (n=2228)	Beef and lamb	Use of information on food labels re: brand name, origin, nutrition, maturation time, expiry date, cooking instructions, name of cut. Attitudes to production methods, traceability and quality control.
TEEC, 2003	France, UK, Italy	Not specified	Focus groups (3) (n=90)	No specific food product considered	Usefulness and acceptability of label information, including expiry date, storage and preparation instructions
Riordan et al., 2002	Ireland	Beef consumers	Survey	Beef	Examination of consumer concerns related to food safety, level of knowledge of food safety practices and awareness of institutional structures to ensure the safety of Irish beef
Yeung and Morris, 2001	N/A	Consumers	Review	N/A	This review aimed to develop a conceptual framework to identify the factors influencing consumer perceptions of food safety related risks and the likely impact on purchasing behaviour

Many of the studies include the issue of food safety information on food labels but generally as part of a broader study of use of food labelling information. For instance, the review of studies by Hall and Ossess (2013) also includes four research papers (Verbeke et al., 2007; Terpstra et al., 2005; Riordan et al., 2002 and Yeung and Morris, 2001) that did not set out to investigate use of food labels explicitly but are included because findings included reference to labelling. Communicating food safety messages via labelling for information (by providing information on food packaging) is required by UK law to communicate specific types of information aimed at reducing adverse health, food chain contamination and encourage safer domestic handling (Temple and Fraser, 2014). Such food labels are largely intended to support singular issues of government food policy goals (Speier et al., 2011).

Findings of the review by Hall and Ossess (2013) also show that some UK consumers are more likely to adhere to expiry dates on food labels than others. However, understanding what drives consumer use of food labels in this context was difficult to determine because decision-making is not found to be driven by objective risk assessment. Instead, the evidence demonstrates that label use is dependent as is understanding, on attitudes, knowledge, experience and trust in the information providers behind the Label in question, which explains the inconsistency in response across consumer groups.

Consumer behaviour is consequently not consistent and in this context, may not necessarily result in consumers behaving the same way every time they handle a certain food product or when handling different types of product. While understanding knowledge and attitudes vary across the consumer groups studied, they simultaneously exhibit high rates of consumer confusion but consumer labels are nevertheless widely used for information (Verbeke et al., 2007). Therefore, evidence is contradictory as consumers do use labels but not in a consistent manner as shown in work by Temple and Fraser (2014). Here, the review of academic literature investigating consumers' responses to labels related to food safety messages shows that food labels are indeed central for communicating information about food products to consumers despite differentiated use and understanding levels across consumer groups.

Food safety labelling regimes are suggested by Speier et al. (2011) to provide a valuable means to impart food safety messages to improve and ameliorate poor domestic food handling practices. Further, Hall and Ossess (2013) examined through a survey of the literature, the key antecedents related to the use of food safety information on food labels. In doing so, the authors developed a model showing the principal antecedents related to the use of the food safety information on food labels for consumers. These antecedents to food safety label use are contextualised and illustrated in Figure 10 below.

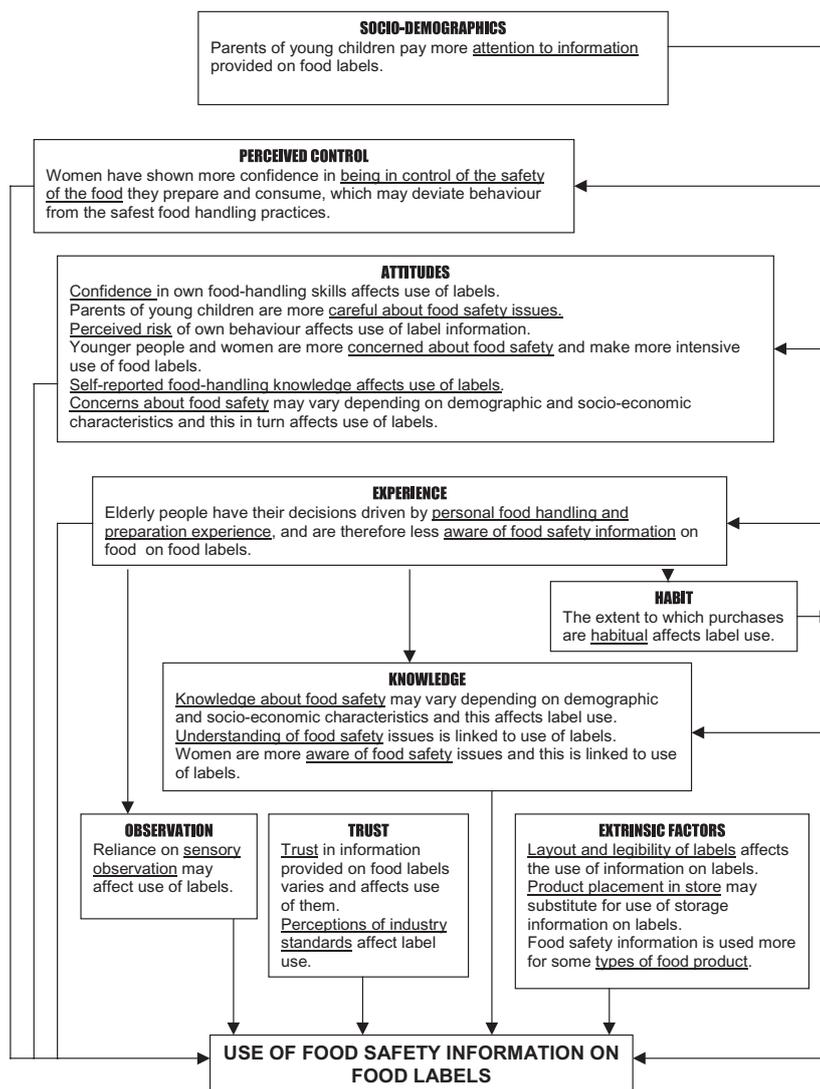


Figure 10 Antecedents related to the use of food safety information on food labels
Source: Hall and Ossess (2013) p. 430

The modelling factors outlined in Figure 10 above, show that the dominant factors influencing the use of food labels are dependent upon the behavioural and attitudinal attributes of experience, knowledge, understanding, habit, observation and trust. Antecedents to the use of food safety labels are consequently suggested by Hall and Ossess (2013), to be influenced by perceived control and attitudes. Perceived risk of individual behaviour was found to affect use of labels although the extent to which was not possible to measure. However, perceptions of industry standards were also found to affect label use along with extrinsic factors such as layout and the legibility of food safety labels.

Diversity of the information can make it difficult for consumers to identify important food safety messages. Confusion is a factor particularly with respect to spoilation dates and more detailed

information such as cooking guidelines are generally ignored. As such, it seems, like many behaviours, the use of labels is influenced by a wide range of factors including attitudes, experience, socio-demographic characteristics, trust in message providers and label design. Recommendations by Hall and Ossaes (2013) are made for more tailored product specific information on labels, observational studies to inform understanding of this issue and clarification for consumers about what information is important to food safety in future research.

Food safety standards are underwritten by both science and law (Glover et al., 2014). This whole issue of food safety is complex, often confusing and sometimes contradictory - Proposition 9.

Proposition 9

Regarding food safety, standards are underwritten by science and law but this is complex, confusing and sometimes contradictory.

3.4 Nutritional Labelling and Health

According to Gortmaker et al. (2011) public health authorities are increasingly feeling a need to act given the indissoluble linkages between the health of children and adults. Balcombe et al. (2010) highlight an ongoing growing awareness and understanding of the links between food consumption and point to the role food plays in health and wellbeing. A series of extensive critical reviews exist of the rapidly growing area of FOP nutritional labelling where much of the research is found to be premised on investigative inquiry related to relationships between food labels, health and choice (Balcombe et al., 2010).

The extent to which such labels can lever positive behavioural changes in society is attributed strongly to the strength of design and overall format of nutritional labels for information (Temple and Fraser, 2014 and Grunert et al., 2010). Regulations specifying what information must be stated on food labels are common in developed countries (Temple and Fraser, 2014). Well-designed labels are widely thought to potentially have a positive influence on national diets, health and wellbeing (Van Kleef and Dagevos, 2015 and Balcombe et al., 2010). Nutrition information on food labels is widely regarded as a key tenet for encouraging food consumers to make healthier choices when shopping (Grunert et al., 2010) and more broadly play a vital role in informing consumers of the nutritional information of packaged food and drink products. Nutritional labelling has become a focal area of much research in recent years including both for the front and back of pack food packages (Temple and Fraser, 2014 and Grunert et al., 2010).

Over the past decade, the UK has witnessed a rapid transformation in the signposting and design of nutritional food labels (Balcombe et al., 2010). In the main, food labels with traditional nutrition information presented in grid form have been superseded by a multifarious array of simplified nutrition labels that are commonly placed on the front of pack, known as front-of-pack (FOP) nutritional signposting information (Grunert et al., 2010). There are two types of nutritional labels for food and

drink products: front of pack (FOP) and back of pack (BOP). Labelling regulations tend to apply to food and drink products that are packaged such as cans, cartons or cardboard boxes (Temple and Fraser, 2014).

A useful definition of the two types of labels by Temple and Fraser (2014 p. 257) is provided here:

“Front-of-Package labels inform the buyer of the brand name and type of food (e.g., Kelloggs Shredded Wheat). The FOP label also may have a statement about the composition of the food (such as “good source of fibre”) or a health claim (such as “diets low in total fat may reduce the risk for some cancers”).

Back-of-Package labels include a Nutrition Facts panel that provides details of the nutritional composition of the food (provides details of the nutritional composition of the food (such as 185mg of sodium per 35g serving). To help the consumer interpret the information, the amounts also stated are as percent of recommended daily intake (called Daily Values in the United States and Canada). The BOP label also lists the ingredients in the food, in order by amount (main ingredient first).”

A critical review of nutritional food labels for health by Temple and Fraser (2014) underscores that a number of contradictions in attempts at assessing and determining the role of labels in informing consumers of the composition of foods to aid food choice selection for a healthier diet. Here, it is recognised that food labels used in many countries fail to adequately convey the information required by consumers (such as which foods are healthiest) in a user-friendly format.

It is thought a typical shopper of a particular ‘same’ food product category will generally spend no more than a few seconds in evaluating each of the choices (Sorensen, 2009). For this reason, nutritional food labels are said to play a critical role in informing consumers about ‘the composition of foods’ (Temple and Fraser, 2014 p.257). This is largely related to the contexts of health and nutritional content although recognition is growing of the increasingly inexorable linkages, interconnectedness and relevance of social and environmental concerns (Reisch et al., 2016; Lang and Barling, 2013 and Lang and Barling, 2012).

There is also a growing interest in drawing upon nutritional evidence for the reduction of fats, sugars and processed foods. Lang and Barling (2012 p.319) put forward the argument by the UK Government’s Sustainable Development Commission that:

“...the nutritional evidence for cutting down on fats, sugars and processed foods melded well with environmental concerns (Sustainable Development Commission 2009b). The Netherlands also broadly agreed (Health Council of the Netherlands 2011). The sustainability of total diets – not just particular products – raises important policy difficulties: is a sustainable diet the same globally? Or will it vary by location?

Can ‘soft’ policy measures such as labelling and consumer information address complex issues such as water conservation and the reduction of unnecessary ‘virtual’ water in food supply chains?

Some of the world’s largest food companies are already tightening specifications for their product ranges, factoring in carbon in particular (CarbonTrust 2008). In so doing, they are effectively choice-editing the food products in terms of their sustainability...”

However, provision of information provided by many food labels at the global and international levels to consumers is often not presented in a 'user friendly' format. Many labels lack clarity and are difficult for consumers to make sense of. Despite this, initiatives for carbon footprint labelling development surged in 2007. These were largely driven by business and government support although much of these early attempts were limited to pilot projects and trials for a limited number of consumer products (Hornibrook et al., 2015 and Hartlieb and Jones, 2009).

A recent critical review by Van Kleef and Dagevos (2015) of the literature in the consumer domain of FOP labelling details the strengths and weaknesses of this form of nutrition education from a consumer perspective. The review covers studies completed in developed countries where regulatory regimes are well established, including those governing food labelling. The search strategy employed for this review utilised a number of key word searches, including terms such as 'food label' and 'food safety' combined with the terms 'consumer' and 'public'.

A number of databases were searched including ScienceDirect, Web of Knowledge and AgEcon. However, the search strategy primarily involved searching topic-relevant journals, including Food Policy, British Food Journal, Trends in Food Science and Technology, Food Quality and Preference, Journal of Food Safety and others. In addition, the websites of certain national and supra-national food safety regulatory bodies (for example, UK FSA, EFSA and the FSANZ) were searched for relevant reports. In this way, the authors aimed to uncover a broad range of literature from around the world, encompassing grey literature, published peer-reviewed literature and other published but not peer-reviewed literature.

Van Kleef and Dagevos (2015) suggest that other useful approaches that deserve more attention include reducing portion sizes, limiting the availability of snack foods, and reducing food advertising (Cohen and Farley, 2008). An assumption is made that for an effective public policy tool to be developed, it is important to understand the factors that influence consumer trust in nutrition logo schemes. However, consumer trust could be negatively influenced by the similar occurrence of a number of alternative logo systems in the market place. In terms of consumers, it is argued that it could take years to fully embrace and understand a logo. This requires commitment from both consumers and other actors involved. It is suggested that it could be a similar process to brand loyalty in which consumers attach themselves to a brand over the years.

While it is widely acknowledged that the problem of nutrition-related diseases does not have a single solution, nutrition labels may play a role in promoting healthy food choices. The academic literature indicates a necessity to develop more real-life understanding in the consumer psychological phenomena surrounding the key issues and controversies of today's nutrition labels debate. Eventually, when the target of nutrition signposting labels are consumers, it seems logical to emphasise the pivotal importance of understanding consumers' information processing and decision-

making better. Van Kleef and Dagevos (2015) suggest that examining the scientific and value base of established or new nutrition signposting labels will be vital to make realistic estimations and expectations about the effectiveness of nutrition labels with respect to improving consumers' dietary choices and health and that these are prime objectives of nutrition labels in current scientific and policy discourse.

In general, consumers, as well as researchers and policy makers, feel that health and nutrition information is often conflicting and confusing (Schor et al., 2010). UK research confirms this as it shows that the coexistence of a range of labels in the market place creates considerable frustration and difficulty in comprehension for shoppers (FSA, 2009). Deeper and more elaborate comprehension often produces inferences, which are beliefs that are not based on information directly presented in the environment. These are heavily influenced by consumer knowledge that is activated during comprehension (Peter and Olson, 1994). Consumers can make inferences from a small level of information. For example, some consumers might infer that a food is healthy because the advertisement emphasises the naturalness of that product.

The literature also indicates that various types of misinterpretations may occur with nutrition labels (Grunert et al., 2014). In this vein, label clarity and intention may be a salient factor for specific types of consumers. For example, a systematic literature review by Campos et al. (2011) on nutritional food labels found that many foods have a logo on the front of the pack indicating an endorsement by a health-related organisation. However, this system is reported to be both inconsistent and flawed. For instance, in Canada, the Heart and Stroke Foundation allows its logo to be added to many food products. Some brands of margarine and orange juice have the logo. However, other brands do not despite having an almost identical composition. Other important misconceptions about FOP labels tend to relate to whether the food producer makes use of a nutrition signposting system and whether the information refers to a single portion size or 100 grams of the product (Grunert et al., 2010b).

Most concerns about misinterpretations regarding the actual healthiness of a food are related to 'seal of approval' systems, such as the Choices label. These labels can only be found on relatively healthy foods within a specific product category and in this way, they provide a positive information cue. Butler (2010) argue that such labels can be misleading because they force consumers to contrast between 'good' and 'bad' foods. Consequently, many consumers find it difficult to distinguish between more nuanced graduations of relative healthiness attributes. This, it is argued may lead to dichotomous thinking, a thinking style that abandons more complex decision options or rules. Such oversimplification may promote unhealthy food choices and encourage overconsumption. Research that supports this concern by Andrews and colleagues (2011) compares the effects of a 'seal of approval' label with a combined traffic light-GDA label and a non-FOP label condition in a between-subjects experiment. The authors found that a 'seal of approval' might act as an implicit health claim

as consumers perceive a product with such a label as healthier than a product with either the traffic light–GDA label or no label.

Steenhuis and colleagues (2010) similarly found that chocolate cake was perceived as less unhealthy with the Choices label compared with no such label. Nevertheless, no changes were observed in the amount of chocolate mousse cake consumed with or without a Choices label. Other types of FOP labels may also be vulnerable to this contrast effect. For example, Grunert and colleagues (2010b) found a tendency of consumers to over interpret the severity of the amber colour and especially, the red colours of the UK TFL scheme. However, the UK's FSA definition is that it is reasonable to have the product occasionally as a treat even if marked with a red coloured TFL indicator.

The literature shows that there is also concern that nutrition information on packages make people vulnerable to what are known as 'halo effects'. Studies of the classic 'halo effect' demonstrate that if a person is judged to be performing well on one aspect, this positive evaluation extends to other aspects as well, even though these aspects may be unrelated (Kahneman, 2011). For example, in using nutritional labels a person may infer what is a reasonable amount to consume and how much pleasure and guilt feeling a person anticipates by eating that given amount (Wansink and Chandon, 2006). FOP labels could also bias evaluations of other product qualities such as health (Roe et al., 1999) and nutrient content claims (Geyskens et al., 2007).

Provision of energy or fat content of a food could also lead consumers to overconsumption (Wansink and Chandon, 2006). Similar results were found with regard to how much a consumer ordered and ate in restaurants they perceived as healthier versus less healthy. For instance, exposure to health primes (for example, words such as diet and fibre) has been shown to increase consumption of low-fat chips (Geyskens et al., 2007). This is because these primes led people to believe that low-fat chips are healthier than conventional alternatives. Chernev (2011) also suggest that consumers tend to believe that eating healthy foods in addition to unhealthy ones can decrease a meal's calorie content.

Another potential reason for the overestimation of healthiness by consumers is that same product category comparisons by consumers are also possible via FOP label use. Therefore, as Grunert et al. (2010b) find, consumers tend to look for the 'best' yoghurts within an entire category of yoghurt products. Research on traditional nutrition label use also shows similar results in that consumers make comparisons within a category of products (Higginson et al., 2002). Conversely, a cross-European study by Fuenekes et al. (2008) found that consumers think that nutrition labels compare products across food products rather than between products within one category. In this vein, consumers are assumed to select foods with a 'seal of approval' are preferable in an absolute sense and not in a relative sense within a particular category. Raghunathan et al. (2006) assert that a commonly related issue associated with health halos is the 'unhealthy=tasty intuition' which can also lead to inappropriate generalisations by consumers. It is also suggested that indicating foods as

'healthy' reduces consumers' taste expectations, experience, and even expected satiation (Aaron et al., 1994). For example with the Choices label, it was found that the higher people rated the enjoyment of the taste of food in their shopping basket, the fewer products with this label were bought (Vyth et al., 2010b).

The anchoring effect may also be at work in consumers' mind while interpreting nutrition information (Szanyi, 2010). Individuals evaluate options based on the surrounding information, and in doing this, consumers may rely strongly on one piece of information for making a decision (Wilson et al., 1996), which is not desirable from a nutritional perspective (Brownawell and Falk, 2010). Consumers tend to focus most typically on familiar nutrients in the realm of food choices. These tend to include declarations of protein, fibre, calcium and vitamin C content and the lack or absence of fat and sodium. Other nutrients that tend to garner less focused and cursory consideration by consumers include saturated fat, fibre, iron, vitamin A and sodium (Drewnowski et al., 2010; Schor et al., 2010 and Higginson et al., 2002b). It is argued that in terms of gender, mostly female consumers are concerned with information relating to fat and energy content (Ranilovic´ and Baric, 2011; Balcombe et al., 2010 and Drichoutis et al., 2005). A pan-European survey by (Hoefkens et al., 2011) found that qualifying nutrients (fibre, vitamins and/or minerals) were considered more important for food choice than disqualifying nutrients. Understanding daily calorific needs and appropriate portion size is also reported as a challenge for consumers (Wansink and Van Ittersum, 2007). Calories displayed on a food product package may therefore become the focal point of attention and could lead people to choose a food that scores relatively lower calorific content relative to other values even in cases in which the difference is negligible (such as a 10 kcal difference (Szanyi, 2010). Consumers could also think that higher calorie counts mean lower nutritional value (Szanyi, 2010), which is not necessarily true.

At the heart of the current nutrition signposting debate is the concern whether signposting schemes are simply self-promotion strategies for the food industry or whether they actually improve consumer diets and health in the general population. Proponents suggest that FOP labelling is effective and feasible in helping consumers make healthier choices (Lobstein and Davies, 2009 and Feunekes et al., 2008) and that they have a positive stimulating effect on product innovation in that it encourages food manufacturers to alter the nutritional composition of their foods in beneficial ways (Rayner et al., 2009). Opponents warn that an excessive amount of nutrition information creates confusion among consumers and could be deceptive (Nestle and Ludwig, 2010). In order to promote a healthy diet, the World Health Organization (2008) recommends the provision of accurate and balanced information for consumers to enable them to make well-informed, healthy choices. Although conflicting interests may hamper further development, FOP labels could play a necessary role in achieving this recommendation.

As labels contain diverse messages and complex combinations of information, the task of understanding how consumers use food safety information on food labels is not easily separated out from the issue of food label use more broadly. Subsequently, information regarding how consumers use and understand food safety information on food labels is most often to be found in articles that deal with other aspects of consumer interaction with food labels (Pieniak et al., 2007; Verbeke and Ward, 2006; Gellynck et al., 2006 and Bernués et al., 2003).

In particular, altering the social environment of consumers that support food behaviour changes is increasingly seen as one of the most promising and effective policy directions (Reisch et al., 2016; Van Kleef and Dagevos, 2015; Grunert et al., 2014; Story et al., 2008 and Thaler and Sunstein, 2008). Consequently, nutrition signposting logos are increasingly forming part of a broader basket of policies to encourage people to change their eating habits. When the environment does not support healthier choices, it becomes problematic to expect consumers to act in accordance with long-term health goals.

Food behaviour is frequently targeted to change nutrition, and therefore health outcomes. This change is only at the individual level and is rarely summarised to the key social and environmental problems that are essentially social - Proposition 10.

Proposition 10

Regarding nutrition and health, food behaviour is targeted and changed but only at the individual level, never summarised to the social and the environmental problem which is essentially social.

3.5 Omni Standards and Meta Labelling

Omni-standards, and 'meta' labelling or sustainability labelling regimes to date are relatively novel foci within the literature. The discourse is predictably discursive with those who argue against such approaches until the 'science' behind the labelling is robust and rigorous enough across each of the multiple issues included within an all-encompassing label (Tzilivakis et al., 2012). Whereas, Dendler (2014) cite that such sustainability or meta labels are largely hampered by different interpretations of the sustainable development concept but nevertheless extol the virtues of such efforts.

While it is beyond of the scope of this research inquiry to analyse sustainable development conceptualisations, Hopwood, Mellor and O'Brien (2005) do provide an in-depth critique of the complexities associated with sustainable development perspectives. Hopwood and colleagues (2005) expand upon the categorisation of environmental views by O'Riordon (1989) who describes sustainable development perspectives as ranging from strong eco-centric to strong techno-centric, and recognises that these often combine with socio-economic viewpoints so that eco-centrics are more inclined towards social and economic equity and redistribution while techno-centrics are more likely to support the economic and political status quo. Figure 11 outlined below illustrates a generalised view of these trends within the sustainable development debate by considering environmental and socio-economic views on two separate axis. The socio-economic axis covers the

level of importance given to human well-being and equality and the environment axis covers the priority of the environment from low environmental concern through techno-centred to eco-centred. The central shaded area of the map indicates the range of views within the sustainable development debate; combining socio-economic and environmental issues. There are views outside this area, concerned either with environmental or socio-economic issues while ignoring the other.

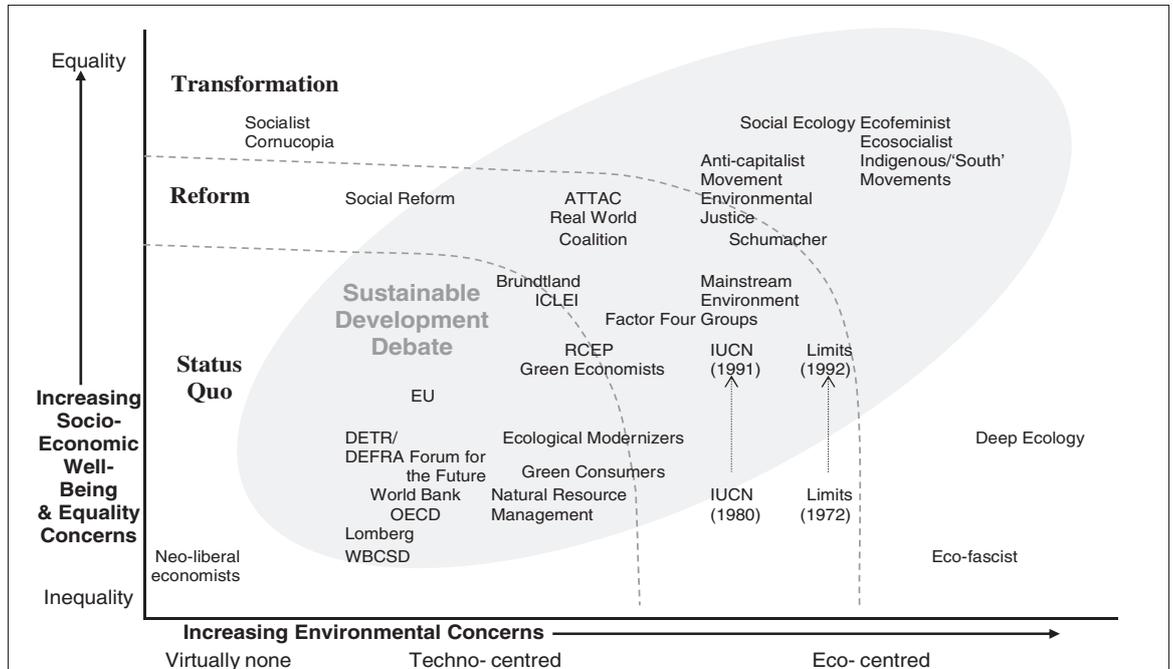


Figure 11 Mapping of Views on Sustainable Development
 Source: Hopwood, Mellor and O'Brien (2005) p.41

This viewpoint is echoed in research published in the Journal of Cleaner Production by Dendler (2014) that investigates the perceived effectiveness of meta labelling for sustainability in food consumption and production systems. The study explores how the notion of Sustainability Meta Labelling has so far been discussed and investigates the prospects for such an overarching scheme to become institutionalised. This research study examined four existing product labelling schemes (EU ecolabel, EU energy label, Marine Stewardship Council and Fairtrade label) as well as the notion of Sustainability Meta Labelling. In combining theoretical arguments of constructivist institutionalism and institutional entrepreneurship with the concept of legitimacy, the authors demonstrate the potential institutionalisation of a sustainability meta labelling scheme. The evidence from this qualitative study indicates that the very issue that is claimed to drive the establishment of a sustainability meta labelling scheme is bound up with different interpretations of the Sustainable Development concept. Different product labels might in fact pose one of the main challenges for its institutionalisation and effectiveness in facilitating more sustainable consumption and production. Legitimacy constructions are demonstrated and are shown to be highly dynamic and frequently inherently conflicting. Many of these

conflicts appear to be likely to increase rather than decrease with the implementation of an overarching Sustainability Meta Labelling scheme. Mobilisation of knowledge, traditional, regulatory and charismatic logics has shown to be able to circumvent some of these procedural and consequential conflicts and facilitate passive alignment with a labelling scheme instead. Labelling schemes are shown to be anything but a silver bullet. This seems particularly, to be the case when a highly contested notion like Sustainable Development is addressed through a product labelling scheme with limited regulatory capacity. A Swiss study by Engels et al. (2010) who utilised the combination of an experimental meta label and an LCA modularity approach (which the authors developed for food products in Switzerland) found such labels could indeed nudge behavioural change amongst consumers but only if supported with the strong backing of the food industry and its expertise in industry promotion/marketing.

According to Upham et al. (2011) and Tzilivakis et al. (2012), increasing pressure on the food industry and society as a whole to evolve towards more sustainable production and consumption has led to the proliferation of product labelling schemes, introduced by various market actors, to inform consumers about environmentally or socially related product attributes including carbon. Traditionally, food product labels tend to relate to single product issue attributes such as food safety and nutrition and health. Despite the rise in eco-label development and market proliferation of such food labels, social and environmental labelling concerns are increasingly difficult to incorporate within a single formulaic food label (Defra, 2010). Upham et al. (2011) p. 328 put forward that *“environmental and social labelling have now proliferated to the point that governments are beginning to seriously consider the prospects for ‘meta’ or ‘omni’ labels that would combine sub-labels and so simplify the presentation of information for consumers.”*

The concept of meta or ‘omni’ labelling underpinned with “omni- standards” was first proposed by Professor Tim Lang, 2008 (and former Adviser to the UK Cabinet Office) who also coined the term ‘food miles’ given consumers as Lang (2008) suggests are increasingly confused by conflicting and often contradictory advice about food. To account for the multiple social and environmental impacts of any single food product, Lang (2008) controversially suggested such omni-labelling could help consumers navigate and increase the reliability of consumer information on food product labels through the integration of information on the multiple aspects of a food product’s health, social and environmental attributes. Indeed, almost a decade ago Lang (2008) suggested the UK Government should set up an independent panel of experts to look to introduce a labelling system that would integrate a holistic range of information relating to all aspects of a food’s impact. For instance, this should include information related to health, environmental effects and the social consequence of the way a certain food product is produced. While Lang (2008) acknowledges the complexity of such an undertaking, he maintains the need to provide consumers with reliable information to help shape behavioural change.

To address the overall complexity of food sustainability, Lang and Barling (2013) note that the final report of the UK's now closed Sustainable Development Commission (SDC) included a proposal to government for a multi-dimensional approach to food sustainability with an 'omni standards' or 'poly-values' approach to sustainability. These include six suggested key issues for food sustainability: quality, health, social values, environment, economy and governance (SDC, 2011). See Table 10 below.

Table 10 Sustainability as a set of 'omni' standards or 'poly' values

Quality		Social Values	
Taste		Pleasure	
Seasonality		Identity	
Cosmetic		Animal welfare	
Fresh		Equality and justice	
Authenticity		Trust	
		Choice	
		Skills (citizenship)	
Environment		Health	
Climate change		Safety	
Energy use		Nutrition	
Water		Equal access	
Land use		Availability	
Soil		Social status/soil affordability	
Biodiversity		Information and education	
Waste reduction			
Economy		Governance	
Food security and resilience		Science and technology	
Affordability (price)		Evidence base	
Efficiency		Transparency	
True competition and fair returns		Democratic accountability	
Jobs and decent working conditions		International aid and development	
Fully internalised costs			

Source: SDC (2011) cited by Lang and Barling (2013) p. 7

Lang recognises the potential challenges associated with the formation of such an 'expert' panel; principally concerning whether NGOs should be included directly or indirectly and to what extent as well as the obvious tensions within government departments in doing so. Lang is quoted in the same article (Guardian, 2009) "*I think there are very interesting tensions within government. I will say very tightly – very interesting nuances between the various departmental chief scientists of their various positions.*"

Lang (2008) seems to have gauged the mood for such initiatives well because by February 2011, following publication of a DEFRA report commissioned to consider the effectiveness of 'meta' or 'omni' labels for the environment (titled: '*Effective approaches to environmental labelling of food products – FO0419*') little appetite for the omni-label approach was apparent. Omni labelling, it was concluded is simply too expensive, complex and ought to have focus placed on the harmonisation and standardisation of process-based schemes to drive change effectively in production which would potentially and eventually require a move from voluntary market regulation towards governmental support in the form of mandatory legislature. In fact, the authors concluded:

“There is not enough robust science to support the development of an omni-label to accurately inform consumers of the environmental impacts of food products, according to a new product. There are still big technical challenges that would need to be addressed before such an omni-label could become a reality, and government should work with industry and green groups to help improve the science and agree common metrics.” (Halliday, 2011)

Indeed, the Food Ethics Council (a UK charity based in Brighton that provides advice on the ethics of food and farming) who also contributed in the development of this research project announced the pitfalls of such an approach to food labelling (Halliday, 2011). This announcement was premised on the findings of the commissioned DEFRA study⁹ specifically centred on investigating the potential benefits and disbenefits of a single ‘catch all’ eco label for food products. It was a collaborative study and involved a review of 70 environmental labelling schemes for food. Findings indicate that such labelling is more effective in the context of ‘best practice’ improvement within the food sector than eliminating or reducing ‘worst practice’. The report suggests that while environmental labels play an important role in the reduction of adverse environmental impact they by no means serve as a panacea to lowering environmental impact and driving behavioural change in production processes within the food industry (DEFRA, 2010). This is because most environmental labels inform consumers ‘how’ their food was produced but don’t necessarily measure the direct environmental impact of individual products. Therefore, focus should be placed upon ‘practice-based’ over ‘outcome-based’ labels as these are suggested to be more cost effective than developing an overall ‘outcome-based’ omni-label. Further, labelling it is suggested, should not be the primary focus of reducing environmental impact as the report reaffirms in its conclusion, support for continued efforts relating to the harmonisation and standardisation of process based ‘best practice’ approaches in production. Key issues arising from the DEFRA (2010) report tend to relay to the ongoing need for ‘standardisation of process’ given numerous gaps remain in the scientific foundation required for such an impact driven labelling scheme. For instance, questions surrounding where an LCA should start and stop were found to be of concern.

Research by Grunert et al. (2014) on the other hand, examines the relationship between consumer motivation, understanding and use of what the authors term as ‘sustainability labels’ on food products (both environmental and ethical labels), which are increasingly appearing on food products. This study employed an online survey undertaken across the UK, France, Germany, Spain, Sweden, and Poland, with a total sample size of 4408 respondents. The authors suggest that despite recognition of the importance attributed to sustainable consumption (Nash, 2009) much of the existing research remains largely fragmented. In fact, most studies concerned with examining consumer attitudes

⁹This was a DEFRA publication (*Effective approaches to environmental labelling of food products*) produced by the UK government, the University of Hertfordshire, The Food Ethics Council and the Policy Studies institute think tank over the course of 2010 (for £68,010).

towards sustainability tend to focus on selected product categories or specific labelling regimes (Kimura et al., 2012; Dutra de Barcellos et al., 2011; Kimura et al., 2011; and Brecard et al., 2009), making it difficult to draw generalisable results. For instance, much of the literature on organic consumption [see, for example: Janssen and Hamm (2012); Zander and Hamm (2011); Aertsens et al. (2009)] does not extend to considerations in the main on other environmental and ethical credence attributes or aspects. However, a considerable level of research can be found concerning more familiar labelling schemes such as the Fair Trade labelling scheme and animal welfare logos which tend to focus on the self-reported intentions of consumers and/or Willingness to Pay. These studies suggest that consumers are willing to pay price surcharges of 10% for Fair Trade labelled products (Kimura et al., 2010; Zander and Hamm 2010; Napolitano et al., 2008; and De Pelsmacker et al., 2005). Grunert et al. (2014) recognise the growth in recent decades of a number of such public and private initiatives that have generally begun by communicating sustainability related information about food to consumers via FOP and BOP labelling. The Fair Trade logo, the Carbon Footprint logo, the Rainforest Alliance logo and Animal-Welfare related logos are all cited as examples of such labelling schemes. However, while the surge in labels and communication could be interpreted as a signal of success given the sales of products utilising such logos are reported to have increased (for example, Fair Trade UK reports an overall sales increase of 12% from 2010 to 2011), label overload and gaps in the understanding of both the general concept of sustainability and of specific sustainability labels may result in consumer confusion and limit the use of such labels (Grunert et al. 2012 and Horne, 2009).

From a theoretical perspective, Grunert et al. (2014) assert their findings are consistent with the motivation-ability-opportunity framework, which implies that the availability of sustainability labels leads to their use only if accompanied by consumer motivation and understanding. Indeed, results indicated that use of labels is related to both motivation and understanding and that motivation, understanding and use are affected by demographic characteristics and country differences. Yet, motivation and understanding alone are found to be insufficient in changing behaviour. The attitude-behaviour relationship is widely understood to demonstrate as in the case of this particular study, that a general concern for sustainability issues amongst consumers does not necessarily materialise into behavioural change, even with the presence of strong levels of consumer understanding and availability of information. This is attributed in part to the trade-off that consumers make when buying food. Other motives than concern for sustainability, may also be of greater relevance, significance and importance to consumers. For instance, as with the findings of research regarding consumers' purchase intentions of Fair Trade labelled products (Kimura et al., 2012), some consumers may associate a level of prestige in purchasing such labelled products. On the other hand, use of labels could be limited by the lack of credibility attached to certain labels or by the uncertainty attributed to who/which administrative/governing body is responsible for certification. Use could also be inhibited by the lack of market proliferation of certain product labels (Vermeir and Verbeke, 2006).

Grunert and colleagues (2014) conclude that sustainability labels currently do not play a major role in consumers' food choices but the future use of these labels will depend on the extent to which consumers' general concern about sustainability can be turned into actual behaviour.

A consumer behaviour study by Siriex et al. (2011) of UK consumers' perceptions regarding individual and combined sustainability labels considers consumer responses more specifically. The research essentially examines consumer perceptions in the UK regarding sustainable labels versus other labels, such as origin or nutrition labels as well as consumers' reactions to combinations of different sustainability labels. Consumer behaviour theory, specifically Willingness to Pay (Black, 2010 and Pelsmacker et al., 2005) and the Attitude-Behaviour-Context Model were deemed significant in building theoretical understanding. The ABC model proposes that when context is neutral or facilitating, attitudes may align with behaviour. However, when context is not favourable there is discord between values or attitudes and actions. Monetary costs, time, complexity and inconvenience are examples of context that impede behaviours. For example, Siriex et al. (2011) point out that making recycling easy has a bigger impact on people's recycling behaviour than their environmental attitudes. The authors conducted two focus groups in the UK. Here, self-reported use shows consumers have positive perceptions of Organic and Fair Trade labels but tend to be sceptical about unfamiliar labels and general claims such as 'climate friendly'. The results also indicate the importance of familiarity, trust and fit between combinations of labels as well as between associating a label with a brand. While the combination of certain labels was found to potentially enhance the value of a food product, this study also indicates that other label combinations (for instance, a private and sustainable label) can detract from a label's value. Implications and recommendations are suggested for managers to counter the image of greenwashing, and for policy makers to facilitate sustainable food choices.

A review of the practicality and efficacy of environmental labels by Tzilivakis (2012) examined practice-based approaches to eco-labelling schemes in the food sector which are more common than outcome-based systems (Lewis et al., 2010). This is due to technical difficulties in the metrics (Lewis et al., 2010) and cost and feasibility issues (MacMillan et al., 2010). Evidence of this research implies that labelling does have potential to influence the behaviour of some consumers and can help encourage producers and manufacturers to reduce their environmental impact. However, while mature environmental labelling schemes can be expected to support consumer awareness of environmental issues and advance best practice in industry, it should not be expected to achieve substantial improvements in performance across the sector on its own. Further, evidence from this research indicates that outcome-based targets are essential if 'effectiveness' is to be judged, especially with respect to achieving environmental improvements and making progress toward more sustainable consumption and production. Findings suggest that it is important to understand the role and effect that both process and outcome-based targets have in the context of any given labelling scheme. However, the study concludes that science is not

sufficiently robust enough to develop an outcome-based, environmentally broad; omni-label at this time although there is a role for environmental labelling in conjunction with other initiatives to improve the sustainability of food production and consumption.

Omni standards and labelling regimes would require a humanistic and social science approach. Such an approach would be neutral to corporate and private gain. However, the science of existing food policy is based in biophysical science. Such science is distant from human need. In this vein, much of the scholarly discourse regarding existing science domains suggests that 'science' is increasingly not addressing social need but seeks to maximise corporate and private gain - Proposition 11.

Proposition 11

Omni standards and labelling regimes would require a humanistic and social science approach that is neutral to corporate and private gain, but the science of food policy is physical science of distance from human beings, while social science is increasingly for corporate and private gain.

3.6 Carbon Footprint Labelling and Consumers

With respect to carbon footprint labelling itself, little academic literature exists and even less so on the public perceptions of carbon labelling. Conversely, a considerable base of literature exists on LCA, which forms the basis of many carbon footprinting efforts (Garnett, 2013; Martindale, 2010; and McKinnon, 2010).

Indeed the dearth of academic literature becomes increasingly evident concerning inquiry specifically related to the UK food industry, that is the food supply chain business response and consumer response to carbon footprinting and labelling of food products (McKinnon, 2010; Upham et al., 2011; and Vandenberg et al., 2011). Academic investigative inquiry is however beginning to emerge in the peer-review literature namely regarding perceptions of carbon labelling in the food sector.

At the commercial level studies tend avoid full disclosure preferring to remain partially within the public domain (Upham et al., 2011). For instance, Upham et al. (2011) highlighted that at the ministerial level in the UK, the Department for Food and Rural Affairs (DEFRA) responded in 2009 to the Environmental Audit Committee's 2007 inquiry regarding environmental labelling (EAC, 2007). On public perceptions of carbon labelling, DEFRA referred to only two studies. Berry et al. (2008), Upham and Bleda (2009) (these are publicly available reports). The study by Upham and Bleda (2009) involved "six focus groups and a large-scale quantitative survey for a major food brand in the UK at the end of 2007."

Interest in carbon footprint labelling has also gauged attention from New Zealand (Saunders et al., 2009 and Saunders et al., 2005) where research typically argues against the 'food mile' concept.

Much of this research closely tracks international carbon footprint, labelling and LCA standards development especially in the UK and Japan. For instance, relatively recently, a particular focus has been placed on assessing consumer attitudes to carbon labelling via focus groups and surveys in the UK and Japan (Guenther et al., 2012). A second example is a New Zealand government report (Landcare Research, 2012) that focuses its desktop research study on retailer action on environmental issues, centred on the UK and Japan to outline potential resultant implications and challenges that New Zealand exporters may face.

An alternative approach in Australia was undertaken by Vanclay et al. (2011) who conducted primary research assessing the consumer response to carbon labelling of groceries in Australia. This research study was based on an isolated case. The centre of study was situated in a convenience store (in a suburb of north New South Wales, Australia) where an assessment was made of the purchasing response (at point of sale) by grocery shoppers to the introduction of carbon footprint labels (displaying embodied carbon emissions calculated by the authors) over a three-month period. This research was published in the journal of Consumer Policy and while it discounts the use of food miles as described in Coley et al. (2009) and Edwards-Jones et al. (2009) as inappropriate for carbon footprint calculations, the authors do not clarify whether an LCA underpinned their carbon footprint calculations. Findings by Vanclay et al. (2011) suggest carbon footprint labelling could potentially stimulate carbon emissions reductions especially when green labelled products provided by business retailers are cheaper for consumers.

An earlier Australian governmental report by Creese and Marks (2009) looks at how climate change will impact market requirements for Victoria's agri-food exports. Their report comprises an examination of the responses to climate change by UK and Japanese governments, consumers and retail value chains, extending to an analysis of the emerging market requirements associated with climate change in the agri-food sector relevant to Victoria's key markets. The methodological approach was qualitative, including a literature review, in-depth market interviews with five agri-food businesses, two governmental agencies and a number of non-governmental organisations (Linking Environment and Farming (LEAF) and the Food and Climate Research Network (FCRN)) across the UK and Japan. Focus on the UK was based on the premise of the UK's leading position on "*incorporating the implications of macro environmental factors into its food system*" (Creese and Marks, 2009) p.4. While, this is a useful report in the sense of gauging the response to carbon footprinting by consumers, government agencies and the wider agri-food market pertinent to Victoria's agri-food markets, it is largely contextualised in terms of the Australian perspective and does not empirically ascertain the UK food consumer response or focus entirely on the realities of the UK food supply chain perspective.

Research published in the British Food Journal by Rööös and Tjärnemo (2011) summarises findings from studies on organic food-purchasing behaviour and discusses how this can be applied to the

field of carbon labelling of food. The authors also highlight the scarcity of research on consumer attitudes and purchasing intentions towards carbon labelled products but point to a number of early studies, namely in the UK by Berry et al. (2008) and Upham and Bleda (2009). The evidence from both studies found that low consumer appeal tends to be associated with confusion in label interpretation and shifting degrees of consumer scepticism. As mentioned in Chapter 2, Berry et al. (2008) argue that carbon footprint labels are not a panacea to a low-carbon food basket as much of the value derives from measuring, acknowledging and actively reducing footprints. These early studies recognise the need for further research to gain insights regarding the motivations for food business uptake, and consumer awareness of carbon labels.

Qualitative research by Upham et al. (2011) involving three focus groups looked specifically at public perceptions of UK carbon labelling. The research aim was to gain an insight into the likely effectiveness of carbon labelling as an option for reducing emissions from the grocery sector, focusing on consumer perceptions and with the proviso that such labelling is still at an early stage in the UK and elsewhere. Findings of the study indicate that the public found it very difficult to make sense of labelled emissions values without additional information. The authors suggest: *“If carbon labelling is to play a significant role in the transition to low carbon economies, it will need to be widely applied and to be on the basis of a carbon reduction label, not simply an emissions reporting label.”* P.355.

Guenther et al. (2012) analysed consumer attitudes towards the display of carbon emissions and how this relates to other sustainability credentials of food products in the UK and Japan, as these are key export markets for New Zealand. This study forms part of wider research project that also includes a choice modelling analysis approach in estimating consumers' willingness to pay for sustainability credentials on food labels. The major criticism is that New Zealand depends heavily on its agricultural exports. As such, increasing pressure in key export markets such as the UK and Japan for information on sustainability credentials of products, including the carbon emissions associated with products throughout the product life cycle, has the potential to adversely affect domestic production and trade in New Zealand. Another study by Hartikainen et al. (2014) investigates how Finnish consumers perceive the communication of carbon footprints for food products employing a qualitative methodology encompassing five semi-structured focus groups and an online survey of 1010 respondents. Only a few food products are carbon labelled in Finland yet carbon labels are still the most used way to communicate environmental impacts of food products in grocery stores. The authors also examine a series of case studies to demonstrate how life-cycle analysis underpinning carbon labelling can lead to reductions in total GHG-emissions within a product life cycle. Findings indicate that while carbon labelling is intended as a consumer-facing climate policy tool, the life-cycle analysis itself is more likely to pressure food chain actors to take action in generating GHG-emissions reductions in food products.

More recently, research by Shewmake et al. (2015) concerned the development of a predictive model (Environmental Impacts of Changes in Consumer Demand (EI-CCD)) to systematically estimate how consumers will respond to information from a carbon footprint label. The EI-CCD in Consumer Demand model uses own- and cross-price elasticities of demand, current prices and quantities of consumer products, and the carbon footprint of consumer products as inputs to predict shifts in consumer demand. This study utilises consumers' value of their individual carbon footprint with own, and cross-price elasticities of demand data on carbon emissions from life cycle analysis (LCA) to simulate shifts in consumer demand for 42 food products and a non-food composite, to predict subsequent changes in carbon emissions from different labelling schemes. Findings indicate that carbon labels will only reduce greenhouse gas emissions if consumers are willing to act on the labels and switch from high carbon goods to lower carbon goods, or if carbon labelling induces firms to reduce carbon emissions in response to more general reputation concerns or to capture efficiencies. Carbon tax may result in lower overall emissions, be less susceptible to mistakes from an incorrect carbon footprint estimate, and be more transparent than a carbon footprint labelling system.

Shewmake et al. (2015) suggest that if a comprehensive carbon policy is not politically viable, private solutions such as labelling and educating consumers about carbon footprints may be a cost-effective second-best or interim strategy. However, the authors state consumer demand is an imperative consideration for those looking to reduce carbon emissions by introducing labels. Further, with information on carbon footprints, budget shares, and elasticities of demand, the authors claim their model can be expanded to analyse the impact of educating consumers on more difficult judgment calls such as hot-house versus imported tomatoes. To predict consumer demand the authors' suggest academics can respond in two ways: (i) conduct experiments where products are labelled and the resulting behaviours are tracked (Vanclay et al., 2011); and (ii) model consumer behaviour using existing information on price elasticities of demand. A recent review by Liu et al. (2016) of existing research and implementation examples to understand the development of carbon labelling (national and international) concludes that both eco-labels and carbon labels are customer driven mechanisms. Their effectiveness largely depends on whether consumers know the meaning of the labels and have basic motives of environmental and social responsibility, thereby making corresponding ethical and altruistic purchasing behaviour.

The benefits and disbenefits of consumer labelling schemes particularly within the food sector are widely contested and debated (Upham et al., 2011). Certainly, provision of environmental information and labelling schemes to consumers within the food sector has generated a wider debate with respect to the standardisation of the due process, verification and communication of such schemes, particularly with respect to product carbon footprints and labels (Vergez, 2012 and McKinnon, 2010).

From an information economics perspective, Upham et al. (2011) argue that large information asymmetries between producers and consumers exist especially regarding the environmental and social performance of products. Labelling for information intends to correct market failure by providing credible and reliable product information to consumers. For this reason, labels for information perform a function that ideally enables consumers to make informed purchasing decisions (Padberg, 1977; D'Souza, 2004; and Teisl and Roe, 1998 cited by Upham et al., 2011). Nonetheless, such rationalisation of labelling schemes tends to be challenged in the academic literature as an oversimplification and oversight of a plethora of other complex influences such as sociological and psychological dimensions of consumption behaviour (Urien and Kilbourne, 2011 and Blake, 1999 cited by Upham et al., 2011). The evidence demonstrates that essentially, as Berry et al. (2008) cautioned in early carbon labelling studies and as Reisch et al. (2016) and Shewmake et al. (2015) find, that reliance on carbon footprint labels alone as a strategy to generate a lower carbon future is insufficient. In fact, Proposition 12 suggests a need to shift focus on consumers with individual responsibility to a focus on collective social environmental responsibility:

Proposition 12

There is need to move from the consumer with individual responsibility to consumers with collective social environmental responsibility.

3.7 Conclusion

Concerns of the food sector both in the UK and internationally tend to relate as mentioned previously, to persistent calls by governments, non-governmental organisations as well as pressure groups to decarbonise food systems and adapt to more sustainable modes of food production (Garnett, 2013 and DEFRA, 2006b). However, these issues are inherently complex given the diverse nature of the food sector, the environmental debate and the increasingly globalised nature of food supply chains (Edwards-Jones et al., 2009 and Ayres, 2008). For instance, the potentialities of inequitable trade implications and adverse impacts on commerce resulting from voluntary and/or mandatory carbon footprinting efforts are especially of concern to countries heavily dependent on international exports such as New Zealand and low income country exporters such as Kenya (Brenton et al., 2009; Creese and Marks, 2009; and Saunders et al., 2009).

The policy driver in many senses is the search for the panacea. Under market conditions, one has to assume that consumers make informed choices. The issue therefore is where they get that information; from a private governance labelling system advocated by government and/or from producers who through marketing, try to differentiate the qualities of their product including claims to environmental good practice. Presently, marketing strategies best capture environmental quality by serving more as a signal of quality than for information. At best, environmental labelling serves as the equivalent of a health and safety warning e.g., the sell by date associated with milk-based products (Grunert et al., 2014 and Rousu and Corrigan, 2008). Trying to obtain an omni-label that

would, based on standards, suggests good practice is perhaps a step too far for the regulatory system. Producer compliance would only occur if comparative advantage could be obtained.

It is difficult to summarise a complex and fragmented literature but it is possible to isolate major characteristics by each of the parallel contexts. See Table 11 below. What emerges quite clearly in terms of behavioural characteristics that could drive change is the dominance of regulatory environments with the major exception of nutrition.

Table 11 Dominant Characteristics of the Parallel Contexts Literature

	Theoretical theme	Critique	Behavioural intervention
Food Safety	Case study	Limits of indemnifying risk	Industry regulation Regulatory and mandatory labelling Technological
Nutrition	Large scale sampling plus case studies	Individual not community focused	Labelling for consumer information Nudging change
Ethics/CSR	Moral philosophy (humanising business)	The limits of ethics under neo-liberalism	Nudging but limited by price
Omni/Meta	Future design for environment	Non robust information and insufficient uptake/support	Hides current fragmentation of food policy labelling interventions
Carbon	Science measurement	Life science based (LCA)	Carbon footprint labelling

In the UK, the urgency of the climate change dilemma has failed to galvanise a coherent integrated response from government. This is echoed in the multi-layered approach frequently adopted by various UK government agencies; many of which encourage uptake of voluntary standards in food businesses across supply chains but with limited success as enforcement and control limitations lead to piece-meal and fragmented uptake effects (Glover et al., 2014; Richards et al., 2014; Rös and Tjärnemo, 2011; Corbett and Klassen, 2006; Potoski and Prakash, 2005; and Barrett et al., 2001). In essence, climate change is a local, national and global policy challenge that is predicted to have serious adverse impacts on food production and supply (Garnett et al., 2015). As such, there is urgent need for economic and political investment to decarbonise the food sector and drive for a more sustainable food system. Indeed, climate change is a complex problem pertinent to not only local, national and international policy regimes but also the food policy landscape more broadly (Lang and Barling, 2013).

The Launch of PAS 2050 in 2008 and its revised version in 2011 is another ‘first’ from the UK but it is not mandatory although it is a government and market supported initiative alike (governed and administered by The Carbon Trust). PAS 2050 is not sector specific and as such its generic nature

means that it will have to be refined to individual sectors, including food. However, PAS 2050 is a voluntary standard which can be used by organisations to carbon footprint products in advance of probable future mandatory compliance and ultimately for carbon labelling. Food production, processing, packaging, and distribution systems will all face directly or indirectly, the issue of carbon footprinting. This will have a strong influence on UK food supply chain actors. Increasing public concern of the environmental impacts of global and national food systems means that supply chain actors will be required to demonstrate how they are responding to the carbon threat. For food businesses, carbon footprinting could contribute towards elements of comparative advantage to be seized by early engagement and knowledge of carbon legislative regimes and regulatory frameworks.

In light of the above, the literature reviews in Chapters 2 and 3 of this thesis highlight a series of key issues that require specific attention for the purpose of research design. These relate to the uptake of PAS 2050 in the supply chain but also the response of consumers to carbon footprint labels. In methodological terms, this requires an approach that can explore the supply side issues with relevant producers to understand their willingness to put environmental concern before profit and shareholder value. On the demand side, consumer behavioural change requires an exploration between response to the problem and actual behavioural change. As the food supply chain is so huge, it is impossible within the limits of doctoral research to encompass that chain with a full quantitative methodology.

This chapter has reflected on the parallel contexts of food safety, nutrition and health, omni labelling in the framework of carbon footprinting and labelling. It finds there are positive lessons to be learnt from the food safety and nutrition and health literatures but they effectively focus on individual behavioural change. As this thesis develops, emphasis will be placed on climate change as a collective problem more given to broad social change rather than individual behaviour modification. As such, the approach is qualitative, utilising a case study approach to inform argument. This allowed the generation of broad research propositions drawn from the literature reviews in Chapters 2 and 3.

For Chapter 2 these propositions are:

1. Carbon standards and labelling are not robust but in decline. Continued non standardisation of carbon accounting tools brings them into disrepute.
2. Carbon footprinting is a techno-political solution that substitutes a false science for a robust food policy.
3. There may be universal access to PAS 2050 but there is no universal uptake. The policy framework is from strong food security to weak sustainability.

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4. There is little link between food production, consumption and environmental policy. The fragmentation of science informing food policy is influenced substantially through the private and corporate control of science.
 5. Corporate uptake of environmental issues, especially climate change is because of the threat of an international legal regime.
 6. Near consumption actors (supermarkets) are the powerhouse of oligopoly that control food policy making. Corporate interests, not that of the State, is the arena for food policy making.
 7. Choice architecture has a fall-back position of nudge economics. Nudge economics is the economics of 'push' with no 'pull'.
 8. Green supply chain management is 'greenwash' – ISO 14001 is as close as it gets.

For Chapter 3, these propositions are:

Food Safety

9. Regarding food safety, standards are underwritten by science and law but this is complex, confusing and sometimes contradictory.

Nutrition and Health

10. Regarding nutrition and health, food behaviour is targeted and changed but only at the individual level, never summarised to the social and the environmental problem which is essentially social.

Omni/Meta Standards and labels

11. Omni standards and labelling regimes would require a humanistic and social science approach that is neutral to corporate and private gain (see the categories of Table 11 above), but the science of food policy is physical science of distance from human beings, while social science is increasingly for corporate and private gain.
12. There is need to move from the consumer with individual responsibility to consumers with collective social environmental responsibility

The research propositions alongside some of the key scholarly literatures from which each was derived are numbered and detailed together in Box 1 below.

Box 1. Research Propositions

Research Propositions derived from the Literature	
Proposition 1	<p>Carbon standards and labelling are not robust but in decline. Continued non standardisation of carbon accounting tools brings them into disrepute.</p> <p>[Chkanikova and Lehner, 2015; Bockell et al., 2011; Newell and Vos, 2011; Swinburn et al., 2011; Brenton et al., 2009; Creese and Marks, 2009; and Saunders et al., 2009] and [Garnett et al., 2015; Glover et al., 2014; Hartlieb and Jones, 2009; Richards et al., 2013; Mont et al., 2013; and Mueller et al., 2009; Mutersbaugh, 2005]</p>
Proposition 2	<p>Carbon footprinting is a techno-political solution that substitutes a false science for a robust food policy.</p> <p>[Freidberg, 2014; Dendler, 2014; and Steenblik and Moise, 2010]</p>
Proposition 3	<p>There may be universal access to PAS 2050 but there is no universal uptake. The policy framework is from strong food security to weak sustainability.</p> <p>[Cohen and Vandenberg, 2012; Upham et al., 2011; McKinnon, 2010; Finkbeiner, 2009; Hogan and Thorpe, 2009; Berry et al., 2008] and [Liobikiene and Dagiliute, 2016; Vittersø and Tangeland, 2015; Dendler, 2014; Lang and Barling, 2013; Lang and Barling, 2012; Hopwood, Mellor and O'Brien, 2005]</p>
Proposition 4	<p>There is little link between food production, consumption and environmental policy. The fragmentation of science informing food policy is influenced substantially through the private and corporate control of science.</p> <p>[Lang and Heasman, 2015; Mayes and Thompson, 2014; Reisch et al., 2013; Mont et al., 2013; Scrinis, 2013; Lang, Barling and Caraher, 2009; Storey et al., 2008; and Haines et al., 2009] and [Reisch et al., 2016; Taylor, 2016; Richards et al., 2013; Lang and Barling, 2013]</p>
Proposition 5	<p>Corporate uptake of environmental issues, especially climate change is because of the threat of an international legal regime.</p> <p>[Richards et al., 2013; Marimon et al., 2012; Arimura et al., 2011; and Mueller et al., 2009]</p>
Proposition 6	<p>Near consumption actors (supermarkets) are the powerhouse of oligopoly that control food policy making. Corporate interests, not that of the State, is the arena for food policy making.</p> <p>[Fuchs et al., 2016; Glover et al., 2014; Burch et al., 2013; Richards et al., 2013; Bocket et al., 2011; Fuchs et al., 2011] and [Taylor, 2016, Chkanikova and Lehner, 2015; Freidberg, 2014; Glover et al., 2014; Mayes, 2014; Mayes and Thompson, 2014; Millstone, 2007; Mutersbaugh, 2005]</p>
Proposition 7	<p>Choice architecture has a fall-back position of nudge economics. Nudge economics is the economics of 'push' with no 'pull'.</p> <p>[Scrinis and Parker, 2016; Sunstein and Reisch, 2013; Galizzi, 2012; and Hartlieb and Jones, 2009] and [Scrinis and Parker, 2016; Guthrie et al., 2015; Galizzi, 2012; Michie et al., 2011; and Hartlieb and Jones, 2009]</p>
Proposition 8	<p>Green supply chain management is 'greenwash' – ISO 14001 is as close as it gets.</p> <p>[Alexander et al., 2014; Bocken et al. 2014; Marimon et al., 2012; Sarkis et al., 2011; Mollenkopf et al., 2010; Mueller et al., 2009; and Mutersbaugh, 2005]</p>
Proposition 9 Food Safety	<p>Regarding food safety, standards are underwritten by science and law but this is complex, confusing and sometimes contradictory.</p> <p>[Temple and Fraser, 2014; Hall and O'Connell, 2013; Speier et al., 2011; Millstone, 2007]</p>
Proposition 10 Nutrition and Health	<p>Regarding nutrition and health, food behaviour is targeted and changed but only at the individual level, never summarised to the social and the environmental problem which is essentially social.</p> <p>[Van Kleef and Dagevos, 2015; Grunert et al., 2014; Mayes, 2014; Larceneux et al. 2012; and Grunert and Wills, 2007]</p>
Proposition 11 Omni/Meta Standards and labels	<p>Omni standards and labelling regimes would require a humanistic and social science approach that is neutral to corporate and private gain, but the science of food policy is physical science of distance from human beings, while social science is increasingly for corporate and private gain.</p> <p>[Dendler, 2014; Grunert et al., 2014; Mayes and Thompson, 2014; Grunert et al., 2012; Resich et al., 2013; Siriex et al., 2011; Tzilivakis et al. 2012; Engels et al., 2010; Lewis et al., 2010; MacMillan, 2010; and Horne, 2009]</p>
Proposition 12	<p>There is need to move from the consumer with individual responsibility to consumers with collective social environmental responsibility.</p> <p>[Taylor, 2016; Alexander et al., 2014; Dendler, 2014; Grunert et al., 2014; and Tzilivakis et al., 2012; Hartlieb and Jones, 2009]</p>

Chapters 2 and 3 have summarised the most frequently cited literature on the carbon footprinting and labelling debates and the parallel contexts that might inform uptake of carbon labelling to produce behavioural and organisational change. The limits of uptake have been noted and the propositions capture part of the reasons for sluggish uptake. Taken together, the propositions outlined above suggest a storyline which will be examined against case material using the Walton and Gilson (1994) health policy triangle framework. Before undertaking the examination of the case material, it is necessary to address issues of method that lead the research in the direction of a case study approach (Yin, 2013; Yin, 2008; Yin, 2004 and Yin, 1994).

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Chapter 4 – Methodology

4.1 Epistemological Framework: Critical Realism

This chapter focuses on providing the rationale behind the research design and methodology of this research inquiry. A series of propositions derived from a literature review were raised in Chapter 3 which will inform the research design and analysis of the results. From Chapter 3 on Parallel Contexts, there are examples of relative success in changing consumer behaviour (Temple and Fraser, 2014; Dendler, 2014; Grunert et al., 2014; Hall and Ossen, 2013; Gortmaker et al. 2011; Balcombe et al., 2010; and Grunert et al., 2010), although this might be noted as being predominantly individual contract rather than social contract. A series of propositions from Chapter 2 relate to the overall framing of the problem of carbon and food as a social problem but these indicate, it is very difficult to achieve social contracts across a collective of actors within a neo-liberal market economy mindset (Taylor, 2016; Lang and Heasman, 2015; Freidberg, 2014; Mayes and Thompson, 2014; Reisch et al., 2013; Scrinis, 2013; Upham et al., 2011; Hartlieb and Jones, 2009; Lang, Barling and Caraher, 2009; Mueller et al., 2009; Storey et al., 2008; Haines et al., 2009; and Bansal and Roth, 2000).

The epistemological framework of this research, however, cannot realistically be identified without a detailed consideration of the philosophy itself (Maxwell and Mittapalli, 2010). The framework assumes a stance which may be described as critical realism. While there are philosophical debates over realism, it is fair to claim that in social sciences, the critical realist stance is one that assumes that a world does exist and it is not simply human experience that defines the world (Maxwell, 2012).

It is against this backdrop that the epistemological basis of the research design has taken place. However, one cannot consider epistemology without first, locating the epistemology (how we know what we know, i.e. 'knowledge') in ontology (what the world is like), for if epistemology is not located in ontology, one is simply left with method. As such, it is not possible to gauge whether any statement is 'truthful'. Ontology itself however, is problematic since it is what we know. Adopting a 'realist' ontology within the context of critical realism involves employing a branch of philosophical science that uses abstraction to tease out and identify specific causal "*powers and liabilities of specific structures that are realized under specific conditions*" (Johnston et al., 2000). This emphasis on specificity of explanation places critical realism's view of causation in direct contrast with the overarching and globalising generalisations of positivism and empiricism, which can particularly confuse numerical correlation with causality. The caution assumed with a critical realist stance leads one to consider the currently discussed issue of how to go about examining nature of corporate claims to environmental good governance whilst avoiding the pitfalls of greenwash (green claims in favour of marketing). Because the study is an open system, the researcher begins with the demand end of the supply chain, i.e. the customer/consumer rather than the company.

According to Maxwell (2012), critical realists retain an ontological realism (there is a real world that exists independently of one's perceptions, theories, and constructions) while accepting a form of epistemological constructivism and relativism (one's *understanding* of this world is inevitably a construction from an individual's own perspectives and standpoint). Different forms of realism

generally agree that there is no possibility of attaining a single, “precise” understanding of the world, what Putnam (1999) describes as a ‘*God’s eye view*’ that is independent of any particular viewpoint. This position has achieved widespread, if often implicit, acceptance as an alternative both to naïve realism and to radical constructivist views that deny the existence of any reality apart from one’s constructions. Critical realists, explicitly reject this collapse of the distinction between ontology and epistemology (Scott, 2000, p. 3; Bhaskar, 1989, p. 185; and Campbell, 1988, p. 447) referred to this conflation of ontology with epistemology as the ‘*epistemic fallacy*’. As Norris (2002) pp. 3-4 stated, “*where the anti-realist goes wrong, the realist will claim, is in confusing ontological with epistemological issues*”. Not only is ontological realism compatible with epistemological constructivism, but ontology has important implications for research that are independent of those of epistemology. Maxwell (2012), Abbott (2004), and Seale (1999), view epistemological and ontological perspectives, not as a set of ‘foundational’ premises that govern or justify qualitative research, but as *resources* for doing qualitative research (Maxwell and Mittapalli, 2010).

Yet, the most common position in social sciences is to adopt a critical realist stance to ontological issues (the world does exist, not just experience) and a critical rationalist approach to method, largely using hypothetico-deductive approaches to falsification. If a proposition cannot be falsified, it does not necessarily follow that the proposition is ‘truthful’. At best, ‘verification’ gives a correspondence theory of ‘truth’ and as paradigms shift, there is a renewed search for falsification. Even with such a rational stance, it is not possible to move an inquiry beyond falsification to a stage of verification. In short, the quantitative methods implied by a critical rationalist approach allow at best, the identification of similitude (i.e. a pattern of things), which require confirmation by other techniques, particularly those of a qualitative nature (Maxwell, 2012). Ontology in this sense is defined in the 1996 Oxford Compact English Dictionary as: “*the branch of metaphysics dealing with the nature of being*” and the researcher’s ontological reasoning of the world undertaken in this particular research study is *critical realism*.

Essentially, the positivist tradition lies in reductionism, akin to the extreme atomism of phenomena, routinely, by shrinking the world into a singular isotropic plane with a series or incidences of ‘scientifically proven’ explanations and predictions of space-time events. In contrast, adoption of realist ontology enables the researcher to explore a world, which encompasses a ‘multi-tiered’ ontology inclusive of mechanisms and structures as well as events (Johnston et al., 2000). As such, critical realism allows the researcher to design a diversity of method incorporating both quantitative and qualitative approaches. It is important to note however, that if a social scientist’s focus is too concentrated on research design and methodology, this may have the propensity to render any substantive research to be overshadowed by overly zealous and meticulous sanitisation of the research process. This may result at worst, in the failure to produce findings or at best, weaken and thereby hamper the identification and delivery of any potential research contribution (Stewart, 2009). Berger (1963) sums up the dilemma: “*...since in science as in love a concentration on technique is quite likely to lead to impotence.*” (Berger, 1963, p.13). Dow (1990) explicitly determines that

harnessing such a philosophical stance means that ‘*diversity of method need not entail diversity of methodology*’ and expands upon this by explaining:

“...since reality is so complex (and open), and cannot be perceived objectively, truth realism is subject to considerable uncertainty in Keynes’s sense. The solution then, is in effect to...employ different methods of analysis and sources of information which, combined with conventions of their academic community etc., generate theoretical and empirical propositions.” (Dow, 1990, p. 353, cited by Jefferson, 2006).

In essence, the quote above drives business management perceptions as a science towards risk management. In particular, risk management has to address the issue of system adaptation. Leary et al. (2009) postulate there are two types of adaptation: type 1 and type 2. Type 1 adaptation is adaptation to the present level of known risk. Type 2 adaptation deals with adapting to ‘known unknowns’ such as climate change. Information and knowledge generation for type 1 and type 2 adaptation will require access to process and communication between actors, which is the central focus of the thesis. The methodology attempts to both capture the process (supply chain dynamics) and the key informants involved in that supply chain.

In terms of approaching business management, there are insights to be gained by quantitative techniques, largely associated with a philosophical basis of logical positivism. This implies an acceptance of notions of falsification, i.e. the requirement to set up hypothetical deductive statements that can be proved wrong. It also means that there is not an absolute truth associated with any scientific statement so that exaggerated claims of business management such as the market is supreme must be treated as ideology not truth. To actually interpret the meaning of the data, the specific moment requires that quantitative work be accompanied by qualitative work. Though, as cited by Jarratt (1996), Steinback and Steinback (1988) suggest, differences in qualitative and quantitative research do not necessarily translate into fundamental superiority of one approach over another. These differences are summarily presented in Table 12 below.

Table 12 A Summation of Differences in Quantitative and Qualitative Research

Dimensions	Quantitative Paradigm	Qualitative Paradigm
Purpose	Prediction and control	Understanding
Reliability	Stable – reality is made up of facts that do not change	Dynamic – reality changes with changes in people’s perceptions
Viewpoint	Outsider – reality is what quantifiable data indicate it to be	Insider – reality is what people perceive it to be
Values	Value free – values can be controlled	Value bound – values will impact on understanding the phenomena
Focus	Particularistic – defined by variables studied	Holistic
Orientation	Verification	Discovery
Data	Objective	Subjective
Instrumentation	Non-human	Human
Conditions	Controlled	Naturalistic
Results	Reliable	Valid – focus on design & procedures to gain real, rich & deep data

Source: Steinback and Steinback (1988) p. 8, cited by Jarratt (1996) p. 7

Given the value of both of quantitative and qualitative research approaches and the potential to provide a foundation on which different insights upon the same phenomena can be combined (Downard and Mearman, 2007), this study adopts a ‘mixed’ methods case study approach to address the research questions of this thesis in a holistic manner (Yin, 2008).

4.2 Methodology

With respect to food supply chain research particularly, a number of examples of methodological practice abound (see the following papers for relevant examples: Spence and Rinaldi, 2014; McKinnon, 2010; Anselmsson and Johansson, 2007; Ilbery and Maye, 2005; and Vasileiou and Morris, 2006). This literature parallels the ‘mixed-methods’ case study approach given the research focus on food supply chains.

Case study material is used to analyse research propositions derived from the literature reviews in Chapters 2 and 3. However, it must be noted that the case studies in themselves cannot be extrapolated to other cases either within the food industry or beyond (Yin, 1994, cited by Bansal and Roth, 2000). Case studies are useful in addressing learning about process content and actors and are particularly useful in outlining policy approaches when there is limited utility to a more positivist, quantitative approach. Caraher et al. (2013) p. 81 assert that: “*What is useful and purposeful about case studies is that they can be useful in addressing learning about process, content and actors (Thomas 2011). Thus, they complement the process set out by Walt and Gilson (1994) as well as Kingdon (2010) and can be particularly useful in outlining policy where other approaches may not be appropriate (Thomas 2011 and Yin 2008).*”

Using a policy triangle as a framework (Walton and Gilson, 1994), this research inquiry attempts to explore the perceptions of potential uptake of carbon footprinting and labelling. See Figure 12 below.

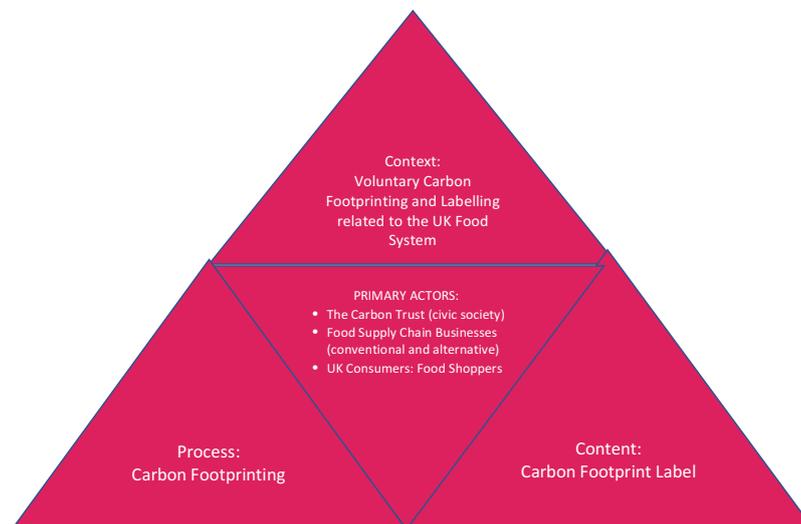


Figure 12 The policy triangle as applied to carbon footprinting and carbon labelling.

Source: Adapted from Caraher et al. (2013) and Walt and Gilson (1994)

In applying Walt and Gilson’s health policy triangle (1994) as a framework, this research analyses ‘who’ has been involved in the development of food policy in the UK, ‘how’ and ‘why’ (Kingdon

2010). The triangle places the perceptions of actors at the centre and uses the organising areas of context and processes as analytical features (Buse, Mays, and Walt 2005). Uptake places actors at the centre and attempts to understand actors in context and process as structural features.

Indeed, Walt and Gilson (1994) developed a policy analysis framework specifically for health, although its relevance extends beyond this sector. They noted that health policy research focused largely on the content of policy, neglecting actors, context and processes. Their policy triangle framework is grounded in a political economy perspective, and considers how all four of these elements interact to shape policy-making. The framework has influenced health policy research in a diverse array of countries, and has been used to analyse a large number of health issues, including mental health, health sector reform, tuberculosis, reproductive health and antenatal syphilis control (Gilson and Raphaely 2007).

Specifically, the policy triangle is used as a framework to describe and analyse the perceptions and perspectives of key food chain stakeholders about the PAS 2050 carbon footprint standard and/or food product carbon footprint labels in influencing integrated food policy for sustainable production and consumption. This occurs in a context where food policy typically favours powerful industry and agricultural interests and where relationships between the health and environmental sectors are in their infancy. The implications for planning and organising a voluntary multi-stakeholder carbon footprint food policy initiative are explored from the perspective of policy and the ways in which this can be influenced through working with key stakeholders.

To date, most studies concerning the perceptions of carbon footprinting and labelling focus on either the retail and/or consumption stages of supply chains but not the 'whole' supply chain including more broadly the phases of production, manufacture, retail and consumption (end-use) (see for example: Hartikainen et al., 2014; Guenther et al., 2012; Rööös Tjärnemo, 2011; Vanclay et al., 2011; Berry et al., 2008; and Creese and Marks, 2009). These issues render the study as inherently interdisciplinary in nature; being firmly couched within the sustainable development, climate change, food supply chain, and political economy and political science fields of research. As such, this gives rise to various degrees of overlap, indeed an open system, necessitating a holistic social science approach and in the view of the researcher, requires a dialectical perspective coupled with a critical realist approach pioneered by Roy Bhaskar (Johnston et al., 2000). Johnston et al. (2000) state that Bhaskar himself claims that a "*concept of ontological depth – of 'the multi-tiered stratification of reality' – is indispensable for the natural, the social and the human sciences*" (Bhaskar, 1979, cited by Johnston et al., 2000, p.562).

4.3 Formulation of Research Questions Appropriate for Case Study Research

Onwuegbuze and Leech (2006) proffer that the development of research questions and data analysis studies should occur in a logical and sequential order and be shaped by the main research question(s) of the study.

Specifically, determining the research question(s) is of significance across both quantitative and qualitative research methods because research questions should narrow the research objective and purpose to explicit questions that a researcher can attempt to address in their research (Cresswell, 2005). Onwuegbuze and Leech (2006) go on to explain that research questions are all the more important because they also significantly influence the type of research design used; the sample size and the sampling scheme, the type of data analysis techniques used and the sort of instruments administered. Indeed this paper comprehensively critiques this confounding dilemma of uncertainty and difficulty in question formulation and points to the lack of guidance.

The research undertaken in this thesis involves a mixed methods case study approach, encompassing both descriptive quantitative and qualitative methods (Jick, 1983, cited by Jarratt, 1996) in turn, facilitating the integration and blending of data methods to “*capture a more complete, holistic, and contextual portrayal of the unit(s) under study.*” (Jick, 1983, p.138, cited by Jarratt, 1996, p. 6). More recently, in the field of economics Downward and Mearman (2007, p. 77) advocate mixed-methods case research approaches and suggest, “*mixed-methods...can be understood as the manifestation of retroduction, the logic of inference espoused by critical realism.*” Indeed, this approach that aligns itself within a critical realist perspective is also suggested by Downward and Mearman (2007) to form the basis for which different insights upon the same phenomenon can unite aspects of different traditions of economic and social thought particularly suited to interdisciplinary social science. In this sense, a mixed methods case study research relates to the notion that such inquiry relies upon a combination of arguments and evidence from a number of different sources to reach the foundation upon which conclusions are drawn (Yin, 2013; Yin, 2008; and Yin, 1994).

As first mentioned in Chapter 1, more specifically, the research undertaken in this thesis includes a consumer case study utilising findings from a closed consumer survey and six separate food chain case studies, each detailing findings derived from key informant/actor (semi-structured) interviews. The main research question and sub-research are detailed again in Table 13 below for information.

Table 13 Main Research Question and Sub Research Questions

Main research Question (M.Q.)	Sub research questions (S.Q.)
<p><i>What is the role of carbon footprint labelling of food products in helping deal with the environmental problem of climate change?</i></p>	<p>S.Q.1. What is the possible space and form of carbon labelling for both the food industry and consumers?</p> <p>S.Q.2. From case studies, is it possible to assume a certain consumer and industry response?</p> <p>S.Q.3. How will UK food shoppers perceive carbon footprint labelling?</p> <p>S.Q.4. Is it possible to capture in a label the complexity of carbon content from a supply chain with multiple processes and multiple producers?</p> <p>S.Q.5. How will producers perceive carbon footprint and label schemes?</p> <p>S.Q.6. How will perceptions of voluntary carbon footprint standards and labels shape business motivations for 'ecological responsiveness'?</p>

Fereday and Muir-Cochrane (2006) suggest mixed (qualitative) methods approaches are useful for adding 'completeness' to accounts and for enhancing the validity of insights of case studies.

Tashakkori and Teddlie (1998) suggest one should involve a combination of methods typically on pragmatic grounds although as Downward and Mearman (2007) (who cite Bryman (2004)) argue that while methods can be combined, one method will always reign supreme over others.

As inferred previously, the research design process of this study is fundamentally devised within a critical realist perspective to elicit information via descriptive quantitative and qualitative means to ensure a holistic inquiry given the inter-disciplinary nature of this research study. The distinctive dichotomous split between gathering two uniquely different sets of data facilitates and necessitates a systematic and robust procedure that is both valid and reproducible. Consequently, the *modus operandi* throughout the course of the project has been that of ensuring a systemised approach in gathering, collating, analysing and drawing conclusions from data to answer the research questions in both the descriptive quantitative and qualitative stages of this study.

Descriptive quantitative findings from the initial consumer survey questionnaire served to address the consumer or 'demand' side of the supply chain spectrum in terms of attempts to assess the 'consumer' response to carbon footprint labels based on PAS 2050. Descriptive quantitative data from the consumer survey questionnaire was essentially sought and utilised to contextualise public perceptions related to 'green' purchasing issues, namely concerning carbon footprinting and climate change. Significantly, this data was also used to highlight the 'realities' of the consumer perspective prior to conducting key informant interviews in the second phase of this research study. All steps in both stages of the research design framework are inextricably linked as they feed from the principal findings of an iterative review of literature. In this vein, two phases of primary data collection are required. These are:

- the consumer/demand side of the chain - via a closed consumer survey questionnaire.
- the supply side of the chain via:
 - a key informant interview with a policy 'entrepreneur'/civic society organisation; and
 - five key informant interviews from conventional and alternative food supply chain businesses operational at different stages of the food chain (production and distribution, manufacture, and retail).

4.4 Survey Instruments

The initial stage of this study encompasses a descriptive quantitative survey of consumers in order to gauge the level of public knowledge and awareness of carbon footprint labels based on PAS 2050 methodology. The sampling technique adopted for the descriptive quantitative research was that of 'convenience sampling' where data collection primarily takes place where and when possible (Graveter and Forzano, 2008). In light of this, the first phase of sampling explicitly concerns the identification of UK supermarket shoppers and collection of relevant descriptive quantitative data for

the purpose of ascertaining the 'consumer response' via a consumer survey questionnaire. At the outset, a questionnaire was the method of choice to survey consumers' perceptions and overall response to carbon footprints, carbon labels and 'green' issues in general given the reliance of earlier studies on drawing upon commercial omnibus surveys and complementing these with in-depth focus groups (Berry et al., 2008; and Upham and Bleda, 2009). The questionnaire 'proper' was self-administered and distributed over a period of four months, commencing the first week of July to the first week of December 2009.

Due to the dominance of supermarket power in the UK, food purchases predominantly take place in the multiple retailers with 75% of all food being purchased from either Tesco, Sainsbury's, ASDA and Morrisons (Dowler et al., 2007). In an attempt to capture as broad and representative sample as possible, the target audience for the purposes of this survey was supermarket shoppers. Such an approach was undertaken to best capture and identify consumers' understanding and perceptions of corporate social responsibility issues in the context of food purchasing. Whilst it may have been useful to interview consumers at smaller independent retail outlets, although the above figure implies that 25% of food purchases occur outside the 'big four', it was assumed that a much smaller percentage of consumers do not visit these supermarkets at all and so a large proportion of the population was likely to be represented.

For the second qualitative stage of research in this study, a 'purposive' sampling approach in line with Patton (1990) and Lincoln and Guba (1985) was adopted to select participant organisations and their respective key informants. This was used to ensure that the sample would include relevant informants who are primarily from the food sector but who function at different stages of food supply chains to ensure a 'whole' supply chain approach (including informants from production, manufacturing and retail) and to provide a range of perspectives regarding carbon footprinting using PAS 2050. This approach reflect the methodological approaches of Walton et al. (1998) and a more recent study by Walker et al. (2008).¹⁰ Six key informant interviews were undertaken to elucidate salient themes influencing uptake (i.e. the drivers and the barriers) of PAS 2050 adoption in food supply chain businesses. According to Yin (1994) the selection of a small number of cases is deemed suitable and acceptable for exploratory qualitative research as results should illustrate the replication of findings.

While the data on which this thesis is built is six years old, there has not been significant movement in food policy around carbon footprinting and carbon labelling to suggest that the consumer and industry opinions answers are dated. Nor has the policy environment significantly altered. Plus, it is because the policy environment hasn't changed, that the critique of the food industry and food policy,

¹⁰ Walker et al. (2008) conducted an influential exploratory study of drivers and barriers to environmental supply chain management in public and private sectors in the UK,

particularly from City University, London remains a necessary voice (Lang and Heasman, 2015; Lang and Barling, 2013 and Lang, Barling and Caraher, 2009).

4.5 Stage 1 - Quantitative Data: Consumer Survey Questionnaire

In order to best capture and identify food consumers' understanding and perceptions of 'green' issues in the context of grocery purchasing, a consumer survey utilising a carefully designed and highly structured questionnaire with a Likert format in parts was used. The development of questions to be put forward to food consumers was based on the emergent themes as a result of the literature review in Chapter 2 of this thesis. More specifically, two carbon labelling studies by Berry et al. (2008) and by Upham and Bleda (2009) were drawn upon to further inform and ensure the validity and relevance of each of the questions included within the questionnaire designed for this research study. At the outset of this research undertaking (2008), these were the most prominent and relevant studies of carbon labelling undertaken in the UK. Given the nature of sampling, 'no-response' bias is not relevant for this study. Such an approach was undertaken to elicit categorical and attitudinal, rather than continuous and numerical, data. A copy of this questionnaire can be found in Appendix 2 of this thesis.

The questionnaire was designed logically with three distinct approaches to questioning. Firstly, a profile of the demographic characteristics of respondents was included with questions directly relating to age, gender and postcode. Secondly, a series of closed, highly structured questions with restrictive answers (yes, no, sometimes and/or not sure as well as less/more) relating to a series of purchasing habits, perceptions on 'green' purchasing and finally, carbon labelling and carbon footprinting were included. Some questions used a Likert scale format with five choices for every given statement or question in order to gauge the degree of agreement each respondent states on any given question. Examples of choices given to respondents to given statements and questions are detailed below:

Strongly Agree	Agree	Neutral	Slightly disagree	Strongly disagree

Very Important	Important	Neutral	Less Important	Not Very Important

Thirdly, a series of issues concerning food product type and purchasing options were provided asking respondents to rank the importance of such issues stated within the questionnaire.

In particular, the questionnaire asked consumers to state:

- whether they thought it was important for food companies to measure the carbon footprint of their products;
- if it was important to have carbon labels on food;
- if they would like to see carbon labels on food products;
- whether they thought carbon labels would make it easier to compare environmental standards and products; and
- whether they would choose to buy a product that has a carbon footprint label over one that did not.

This approach makes no distinction between shoppers based on supermarket preference, firstly because the aim is to capture as broad a set of consumer perceptions as possible. Secondly, the distinction is removed to avoid bias and achieve as representative a target audience as possible.

4.6 Piloting the Questionnaire

The questionnaire was piloted prior to launching the questionnaire 'proper'. The pilot questionnaire was used as a control in order to test the validity, usefulness, appropriacy of questions and useability in order to highlight any flaws of the designed questionnaire before administering more widely.

As such, testing the questionnaire via a pilot of 20 respondents was undertaken in May 2009. This pilot is not included in the study, except as an indicator of the validity of the questionnaire itself. The pilot was tested on 15 consumers shopping at a small Co-operative supermarket in Amble, Northumberland and 5 students at the final stage of their degree (third year) at Northumbria University. These respondents were asked to make suggestions, make any necessary corrections and advise as to the usability of the questionnaire.

Piloting the questionnaire amongst these respondents revealed suggestions to include an 'other' category in the demographic profile of the questionnaire requesting information on gender orientation and the request for an 'other' category in the supermarket choice section. As such, the questionnaire was revised to include the option of 'other' in the gender category and the same for the supermarket choice question. Another suggestion made by a several respondents was that it would perhaps be useful to show examples of carbon footprints on products. See figures 1a, 1b and 1c. This was taken on board.

In distributing the questionnaire via email, images of carbon footprints were provided; when asking consumers to complete questionnaires in hard copy format, realia in the form of packets of crisps and

cartons of juice were shown to respondents prior to completion. Some visual examples are provided below.



Figure 1a. Example of a carbon footprint label on a carton of orange juice. Fruitnet (2009)



Figure 1b. Example of a carbon label. BBC (2009)



Figure 1c. Example of a carbon label on a packet of Walkers crisps. Terrapass (2007)

4.7 Questionnaire Validation

Following revisions, the customer survey questionnaire formed the empirical foundation of this research. The updated questionnaire was used as a basis upon which to inform the next stage of research comprising key informant interviews. This is similar in approach to that adopted by Kottila et al. (2005) in their study of actor interaction within organic food supply chains in the context of information management. Jick (1983) cited by Jarratt (1996) highlights that it is 'unusual' for

quantitative results to be used to inform qualitative data within the domain of organisational research, as the reverse is more common. However, the merits of doing so enable the researcher to capture in the first instance, consumers' perceptions of a range of green issues. Thus, survey results, as mentioned previously, were intended to serve as the basis for the subsequent qualitative study. Survey findings were also used to 'set the scene' prior to the second stage of research and to ascertain the present level of public knowledge and perceptions of carbon footprinting amongst consumers ('end-users').

Descriptive results also served to give the researcher insights as to public perceptions on 'green' purchasing issues and opportunity to assess levels of public knowledge of carbon footprint labels based upon PAS 2050 methodology prior to investigation of the supply-side of UK food chains.

4.8 Sample Size of Consumer Frame

As such, the questionnaire put to food consumers was self-administered (where permission was granted) to customers at a range of retail supermarkets, public spaces and places and via email distribution lists to ensure representativeness. For clarification, email responses (54 out of a total of 428) were not excluded from this research study because upon investigation, it was revealed that given no significant difference occurred between the sample excluding email responses against the sample including all hard copy questionnaire responses (and vice versa).

4.9 Stage 2 - Qualitative Data: Key informant Interviews

The qualitative stage of this study involves the purposive selection of six key informants from different UK food supply chain businesses and another key stakeholder, the technical author of PAS 2050 who is employed at The Carbon Trust. As mentioned previously, each selected participant and respective business occupy a range of supply chain positions in a variety of supply chains and were selected in order to explore both the similarities and contrasts of each participant's response in the context of actors' perceptions and perspectives. Selection of each key informant and relative business was also based on *a priori* knowledge of their engagement at the strategic level in food supply to the UK market and the known 'expertise' of each actor with respect to the food sector (ten plus years of working in the food industry). Each key informant was chosen for their different positions in the food chain (from farm production through processing and wholesaling to retail). Special attention was paid to the role of organic farming as an alternative food provider that is more 'environmentally friendly'.

This method was chosen as pertinent for the purposes of this research undertaking following a series of informal discussions with a number of senior academics and senior managers. All have personal experience of and interest in carbon footprinting and wider sustainability issues (for instance, details of this research were shared and discussed with Professor Tim Lang (City University, London), Professor Julian Agyeman (Tufts University, US), Professor Phil O'Keefe, Dr Geoff O'Brien (Northumbria University) and Chloe Meacher, Climate Change Manager at Tesco. Similarly, the questions included within the interview protocol framework of this study were informed by the literature review in Chapter 2, reviewed and considered for revision as appropriate subsequent to

consultation with the above mentioned academics prior to launching the 'interview proper' for all participants. However, having followed this approach, unlike the first stage of this research study, no revisions were made to the framework of interview questions as each pre-screening interview revealed the pertinence of the semi-structured interview-framework (included in Appendix 3). In light of the purposive sampling approach, the sample includes upstream, midstream and downstream food supply chain businesses as well as The Carbon Trust given their pivotal role in the development and publication of PAS 2050 and its related certification processes.

Sample selection of key informants was thus founded on the notion that key informants would be familiar with internal and external policy-making in the context of their food business and food supply chain position. As Walton et al. (1998) explain, sampling with interview-based research involves:

"not only decisions about which people to observe or interview, but also about settings, events and social processes." Walton et al. (1998) p.4

Further, selection of each participant was deemed appropriate having sought advice from, and following a series of informal discussions with a number of senior academics and managers with personal experience of and interest in carbon footprinting and wider sustainability issues. It proved impossible to find a key informant from Tesco following the participation of Chloe Meacher in the design of the qualitative sample. In fact, contact with Chloe Meacher ceased post her initial foray with this research task, given the Tesco office informed the researcher of her long-term absence. After being informed of this, all queries from the researcher were directly referred to Tesco's press office for contact.

In light of Walt and Gilson's (1994) policy triangle, an attempt was, however, made to encourage a range of actors who are key stakeholders in the food policy context. Key 'actors' who agreed to participate with the primary research, included one who represented a global conventional, commercial food producer of citrus fruits in South Africa who also export and supply citrus fruits to Tesco in the UK; an 'alternative' UK based, co-operative organic food producer and 'local' regional distributor of fruit and vegetables dependent principally through its online platform and local farm shops. Another actor represents an SME food industry manufacturer of vegetable products whose customers are Tesco, Sainsbury's, Asda and Iceland. In terms of retail, a key actor representing a supermarket retailer, Sainsbury's and a key actor representing retail service restaurants, and an actor from a 'civic society' organisation, The Carbon Trust.

For details of each of the participants, their business role and their affiliated business see Table 14 below.

Table 14 Research Participants

Key Informant Name:	Position/Role	Food Business	Interview Type	Date of Interview	Supply Chain Position of Business	Supply Chain Category
Graham Sinden	Technical Author of PAS 2050	The Carbon Trust	Telephone	05 December 2011	Neutral	Neutral
Guy Watson	Owner	Riverford Organic Vegetables	Face to Face	17 November 2011	Upstream	Organic Producer and Supplier
Paul Crewe	Head of Engineering, Sustainability, Energy Environment	Sainsbury's	Face to Face	27 July 2011	Downstream	Retail Supermarket
David Farrell	Sustainable Business Group Director	Colors Fruits	Telephone	20 May 2010	Upstream	Producer and Distributor
Iain Elliott	Environmental Manager	Northumberland Foods	Face to Face	23 October 2010	Mid-Stream	Manufacture
Philip Cooke	Head of Procurement	Tragus Holdings	Face to Face	5 April 2010	Downstream	Retail Service

As suggested by Walton et al. (1998), to avoid the potential confusion of results from a cross-industry study, this research selected a single industry, the food sector as a 'control' for differences in processes, materials and overall context. In light of this and in order to elicit responses from production, manufacturing and retail stages of supply chains, a group of food supply chain businesses that operate at different stages of UK food supply chains as well as the technical author of PAS 2050 (the policy-standard under scrutiny) were selected.

The unit of analysis for this qualitative study is the business. Hence, each key informant interview was conducted and analysed individually. In-depth face-to-face key informant interviews and telephone interviews (where meeting face-to-face was not possible) were conducted with 6 individuals from 6 different businesses operating at different stages of their respective supply chains. For clarification, the methodological approach adopted for both the telephone interviews and face-to-face interviews was exactly the same and the solicited results from both approaches were not compromised given that all interviews spanned between 60 and 87 minutes, did not reveal any inconsistencies and were consistent with the approach of Walton et al. (1998) and Walker et al. (2008).

A checklist of questions was piloted via a series of pre-interview telephone calls with every participant and reviewed to iron out difficulties. The checklist essentially forms the interview protocol framework comprising a series of pertinent questions as points of reference for conducting each of the key informant interviews. The final version is included in Appendix 3.

Due to the nature of semi-structured interviews, the interview protocol's checklist of questions acted as a guide/aide memoire rather than a 'fixed' closed question basis. As such, every key informant who participated in this research undertaking received a pre-interview telephone call to introduce the research project of this thesis, ascertain willingness to participate and gauge the relevance of each

key informant and their respective business for the purposes of this study. The pre-interview focused on preliminary enquiries including the following questions:

1. Who is responsible for environmental standards, sustainability and climate change targets in general?
2. Do you currently have an EMS and/or an LCA in place?
3. If so, what are the principal reasons for doing so?
4. Are suppliers included and if so, to what extent?
5. Are you familiar with the PAS 2050 carbon footprint standard?

If telephoning was unsuccessful a letter asking permission and interest to participate with the study was sent to key people (via email) across several organisations who were responsible for environmental management, reporting and/or corporate social responsibility. Implementation of the devised screening process enabled the author of this thesis to specifically gauge and assess willingness of participation from each prospective interviewee with the research project of this thesis.

Following all pre-screening interview phone calls, and reviews of the checklist of questions, key informant interviews were conducted. Each interview was in-depth (average interview period being 1 hour) and semi-structured in nature. The adopted technique provided a definitive framework within substantive boundary confines to avoid digression and simultaneously encouraged freedom of discussion in the context of 'green issues' from each participant.

Key informant interviews were also undertaken to explore in more detail, the 'policy' response regarding the purpose and perceived potential effectiveness of the PAS 2050 standard as well as to ascertain what influence PAS 2050 has had on different food supply chain businesses, that is the 'food business' response. More on the interview protocol used for each interview participant is discussed in the next section.

4.10 Qualitative Key Informant Interview Methodology

This section demonstrably outlines the methodological approach of the qualitative interviews conducted with key informants. Firstly, as previously mentioned a checklist of questions was piloted via a series of pre-interview telephone calls with every participant and reviewed to iron out difficulties. The checklist (enclosed in Appendix 3) was used for all key informant interviews. Secondly, the interviews were transcribed and numbered by sentence. Thirdly, key noun phrases were pulled out and registered in a table against original sentence number. Finally, these key phrases were categorised against key emergent themes. The qualitative interviews were interpreted in a discourse methodology using manual thematic analysis as defined by Fereday and Muir-Cochrane (2006) to ensure contact, familiarity with and to preserve the richness of the qualitative data. Figure 13 illustrates this iterative process.

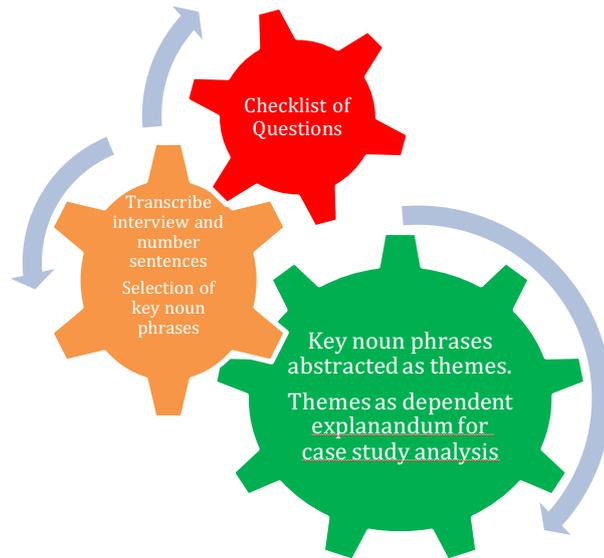


Figure 13 An Iterative Process: Deriving Abstracted Themes from Key Informant Interviews

A worked example from one informant interview (a key informant from a food manufacturing company) is outlined below. This demonstrates how the qualitative interviews were interpreted in a discourse methodology using thematic analysis Fereday and Muir-Cochrane (2006). Table 15 contains one original interview transcript numbered by broad responses. These broad responses produced highlighted phrases, which are grouped in the same table as generic issues that shaped emergent themes. These themes were then used as the dependent explanandum.

Table 15 Key Lines from Interview

Line from Interview	Relevant Quote	Generic Issues as Originators of Themes
1.	Well, I am the Environmental Manager here at Northumberland Foods.	SME
4.	we are a food manufacturing company. We specialise in potato and parsnip vegetable products.	
16.	We are a small to medium sized company. We employ about 180 people on site, operate a 24/7 shift system...	
18.	We are a main line supplier to supermarkets in the UK.	
78.	In terms of energy consumption, that's something that we started in the continual improvement and we set up a task force for that and it is made up of a Shift Manager, Shift Supervisor and one of the engineers that have made up the core group.	Energy Efficiency Considerations
80.	we use electricity on site and all our cooking is done via steam, which produced in boilers that either operate on kerosene or heavy oil. Unfortunately we have no gas here	Energy Efficiency Considerations (cont.)
124.	We compete with a number of companies, when it comes to the production of mashed and roast potatoes.	Market Share
125.	The good thing is that a lot of the companies we compete against are in Europe who buy British potatoes in Europe to manufacture and supply back to the UK.	

Line from Interview	Relevant Quote	Generic Issues as Originators of Themes
110. 41. 111. 24. 126.	As BRC goes, we have to meet BRC if we didn't have that, we wouldn't have the business and that is as simple as it gets. Unfortunately, as green as we are and everything else, we are still commercially driven. Is BRC driven on the commercial basis? Yes, because we want to make money and if we don't get it then we don't have it. However, we are also market driven by the customers that we supply and they actually tell us in some circumstances which potato growers we're allowed to buy from, which types of batter products we can use. With the recession that hit us last year, the strength of the Pound and the Euro turned tables on itself which then put us in a far stronger position to counter the attack from Europe therefore giving us a better home market advantage.	
89. 130. 137.	Yes, carbon footprinting will be on the agenda Potentially, if we worked with the Carbon Trust to carbon footprint products and show that we have a better product within the market place, that it hasn't travelled thousands and thousands of miles to end up on somebody's plate, then we could possibly have some sort of competitive advantage. Ideally, I would like everything sourced on my doorstep. However, I know that is highly impractical.	Carbon Footprint
114.	The BRC is driven by our customers in terms of what they are looking for and from their perspective; they're being driven by their customers.	Customer Demand
117. 118.	<i>(again, with reference to BRC standards)</i> Ultimately, I suppose yes it is the government that's driving it but they're not directly driving it, they're driving their local councils, the local councils are driving the people, the people are driving the supermarkets and the supermarkets then driving the manufacturers. People, the customers demand standards from the supermarkets and they demand it by what they buy.	
127.	We are a company versus every other company that is manufacturing roast potatoes or parsnips and compete against others that way rather than as a whole supply chain.	Supply Chain Position
103. 122. 133. 136.	if we were to fail the BRC, we would potentially lose 78% of business overnight, so we can't afford not to it is the supermarkets that are driven by the customers and the supermarkets that drive the manufacturing end, so it is like a circle because the people that work for manufacturing also buy from supermarkets and so on Different supermarkets have different requirements. Some aren't really...although we as a company we will source as closely as possible, some supermarkets don't mind where it comes from as long as it meets demand. There is no single driving factor behind what we do and how we do it that is for adopting standards, it is mainly driven by the supermarkets.	Supermarket Control/Demand

Line from Interview	Relevant Quote	Generic Issues as Originators of Themes
33. 37.	It's more driven by quality control in truth it's then quality control driven	Quality Control
30. 28. 31. 32. 135.	Potatoes are all year round but the reason they're all year round is because you have 3 growing times for potatoes which is where the item specific potato also comes in The parsnips are very seasonal. they can be held in warehousing at certain temperatures which will prevent them from sprouting We tend to use temperature controlled warehousing as opposed to gas controlled. We came away from gas controlled quite some time ago, as in years ago because we found it was better to have the potatoes temperature controlled and it gave them a better dry matter, less sugars, bound starches which enable us to use them for the cooking. The classic now is that some supermarkets will only stock UK reared meat, UK grown vegetables and because of that they're season driven as opposed to a product you can get all year long.	Seasonality, Storage and Freshness
95. 129.	driven by what we call the BRC system which is the British Retail Consortium. BRC is now an industry norm, everyone complies because it is an industry standard.	Performance/ Standard
98.	there are some of our customers, though they accept the BRC still want to do their own internal audits	
109.	The BRC as I understand it five years ago was far more lax than the independent systems were. I believe probably because they try to do too much in one but as the years have gone on, they are catching up and I wouldn't be surprised if very shortly, if they are passing those independent systems in terms of their rigour.	
116. 91. 92. 93.	...the government has a big part of it because they have to meet certain aspects because if they don't, they're in trouble with the rest of Europe and so on and so on, so they're going to push it down. ...as is the Federation Health Committee, which is the reduction of water because that is one of our biggest, biggest uses is water on site. We bring in something in the region of about 500 cubic metres of water a day to this site, So, it's the Federation Health Committee that I will be the first project I will push forward when I get time to do so. That will be the first one and then the Carbon Trust will be the one that will follow that.	Performance/ Standard (cont.)
26. 43. 44.	Sustainability, yes from a client driven point of view, it is very high on the agenda. More and more of the supermarkets are looking for sustainably produced materials being used within a product, more because they use that as a selling feature for themselves.	Sustainability

Line from Interview	Relevant Quote	Generic Issues as Originators of Themes
45.	...because the average customer, the average Joe Bloggs is asking them for it and therefore they're pushing it to the manufacturing side and from the manufacturing side, we're pushing out from the supply chain to say this is where that's coming from.	
45.	...from the manufacturing side, we're pushing out from the supply chain to say this is where that's coming from	
143.	To me the food miles, provenance, quality and taste is important.	
72.	logistics is actually not driven by ourselves	Logistics
76.	We use an outside haulier and we will deliver in bulk to their centralised hubs to reduce the logistics...	
77.	...and then as I say, the supermarkets are doing it on a returns basis, so as they deliver, they're also collecting.	

4.11 Ethics and Reflections on the Research Process

The author of this research conducted this study in line with the ethical guidelines of The Newcastle Business School and its ethical code of practice. Ethical concerns, permission and anonymity considerations are detailed in the relevant consent forms, the content of which reflects the specifics of the study of this thesis. These are located in Appendix 4. As is customary with the Newcastle Business School Ethics Sub-Committee's good practice and the Northumbria University Ethics Committee, ethical consent forms were completed and permission sought from each participating organisation and research participant; namely, each key informant being interviewed and their respective business. For reasons of practicality, Ethics Consent Forms were summarised on the reverse of questionnaires. Full versions were made available to interviewees and to those customers completing questionnaires upon request. Each consumer was made aware of this option prior to any request for information. Additionally, for the first stage of research, each questionnaire includes a statement informing each participant of the purpose of the research as well as the contact details of the researcher (the author of this thesis).

For the second stage of research, following the identification and negotiation of participation, each key informant was emailed copies of each of these forms and a description of the research purpose prior to the commencement of research interviews. Each key informant received both an organisational and individual Informed Consent Form to complete prior to participation in semi-structured interviews.

In light of the ethical considerations outlined above, it is important to note the financing of this research. The author of this thesis initially held a research assistant position which was co-financed by Northumbria University and ABN-Agri British Food Nutrition. This 2 year studentship had a range of products that included:

-
- A carbon footprint LCA accounting exercise and report of an Animal Feed Mill in North Allerton;
 - An extensive review and critical analysis of the Environmental Kuznets Curve; and
 - Contribution in the production of a series of bid documents for invited tenders from DEFRA including one on the eco-labelling of food.

In the first two years, I began work on the consumer survey but this was largely completed together with the supply survey when I transferred from the Research Assistantship to a teaching position at Newcastle Business School at Northumbria University. In the third year of employment at Northumbria, I published a joint paper with Professor David Oglethorpe in Food Policy which reflected initial findings of the consumer survey. For the last five years, the research has effectively been financed by Northumbria University through my teaching fellowship.

In one version of this research study, I utilised the OECD DAC criteria in an attempt to understand the efficiency and effectiveness of carbon footprint labelling in an evaluative context. This attempt has been criticised where the criticism seemed to come from the assumption that the evaluation was commissioned either by people in the supply chain or government agencies. This was never the case, although it has led me to question the use of the evaluative framework in a doctoral dissertation and to explore theories of change (Geels et al., 2015; Marsden, 2013; Shove, 2010; Hopwood, Mellor and O'Brien, 2005).

The next two chapters pit the empirical data against the theoretical framework (Propositions). As such, the case material is used to explore the robustness of the propositions themselves.

* * *

Chapter 5 – Consumer Case Study Survey: Analysis and Findings

5.1 Introduction

This chapter focuses on ascertaining the food consumer response to carbon footprinting and labelling, including parallel contexts in order to understand the consumer element. As mentioned previously, a series of propositions were raised in Chapter 3 which will inform the analysis of the results. From Chapter 3 on Parallel Contexts, there are examples of relative success in changing consumer behaviour, although this might be noted as being predominantly individual contract rather than social contract.

Gaining some understanding and knowledge of consumers' 'green' perceptions and more specifically, ascertaining their response to carbon footprint labels is a useful starting point. For the purpose of the research conducted in this thesis, consumer insights elicited from a survey of UK supermarket shoppers were sought to 'set the scene' and contribute towards the overall research study with respect to determining the 'demand' or 'end-user' supply chain response to carbon footprint labels and wider 'green' shopping issues.

Given the lack of peer-reviewed articles related to UK supermarket shoppers' perceptions of carbon footprint labels based on the PAS 2050 standard and broader 'green' issues related to food shopping, it is important to explore consumers' opinions with respect to 'green' purchasing. More specifically, identifying the role consumers can legitimately be expected to take in delivering a less carbon heavy food chain is relevant to 'consumer' conscious businesses. This is also of interest to food businesses, particularly for those that are considering adoption of PAS 2050, have adopted PAS 2050 and certified their carbon footprints for carbon labels or having adopted PAS 2050, are pursuing certification for the communication of carbon footprint results via carbon labels.

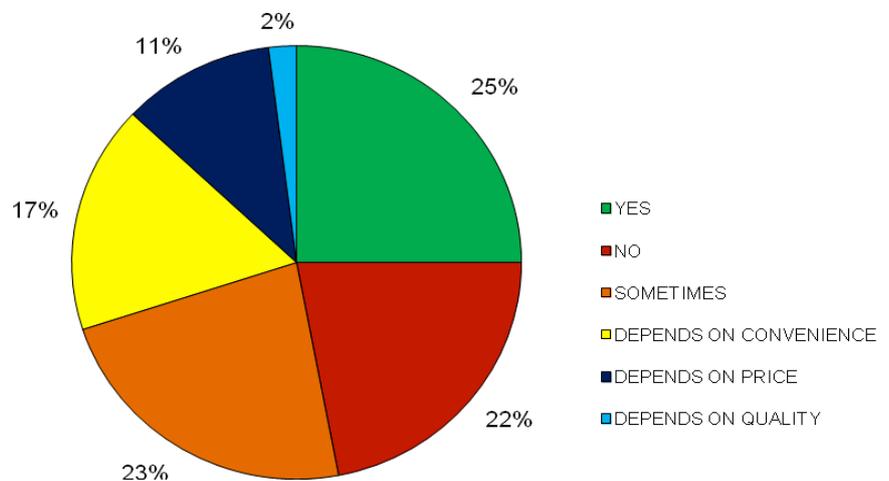
In light of the above, the following sections outline how these issues were examined through this survey of supermarket consumers in the UK.

5.2 Findings

The 428 responses were distributed with numbers answering questions that fall broadly into five groups. 19% of respondents were under the age of 21, 30% were aged between 21 and 40, 28% were aged between 41 and 65 and 23% were aged over 65. These figures correspond well to national demographic figures within the UK given that according to ONS (2011), the UK population is distributed as follows: 25% under 21, 27% between 21 and 40, 33% between 41 and 65 and 15% over 65. This difference in distribution against national averages is not statistically significant having used a t-test for pair-wise comparisons of proportions that fall in each age category ($p = 0.99$) and is in part explained by the fact that female respondents dominated the sample at 63%, but this still meant an adequate response by the remaining 37% of males ($n = 159$). The sample is thus pertinent in terms of its representativeness of the UK population.

The descriptive results that follow first describe the distribution of general consumption preferences amongst the sample, then assesses how shopping habits may have changed and concludes by investigating more specifically, issues surrounding carbon footprints, carbon labelling and climate change.

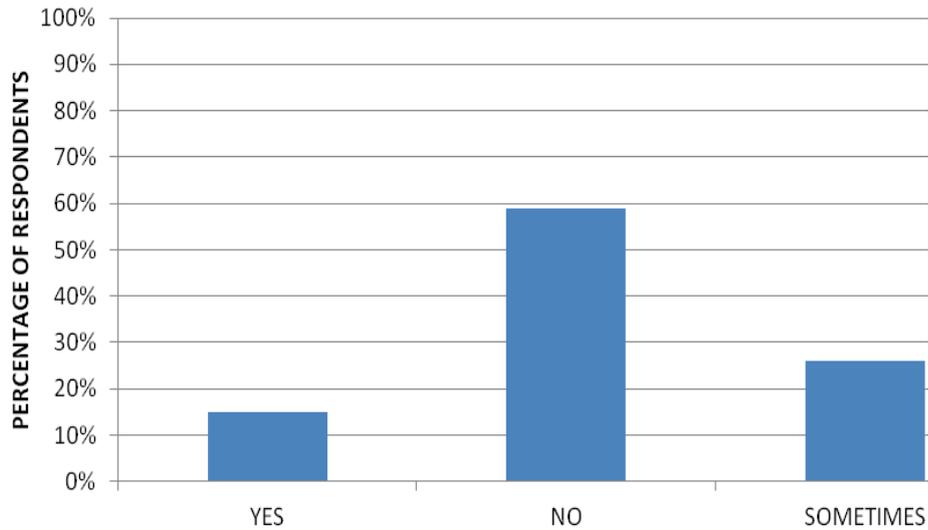
From the total sample of 428 respondents approximately a third at 25% claimed that yes they would try to shop 'locally'¹¹ and 23% would 'sometimes'. Conversely, 22% answered 'no'. The remaining 30% of answers included 17% of respondents expressing a preference to shop locally depending on convenience, 11% dependent on price and 2% on quality as detailed in Figure 5a.



**% of consumers who claim to shop 'local' for main food Shopping
Figure 5a *n=428**

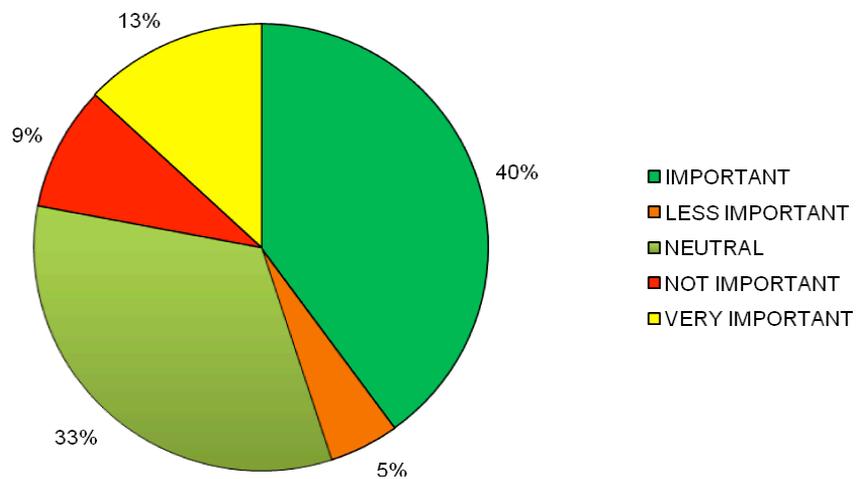
As suggested by Dowler et al. (2007) the dominance of grocery shopping in supermarket retailers within the UK is reflected in the proportionally low number of respondents (15%) from the total sample who claim to shop at farmers' markets and/or farm shops. 59% of the total sample stated that they do not shop at farmers' markets or farm shops and 26% stated they sometimes shop at farmers' markets and farm shops. See Figure 5b on the following page.

¹¹ The definition of 'local' being non-franchise, non-supermarket based shopping.



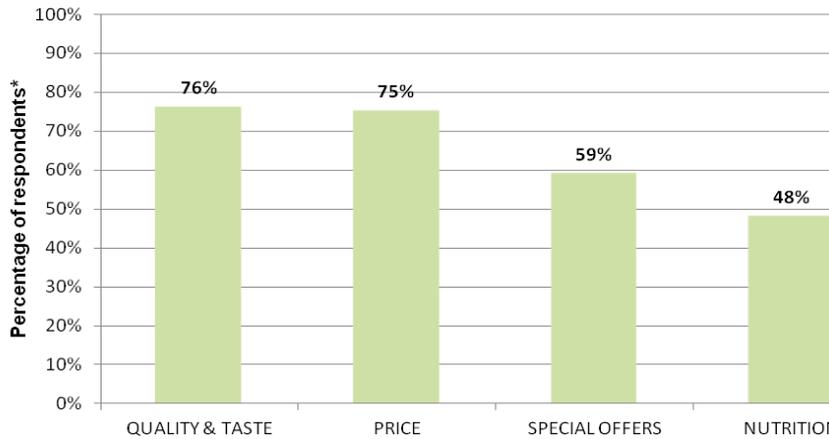
% consumers that shop at farmers' markets/farm shops
Figure 5b *n=428

Conversely, as illustrated in Figure 5c, 40% of consumers expressed a definite association with the importance of climate change and food. This was closely followed with 13% of consumers claiming climate change as 'very important'. 33% expressed neutrality, 9% did not think climate change was an important factor and 5% stated that climate change was 'less important'.



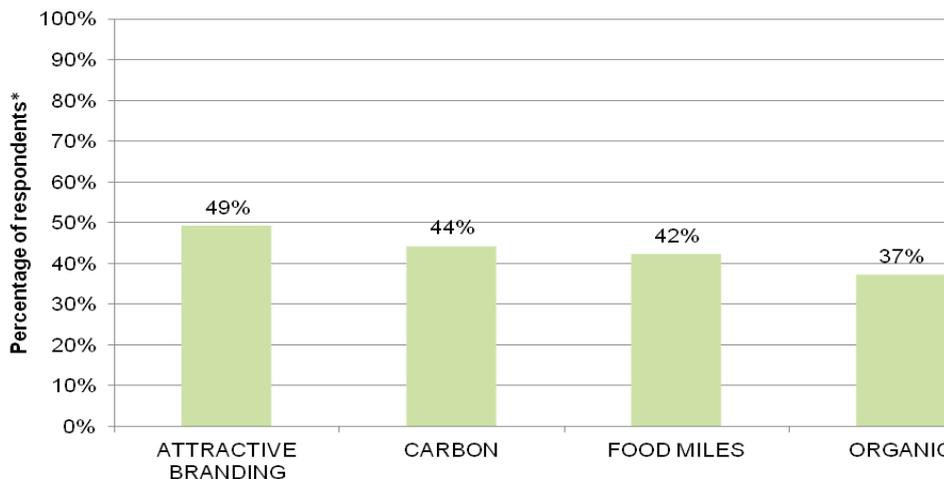
Do consumers think climate change is important when buying food?
Figure 5c *n=428

The four factors highlighted by respondees as most important when buying food, related to quality and taste with 76% of respondents in agreement; price with 75%; special offers at 59%; and nutrition at 48% respectively. See Figure 5d.



Factors ranked as most important when buying food by consumers
Figure 5d *n=428

The three factors attributed with the lowest level of importance included attractive branding with 49% of respondees agreeing, carbon with 44% agreeing, food miles with 42% and organic food with 37% respectively. See Figure 5e.



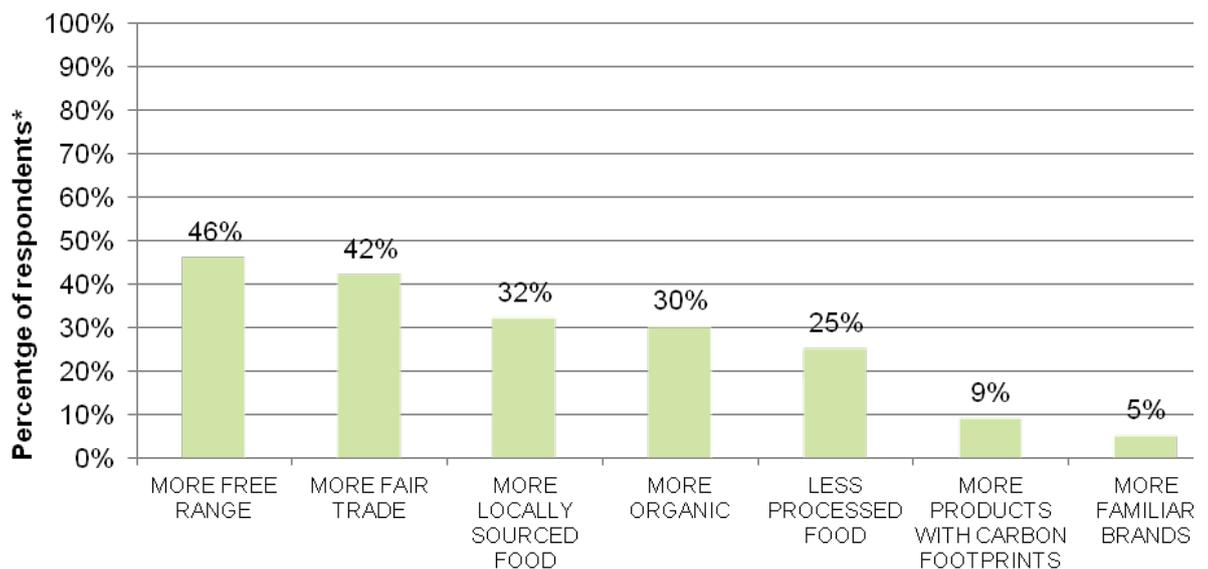
Factors attributed with 'low' importance when buying food by consumers
Figure 5e *n=428

5.3 Shopping Habits and Consumer Behavioural Change

With respect to shopping habits, consumers were asked whether their shopping priorities had changed over the last ten years. 68% claimed that yes, individual shopping habits had changed with the remaining 32% claiming the reverse. In an attempt to illuminate and denote the specific nature of changes in consumer behaviour that have taken place, a series of categories were proffered to those who had claimed a change in shopping priorities with a 'more' or 'less' option to choose from. It should be noted that it was explicitly stated in the question that categories should only be chosen

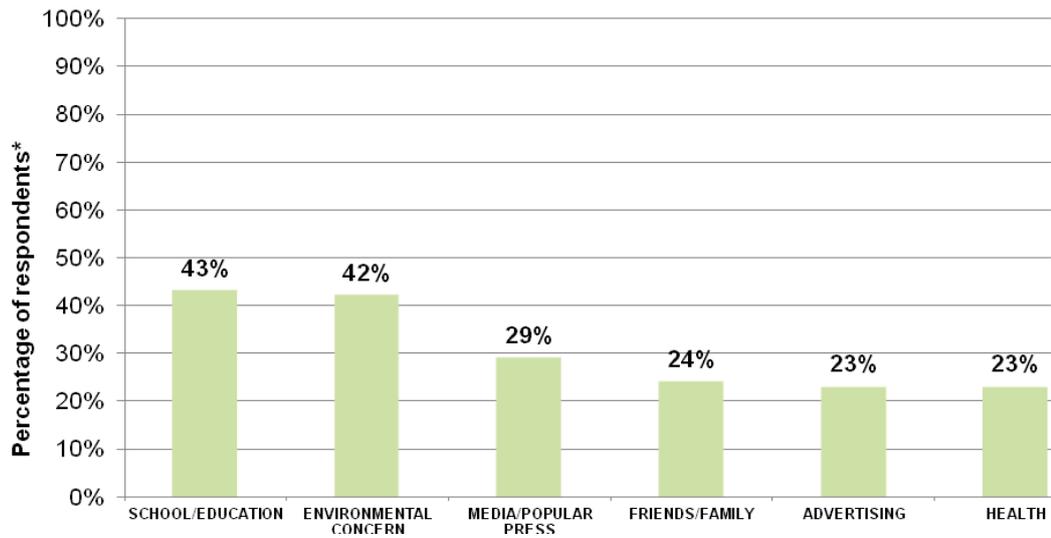
if applicable. For example, any number of choices could be made, as long as they were specifically applicable to the individual's shopping priorities in question.

Essentially, consumers were asked whether shopping priorities had orientated more towards buying 'more' or 'less' of specific categories. The highest level at 46% expressed a shift in habit change towards a preference to buy more free-range food. 42% of respondents claimed a preferred move towards purchasing more fair trade products closely followed with 32% of consumers expressing an interest in more locally sourced food and 30% of consumers stating a preference for purchasing more food that is organic. These results are illustrated in more detail in Figure 5f below.



How consumers' shopping habits have changed over the last ten years
Figure 5f *n=428

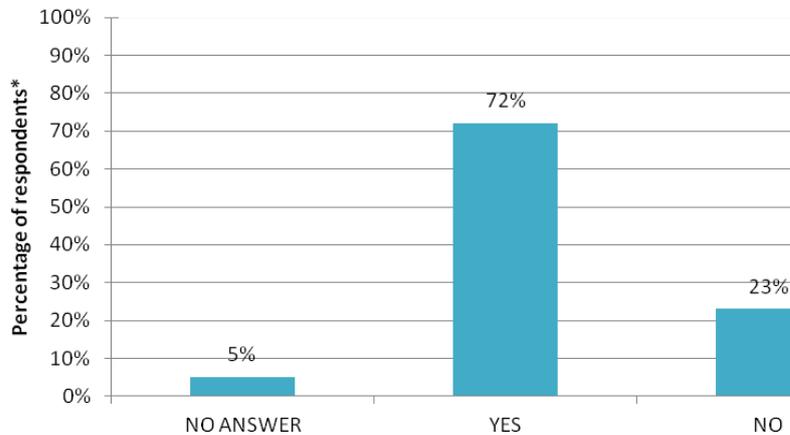
Elucidating what consumers are now prioritising as opposed to ten years ago in terms of what they claim to look for when food shopping required qualification. As such, a follow up question relating to the influences towards such changes in priorities was included in the questionnaire. It provided a sum of six influential factors that consumers could choose from related to individual change in shopping habits. Results from this survey show that the categories 'school and education' at a response rate of 43% and concern for the environment at 42% are the most dominant factors that have influenced changes in consumers' priorities over the last ten years. See Figure 5g.



Factors influencing changes in food purchasing habits over last ten years
Figure 5g *n=428

5.4 Carbon Footprint and Carbon Label Issues: Level of Demand

Out of the total sample, 72% of respondents expressed a preference for carbon labels on food products, 23% expressed the opposite preference, stating that they would not like carbon labels on food and the remaining 5% did not give an answer, see Figure 5h.

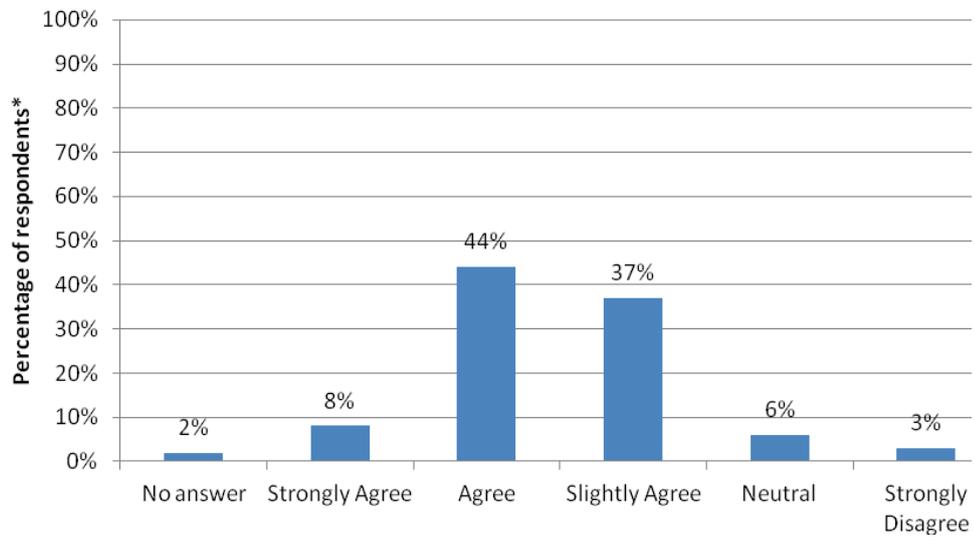


Level of demand for carbon labels on food
Figure 5h *n=428

5.5 Carbon Footprint Comprehension and Knowledge

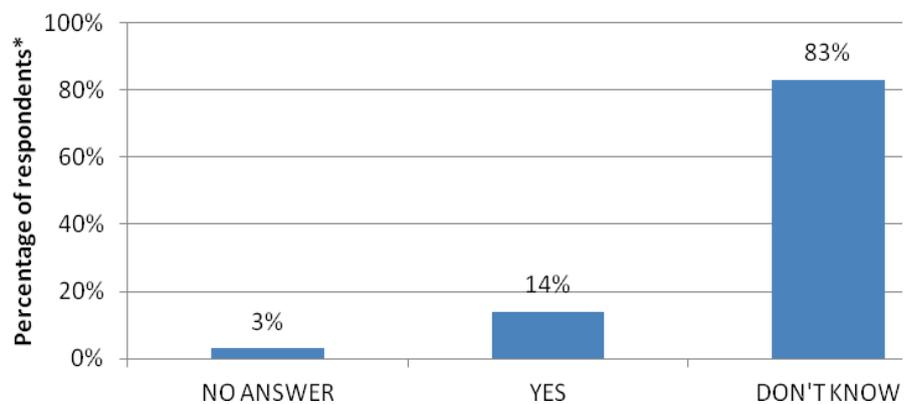
Consumers were asked to select, using a likert scaling method whether they found understanding and comparing carbon footprints confusing. The overwhelming response was that of agreement with the given statement. 44% agreed that understanding and comparing carbon footprints is confusing. This Figure was closely followed with 37% of

consumers *slightly agreeing* with the statement. At the opposite end of the scale a minimal percentage of 3% *strongly disagreed*. These findings are illustrated in Figure 5i.



Comparing carbon footprints is confusing: consumer opinions
Figure 5i *n=428

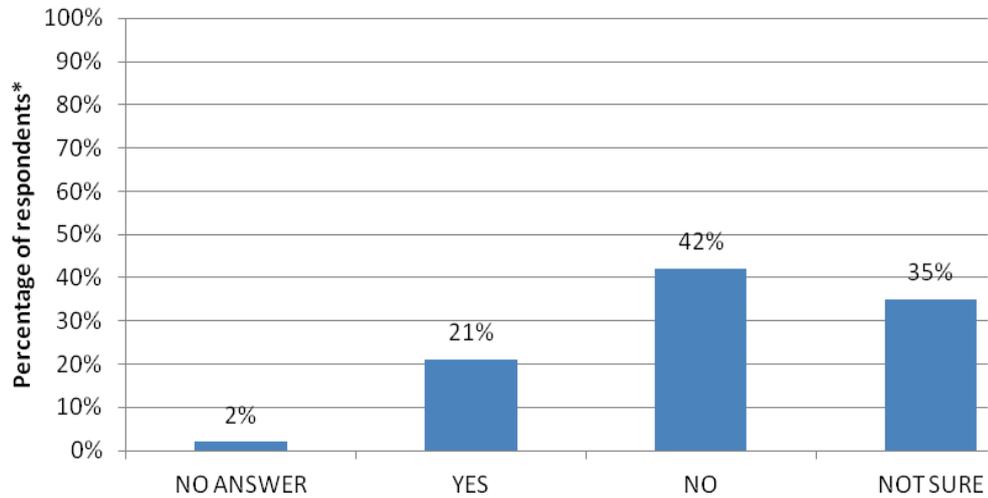
With respect to personal carbon footprint knowledge, as illustrated in Figure 5j, 14% of consumers stated that they knew their own personal carbon footprint, though 83% did not. A proportionally small Figure of 3% did not answer this question.



Percentage of people who know/don't know their personal carbon footprint
Figure 5j *n=428

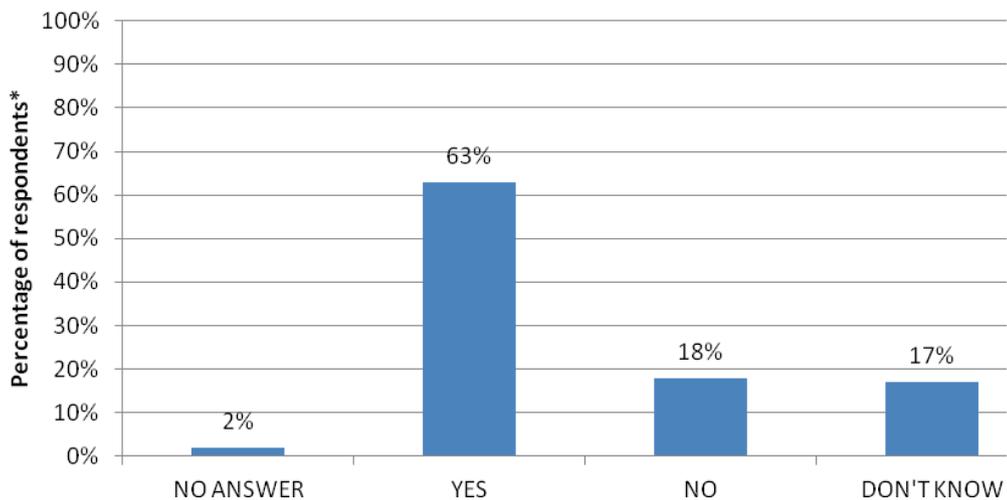
5.6 Carbon Footprint Labels For Information

Out of the given sample, 21% of consumers do think a carbon footprint label on products would indicate better quality, whereas 41% did not think this to be the case and 35% were not sure. See Figure 5k.



Percentage of consumers who think a carbon footprint relates to quality
Figure 5k *n=428

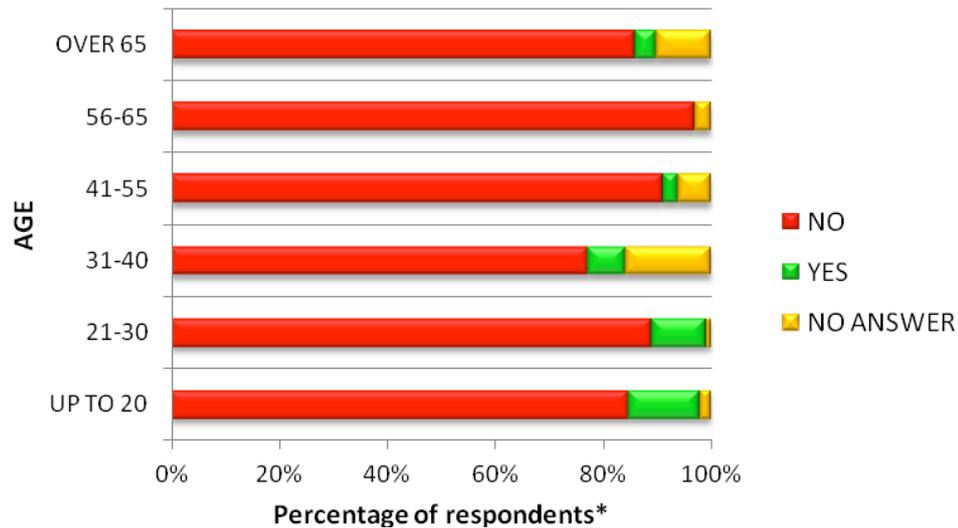
When asked whether consumers think that carbon labels are useful to compare environmental standards, a significant percentage of 63% stated that yes, they would find carbon labels useful for this purpose. The breakdown of differing responses is detailed in Figure 5l.



Percentage of consumers who think that carbon labels are useful for the comparison of environmental standards
Figure 5m *n=428

5.7 Opinion Dependent on Age

Data from the questionnaires were examined to see whether variations dependent on age arose in response rates to the question regarding knowledge of personal carbon footprints. Very little variation occurred as generally, little knowledge of carbon footprints was expressed throughout all age categories. This is graphically represented in Figure 5n.



Knowledge of Personal Carbon Footprints: Percentage of Consumers by Age
Figure 5n *n=428

Upon closer inspection and as detailed in Figure 5n, the highest number of people that did not know their personal carbon footprints fall in the age category of 56-65. The highest number of respondents that stated they knew their carbon footprints were from two distinct categories of age, those of 'up to 20' at 13% and '21-30' at 10%.

The following section summarises the above findings and explains how these contribute towards answering the main research question introduced at the beginning of this chapter.

5.8 Findings: The Consumer Response to Carbon Footprint Labels

The survey questionnaire was administered to a broad cross-section of age groups. In so doing, it was hoped that a balanced and representative approach would glean an initial set of insights into the world of consumer preference relating to 'green' issues when food shopping. Data from this questionnaire have materialised as a result of carefully designed questions with reference to local food shopping, general food shopping, supermarket preference, shopping habits, shopping habit changes, the direct influences on such behavioural change and the more specific issues requesting consumers to rank the importance and non-importance of factors considered when purchasing food. Added to this attempt to capture a broad spectrum of information was the effort to tease out the more specific, including questions surrounding climate change with food purchase, the demand for

carbon labels, the level of understanding of carbon footprints and knowledge of personal carbon footprints.

5.9 Shopping Habit Change over the Past Ten Years

Shopping habit change over the past ten years is significant. 68% of respondents claimed definitive changes in purchasing behaviour. Consumers predominantly stated that their purchasing habits had largely shifted towards purchasing more free range, more fair trade, more locally sourced food, more organic and less processed food products. The high percentage (79%) of consumers (including those who stated 'depends on price/convenience/sometimes') expressing an effort to buy 'locally' appears to substantiate these statements.

Buying more products with carbon footprint labels was not a significant factor in shopping habit change with only 9% of respondents agreeing. Influential factors shaping such purchasing habit changes were principally associated with school and education and environmental concern with 43% and 42% stating such factors respectively. The remaining four factors provided in the questionnaire were: (i) media and popular press; (ii) advertising; (iii) health; and (iv) friends/family, achieving no lower than 23% of respondents and no higher than 29%.

The findings suggest that though in totality (in terms of the whole sample being considered) and in light of such a high proportion of the sample expressing a definite shift in shopping habits, concern is also high with respect to climate change and food purchasing simultaneously (Figure 5f).

5.10 Carbon Footprint Labels: Interpretating and Understanding

Much confusion remains surrounding the understanding of carbon footprint labels with a total of 89% of the sample agreeing carbon footprints are confusing. Confirming this consensus from this particular survey is the extremely high percentage of consumers (83%) who do not know their own personal carbon footprint yet expressed an almost equally high demand (72%) for carbon labels on food products. Further, carbon footprint knowledge does not vary dramatically dependent on age, though the younger age categories have expressed marginally (in terms of the number of respondents) more knowledge of personal carbon footprints.

Additionally, 42% of respondents do not associate carbon labels with quality though 21% of the sample claim that yes; they do associate carbon labels with quality. 63% of respondents claim they would find carbon labels useful for the comparison of environmental standards even as mentioned earlier, many respondents find carbon footprint labels confusing (44% 'agree' and 8% 'strongly agree').

5.11 Carbon Footprint Label Demand

Despite these results, a significant number of respondents (72%) stated that they want carbon labels on food. Though the stated preference for carbon labels was evidently high in this survey, the factors ranked as most important by consumers in the purchase of food related to quality and taste with 76%. This was closely followed by 75% concerned with price and 59% with special offers. Factors

including attractive branding of products, carbon and food miles were ranked low in importance with attractive branding attracting 49%, carbon 44% and food miles 42% respectively. These results appear to reflect the relatively embryonic stage and poor knowledge of carbon footprints and carbon footprint labelling schemes as greater importance tends to be largely attributed to quality, taste, price, special offers and nutrition despite the high demand for labels and claim that carbon labels could potentially assist in the comparison of environmental standards.

In summarising these findings, it has been revealed that though much discord has arisen as to some of the more specific issues related to consumers' preferences, the sample has little variation in terms of age and thus is representative of supermarket shoppers in general given both genders, different age and socio-economic groups all shop for groceries and typically do so at supermarkets (Vanclay et al., 2011 and Dowler et al., 2007). The main points derived from this data analysis are listed below:

5.12 Key Findings

- 1) 68% of consumers claimed they have changed their purchasing habits over the past ten years
- 2) Many consumers' shopping habits have shifted towards considering: free range, fair trade, locally sourced food, organic, and less processed food products
- 3) 76% of consumers ranked quality and taste as most important when purchasing food
- 4) 72% of consumers would like carbon labels on food products
- 5) 63% of consumers think carbon labels are useful for the comparison of environmental standards
- 6) 89% of consumers find carbon footprints confusing (a combination of 'agreeing', 'strongly agreeing' and 'slightly agreeing' to the given statement)
- 7) 83% of consumers do not know their own personal carbon footprint

The most explicit difference within the total sample is the dichotomous split between those who have claimed a food shopping habit change and those who have not. Nevertheless, it appears that the dominant theme arising from these findings tends to be that consumers generally would like carbon labels on food products. However, because there is little understanding/knowledge surrounding such information as well as little in terms of availability of products with carbon footprints, it is difficult for consumers to compare environmental standards via carbon labels even though the majority of respondents think such labels would help to do so. Consumers are more orientated towards considering traditional factors when purchasing food, particularly, quality and taste, price and special offers.

5.13 Knowledge and awareness of carbon footprinting amongst UK food consumers (end-users)

The consumer case study findings outlined in Chapter 5 and discussed in more detail previously, indicate that given the present level of market dissonance with respect to PAS 2050 carbon footprinting and carbon footprint labelling, UK food consumers remain primarily concerned with traditional factors of quality and taste and price when shopping for food. Consumers are nevertheless increasingly interested in climate change issues and interested in the environmental impact of food but do not feel well informed to make purchasing decisions on carbon footprint labelled products alone or have the opportunity to select substitutable food products through carbon-based value judgements. As such, the realities of any positive environmental, social and economic impacts to be had via carbon labels rests primarily on the functionality of carbon footprint and labelling efforts across respective food supply chains rather than dependence on consumer demand and/or the notion of consumer guilt.

While consumers in this study demonstrate clear preferences for 'greener' food products, the actualities of the contemporary food shopping experience is that food consumers can eventually only purchase what is offered by retailers. Subsequently, looking towards the demand side of food supply chains to communicate relative GHG emissions of any product is simply just a part of the challenge as any impact at the end of the chain will be dependent on whether consumers will be able to make 'real' and undisputable product comparisons within specific and like for like product categories. This suggests that carbon footprint labels based on PAS 2050 carbon footprint efforts by food supply chain actors is still a long way from translating consumer-expressed preference for carbon footprint labelled products into action.

This is comprehensible from a retailer's perspective because the carbon labelling of different product categories in the existent climate merely serves to augment sales of particular or 'special' products rather than promote comparisons within single categories. Given the diverse number of carbon labelled product categories that exist do not currently commonly exhibit wide within-category or sector specific uptake, implies universal and widespread adoption could risk growth in the sales of a product at the expense of another. If carbon footprint labelling however, is really used to help consumers shop for a lower carbon food basket, retailers and their suppliers will be required to forego sales in carbon-heavy products. To obviate this difficulty, in reality, retailers and their suppliers will require an immediate and comprehensive switch by all competitors to suddenly carbon footprint all products so that the market place immediately becomes flat and competitive again. This is clearly utopian given the scale of the challenge. In exploring the present level of knowledge and awareness of carbon footprinting amongst UK food consumers, the following key conclusions have been drawn:

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- Consumers are increasingly aware of climate change and many consumers' shopping habits over the past ten years have shifted towards considering: free range, fair trade, locally sourced food, organic, and less processed food products.
 - Despite growing awareness of 'green' issues when shopping for food, consumers continue to be primarily concerned with price, special offers, quality and taste when shopping for food.
 - Carbon footprint labelling does not address other environmental impacts or wider sustainability issues that consumers are also increasingly aware of.
 - Consumer demand for carbon footprint labels is relatively strong but this is also contradicted by the fact that consumers find carbon footprint labels confusing and difficult to compare especially within 'same' food product categories.
 - The carbon labelling of different product categories has not so far stimulated further carbon labelling efforts of competing product lines, exacerbating the difficulty for consumers in comparing footprinted products.
 - Carbon footprint labelling for communication and information is unlikely to generate a lower carbon food basket for UK food shoppers.

5.14 Key Findings against Research Propositions

The Key Findings are derived from empirical field work and the Research Propositions were generated from a detailed reading of the literature around carbon footprinting and parallel contexts in Chapters 2 and 3 of this thesis. In matching the two data conclusion sets together the findings begin to provide a sense of the difficulties of the design of carbon footprinting and carbon labelling present for consumer uptake. A snap shot summary of the key findings is outlined in Table 16 on the following page. It shows the dominance of the negative propositions (key findings 6 and 7) over the more positive ones (key findings 1 to 5). In one sense, this is simply a more detailed analysis of the well established proposition that consumers say they would react to nudges that changed their consumer behaviour towards one that supports a broader environmental objective over the whole food chain. However, in reality, quality and taste, together with price, dictate final purchases. As such, environmental sustainability implied by the carbon footprinting and carbon labelling regimes is a distant wish list, not an actual material action.

Table 16 Research Propositions against Key Findings from Consumer Case Study

Key Propositions Proposition Number against Key Finding Number(s)			Key Findings: Number and Content
Proposition 1	Carbon standards and labelling are not robust but in decline. Continued non standardisation of carbon accounting tools brings them into disrepute.	Key Findings 6, 7 & 8	6) 89% of consumers find carbon footprints confusing (a combination of 'agreeing', 'strongly agreeing' and 'slightly agreeing' to the given statement) 7) 76% of consumers ranked quality and taste as most important when purchasing food 8) 83% of consumers do not know their own personal carbon footprint
Proposition 2	Carbon footprinting is a technological solution that substitutes a false science for a robust food policy.	[for supply side – see Chapter 6]	[for supply side – see Chapter 6]
Proposition 3	There may be universal access to PAS 2050 but there is no universal uptake. The policy framework is from strong food security to weak sustainability.	Key Findings 1, 2 & 7 [for supply side – see Chapter 6]	1) 68% of consumers claimed they have changed their purchasing habits over the past ten years 2) Many consumers' shopping habits have shifted towards considering: free range, fair trade, locally sourced food, organic, and less processed food products 7) 76% of consumers ranked quality and taste as most important when purchasing food. [for supply side – see Chapter 6]
Proposition 4	There is little link between food production, consumption and environmental policy. The fragmentation of science informing food policy is influenced substantially through the private and corporate control of science.	Key Finding 2 [for supply side – see Chapter 6]	2) Many consumers' shopping habits have shifted towards considering: free range, fair trade, locally sourced food, organic, and less processed food products [for supply side – see Chapter 6]
Proposition 5	Corporate uptake of environmental issues, especially climate change is largely precautionary due to the threat of an international legal regime.	[for supply side – see Chapter 6]	[for supply side – see Chapter 6]
Proposition 6	Near consumption actors (supermarkets) are the powerhouse of oligopoly that control food policy making. Corporate interests, not that of the State, is the arena for food policy making.	[for supply side – see Chapter 6] Relates to all key findings but the key observation is that these are individual, not social responses.	[for supply side – see Chapter 6] 1) 68% of consumers claimed they have changed their purchasing habits over the past ten years 2) Many consumers' shopping habits have shifted towards considering: free range, fair trade, locally sourced food, organic, and less processed food products 3) 76% of consumers ranked quality and taste as most important when purchasing food 4) 72% of consumers would like carbon labels on food products 5) 63% of consumers think carbon labels are useful for the comparison of environmental standards 6) 89% of consumers find carbon footprints confusing (a combination of 'agreeing', 'strongly agreeing' and 'slightly agreeing' to the given statement) 8) 83% of consumers do not know their own personal carbon footprint
Proposition 7	Choice architecture has a fall-back position of nudge economics. Nudge economics is the economics of 'push' with no 'pull'.	for supply side – see Chapter 6]	[for supply side – see Chapter 6]
Proposition 8	Green supply chain management is 'greenwash' – ISO 14001 is as close as it gets.	Key Finding 6 [for supply side – see Chapter 6]	6) 89% of consumers find carbon footprints confusing (a combination of 'agreeing', 'strongly agreeing' and 'slightly agreeing' to the given statement).
Proposition 9 Food Safety	Regarding food safety, standards are underwritten by science and law but this is complex, confusing and sometimes contradictory.	[for supply side – see Chapter 6]	[for supply side – see Chapter 6]
Proposition 10 Nutrition and Health	Regarding nutrition and health, food behaviour is targeted and changed but only at the individual level, never summarised to the social and the environmental problem which is essentially social.	Key Finding 5 & 6	[for supply side – see Chapter 6] 5) 63% of consumers think carbon labels are useful for the comparison of environmental standards. 6) 89% of consumers find carbon footprints confusing (a combination of 'agreeing', 'strongly agreeing' and 'slightly agreeing' to the given statement).

Key Propositions Proposition Number against Key Finding Number(s)		Key Findings: Number and Content	
Proposition 11 Omni/Meta Standards and labels	Omni standards and labelling regimes would require a humanistic and social science approach that is neutral to corporate and private gain but the science of food policy is physical science of distance from human beings, while social science is increasingly for corporate and private gain.	Key Finding 2, 5 & 7	2) Many consumers' shopping habits have shifted towards considering: free range, fair trade, locally sourced food, organic, and less processed food products. 5) 63% of consumers think carbon labels are useful for the comparison of environmental standards. 7) 76% of consumers ranked quality and taste as most important when purchasing food
Proposition 12	There is need to move from the consumer with individual responsibility to consumers with collective social environmental responsibility.	Key Finding 2	2) Many consumers' shopping habits have shifted towards considering free range, fair trade, locally sourced food, organic and less processed food products.

Looking specifically to each of the research propositions against the findings derived from the consumer survey case study data, demonstrably highlights a series of key issues evident in the consumer element of the food chain. For instance, with respect to Proposition 1, [which suggests that carbon footprint standards and labels are not robust but in decline and that the ongoing non-standardisation of accounting tools brings them into disrepute] the consumer findings show that from the perspective of a food shopper, understanding of carbon labels is relatively weak as many consumers find such labels confusing and more specifically, 83% of the sample stated that they do not know their own personal carbon footprint. Issues such as quality, taste and price are ranked most highly by the consumers of this sample set.

Evidence from the sample shows that low consumer appeal tends to be associated with confusion in label interpretation and shifting degrees of consumer scepticism. This is in line with the findings from Van Kleef and Dagevos (2015); Dendler (2014) and Grunert et al. (2014) as well as Tzilivakis et al. (2012) amongst others, who suggest that while nutrition, health and provenance are issues of importance to consumers, environmental concerns are increasingly entering the psyche of the food shopper. Moreover, as with the parallel issue of food safety, (which, unlike carbon footprint labelling is underwritten by *both* science and law), consumers find the whole issue of food sustainability, specifically carbon footprinting, confusing and sometimes contradictory. As found by Hall and Ossess (2013), the indication from this sample set is that awareness and food label use is shaped by a multifarious 'alphabet spaghetti soup' of factors. These can include attitudes, experience, socio-demographic characteristics, trust in message providers and label design.

While Upham et al. (2011); White et al. (2009); Berry et al. (2008) suggest that carbon footprint labelling may play a major role in influencing behavioural change, it is argued that low consumer appeal tends to be associated with confusion in label interpretation and shifting degrees of consumer scepticism. In this sense, the findings corroborate those of Peattie (2010) and Rettie (2014) who propose that generating a shift change towards increasing sustainable consumption is reliant to a certain degree on what is offered to consumers in the market place and contingent on the efficacy of individual marketing campaigns. In this sense, the willingness of consumers to engage with 'greener' consumption shopping behaviours firmly places the locus of responsibility for change upon individual food shoppers, not the food industry. Yet, such shopping behaviours are inherently heterogeneous, context dependent and complex. Influencing such diverse consumer behaviours towards 'greener'

shopping is naïve given a drive to more sustainable consumption is exacerbated in a market environment littered with an inconsistent array of voluntary ‘nudging’ food labelling regimes. Situated behind the veneer of labelled products; is the rationale that such labelling regimes are inextricably tied to and therefore dependent upon food industry actors’ motivations for uptake, including issue saliency, the type of food/drink product, modes and style of production systems to the retail gate as well as the often powerful market governance strategies inherent in increasingly globalised, large-scale intensive food supply systems. Choice editing becomes almost impossible for food shoppers when ‘choice’ is limited to what is offered by the market place, particularly, when for instance, in the case of carbon footprint labels, not all product categories carry the footprint logo, making it difficult for consumers to make within product category comparisons. Moreover, whether consumers would wish/have the time to do so in a crowded marketplace when an individual shopper generally makes a decision based on a label within a matter of a few seconds (Sorensen, 2009) is of concern; given, in parallel, the widespread proliferation of nutritional food labels which are said to play a critical role in informing consumers on food content (Temple and Fraser, 2014).

5.15 Conclusion

Trying to capture the research propositions against the research questions results in a presentation in tabulation form. The problem with any tabulation is that there is a tendency to read it in a positivist fashion. In building a conclusion, what is attempted is a reflective dialectical reading of the relationships between the propositions and the research questions.

What emerges against the key findings of the propositions is an emphasis on the negative, namely that people find carbon footprint labelling confusing. Secondly, again as a negative finding, consumers in general, do not know their own personal carbon footprint, nor can they put that in a broader social context of climate change. On the more positive side, there is evidence that individual consumers have changed their purchasing habits with reference to environmental issues. However, environment does not rank highly in determining final purchases. In essence, this means that their preference for carbon footprint labels is a ‘false response’ driven by the direction of the questionnaire which was focused on individual consumption habits, not consumption to address the social problem of carbon footprinting.

In light of the above, the findings from this survey of consumers addresses in part, the main research question and sub-questions which essentially concerns the examination of the consumer response, (that is the end-user) at the demand side of the food supply chain. These findings are discussed in more detail in Chapter 7 together with data from the supply side case study which were elicited from key informant interviews (a policy actor and five different business actors).

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Chapter 6 – Food Supply Chain Case Study Analyses and Findings

6.1 Introduction

This chapter focuses on presenting food chain actors' perceptions and perspectives of carbon footprinting and labelling, drawing upon the parallel contexts in order to understand producers' perceptions. As mentioned previously, a series of propositions were raised in Chapter 3 which will inform the analysis of the results. From Chapter 3 on Parallel Contexts, there are examples of relative success in supply side changes, although this might be noted as being predominantly to ensure market share rather than responding to a social contract on environment.

The findings consider the perceived drivers and barriers of key informants' directly involved with UK food supply chain businesses to implementation of environmental practices with a particular focus on carbon footprinting and labelling based upon PAS 2050. As such, this chapter outlines the principal determinants expressed by key informants in UK food supply chain businesses that either drive or hinder uptake of environmental practices, policies and programmes.

Six key informant interviews of individuals identified as pivotal within their business to the adoption of any statutory/mandatory environmental 'green' policies within food supply chains, primarily based in the UK were conducted. Interviews spanned a time period from 2010 to the end of 2011. The first out of the six participants selected was the technical author of PAS 2050, and is employed at the Carbon Trust where decarbonisation is emphasised and advocated via a range of tools and practices including carbon footprinting and labelling. The remaining five of the six participants were selected from a broad range of food supply chain businesses amongst equally diverse food supply chain types as this very much characterises the heterogeneous nature of food supply in the UK and abroad. All participants were directly involved in decision-making areas within their businesses.

6.2 Key Actors: Supply Chain Position and Function of Participants' Business

For clarification, aside from Key Informant Interview A that concerns an interview with a key actor from the Carbon Trust (termed as a 'civic society' organisation given its independence from government) who was directly involved in the design and content of the PAS 2050 standard, (Key Informant A), each of the subsequent interviews concern a number of various UK food supply chain businesses operating at different stages of their respective food supply chains. With respect to the five remaining key informant interviews presented, each food business holds a particular function and operates at an individual stage of their respective food supply chain.

Key Informant 1 concerns an interview with the owner and Chief Executive of an 'alternative' food producer and delivery organisation, that produces and distributes organic vegetables. This business, functions using a 'co-operative' farming model, including organic producing farms within its portfolio around the UK. It is, nevertheless, broadly as an upstream supply chain organisation. Production, distribution and retail stages of the food chain are closely linked as the Riverford Organic Vegetables operate as a co-operative with approximately 40,000 boxes distributed through a system of franchisees who work locally to provide local supply to consumers' homes. A central

premise of the business is to provide short, transparent and sustainable modes of production and supply to end-users/consumers.

Key Informant 2 is from Sainsbury's Plc, which is a supermarket retailer that functions at the downstream stage of its supply chains. Key Informant 3 in contrast, represents South Africa's second largest fresh fruit exporter, which has a strongly vertically integrated business that owns many of its farms and fruit packaging operations. In terms of supply chain position, Colors Fruits engage at the early upstream stages – producing, procuring, distributing and supplying fresh fruit to a number of UK supermarket retailers including Sainsbury's, Marks and Spencer and Tesco.

Key Informant 4 relates to Northumberland Foods, an SME food manufacturer, a mid-stream supply chain business that specialises in frozen vegetable products, supplying UK supermarkets such as Tesco, Iceland and Sainsbury's. Key Informant 5 represents Tragus Holdings that sits within the Hospitality sector, operating more than 295 high street retail restaurants under the brands, Café Rouge, Belgo, Strada, and Bella Italia. To summarise, each key informant interview is presented individually as outlined below and detailed in the following table, (Table 17):

Table 17 Research Participants' Organisations by Business Type, Purpose, Supply Chain Position, Function and Customer Category

Business	Business type	Business Purpose	Supply Chain Position	Supply Chain Type	Customer category
The Carbon Trust	Independent organisation assisting governments, the public sector and businesses in decarbonisation	Policy development, dissemination, implementation, guidance and certification processes re carbon reduction	Neutral	N/A	Governments, the public sector and businesses Applies to all major industry sectors
Riverford Organic Vegetables	National organic co-operative farm network producing fruit and vegetables for local and regional distribution to food consumers	Producer and Distributor to end-users (consumers)	Upstream & Downstream	Short supply chains	Food consumers
Sainsbury's	National supermarket	Supermarket Retailer	Downstream	Long complex supply chains	Food consumers
Colors Fruits	International fruit producer based in South Africa	Producer and Distributor to supermarket retailers	Upstream	Long complex supply chains	Supermarket retailers
Northumberland Foods	SME process and manufacture ready-cooked potatoes and parsnips for retail	Manufacturer	Mid-Stream	Long complex supply chains	Supermarket retailers
Tragus Holdings	Conventional Food Service Retail Operative SC Position	Operator of 295 UK Restaurants	Downstream	Long complex supply chains	Food consumers

6.3 Format of Analysis and Presentation of Findings

The first key informant interview under analysis (Case Study A) is the Carbon Trust. A detailed reportage of Dr Graham Sinden's narrative is presented first to seek insights and give context as to the perceived drivers and barriers in the development and dissemination of PAS 2050. As the key informant from the Carbon Trust is the technical author of the PAS 2050 carbon footprinting standard in question, the narrative of the 'policy entrepreneur' is presented separately from the food chain business' series of interview analyses. This is so that findings relating to the interviewee's perspective on the design, development, implementation and dissemination of the standard are not confused with those of 'active' supply chain actors.

6.3.a. Case Study A, The Carbon Trust: Graham Sinden

Overall, much of the narrative in question was positively skewed towards the benefits and potential benefits of PAS 2050 adoption. Advocacy of the standard premised on the notion that PAS 2050 is perceived as a world-leading standard for the measurement of carbon emissions (carbon footprints) for products and services across a range of sectors.

Key actor Dr Graham Sinden from the Carbon Trust is the technical author of the carbon footprinting standard, PAS 2050. Dr Graham Sinden was selected based on his leading position in the design, development and dissemination of PAS 2050, his continuing work on carbon footprinting for the Carbon Trust and his international role in carbon policy formation. Essentially as a *policy entrepreneur*, this key informant is of significant interest in evaluating his perceptions of carbon footprinting and PAS 2050. In this vein, Table 16 summarises key themes elucidated from this participant's interview although the next section begins with an analysis of Dr Graham Sinden's interview. An exploration of these findings in further detail was conducted in order to reveal a number of insights as to the underpinning determinants for PAS 2050 development and dissemination in the Food Supply Chain context.

PAS 2050 is shown to be highly relevant to the Carbon Trust particularly as they harness a significant overarching aim of standardising methodological and LCA approaches in carbon footprinting. Standardisation of LCA methodological approaches in the form of PAS 2050 is claimed to be a well respected credible precedent for other international product carbon footprinting standards and schemes. Development of PAS 2050 was said to be a definitive and substantive move away from the misnomer and oversimplification of the carbon problem. PAS 2050 would improve the due process of determining impacts of food supply chains on climate change with greater levels of confidence and accuracy. The development, piloting and implementation of PAS 2050 are described as understandable requisites for the need to parallel decarbonisation with energy efficiency gains. Development of the world's first standardised life cycle analysis (LCA) approach to calculate carbon footprints (PAS 2050) is perceived as a solution to the multifarious variances in the methodological application in traditional LCA studies. It is expressed that PAS 2050 aims to provide standardisation, conformity and credibility in the realm of carbon footprinting. Similarly, it is viewed strongly as a benchmark for carbon policy formation from both a methodological and development perspective internationally. For instance, the International

Organization for Standardization (ISO) and World Resources Institute were highlighted by the participant as examples of businesses using PAS 2050 in their ongoing work on carbon footprint policy standards. It is also claimed that dissemination is widespread with approximately 20,000 downloads of the PAS across 100 countries over the first two years of its launch. However, upon further questioning, the participant conceded the inevitable difficulty in verifying these approximations in PAS 2050 adoption as control of footprint results is not centralised by any particular agency/business. A direct quote confirming this is cited below:

..."most of the footprinting or the degree to what it has been used for published footprints and that sort of thing; I think that's quite hard to judge because there's no central control of footprint results that come out of PAS 2050 so you know, people can be using it, using internally, using it to publish externally but without any requirement to sort of notify, etc, then it's hard to know what that uptake rate is."

6.3.a.i Voluntary versus Mandatory Policy

For the purposes of carbon footprint labelling, affirmation is given that the PAS 2050 methodology is an essential pre-requisite in the pursuit of carbon labelling via the Carbon Trust. It is explained that a separate certification process using the independently verified PAS 2050 results is required for the Carbon Trust to authorise carbon labels. Emphasis is placed upon the significance of providing a standardised method and guidelines for carbon footprint calculations rather than any imperative relating to potentialities of the benefits and dis-benefits of voluntary and mandatory approaches. This generalisation is expanded upon to explain that as PAS 2050 is publicly available, people can decide the extent to which the standard is adopted and applied. Mandatory application and implementation is viewed as inconsequential as noted here:

..."The degree of effort to implement it is set by the standard and the expectations of the verifiers that are verifying the results and making its use mandatory wouldn't affect that unless you changed the requirements of the PAS. It would of course, it would require more people to use it but the actual experience of individuals trying to use it wouldn't change, I don't think..."

6.3.a.ii Diffusion of Uptake

Dr Sinden confirmed PAS 2050 development involved trialling different drafts of the standard amongst a range of sectors, differing sized companies and supply chain positions across the UK. It was explained that with respect to the food sector, feedback from involved stakeholders was designed to not only cover the standard in question but also extended towards the pragmatic applicability and actualities of the PAS by an equally diverse set of businesses; citing small-scale producers as an example. An excerpt from the interview is provided here:

"...When we were putting the PAS together, we went out and trialled different drafts of it with different companies. We made sure we had different sized companies, different sorts of companies, companies in different sectors, etc so that we could give feedback not just on the standard itself but its applicability to small scale producers and things like that...Since then, the application of it has been pretty broad. We've worked with small fruit producers in South Africa, Colors Fruits in South Africa who sell to UK supermarkets."

We've worked at the other end, with European Industry associations in the Food Sector, so you know, representing probably thousands or tens of thousands of members. I think it covers quite a broad spectrum within the Food Sector..."

The degree to which companies' awareness that for labelling purposes, PAS 2050 compliance is essential prior to certification was perceived as a separate commercial side of footprinting and labelling services. It was explained that it was largely company context specific. In terms of the degree and extent to which knowledge of the need to conform to the PAS for labelling is concerned, the participant said that the extent to which companies would be aware of the necessity of PAS 2050 compliance prior to labelling is unknown. However, he did say that companies had a number of routes to the exposure of this tacit knowledge rather than some form of inherent knowledge and provided the following examples:

- customers asking for this type of information specifically
- witnessing competitors adopt CF labelling via PAS 2050
- competitors speculating and discussing the PAS

6.3.a.iii Criticism of the technicality and method of PAS 2050

PAS 2050 is strongly advocated as setting the premise for codifying rules concerning carbon footprinting. Much of the feedback from piloted participants was positive with little criticism regarding its approach or the manner in which issues were addressed in the development, implementation and application of the PAS. The interviewee stated that certain individuals and sectors may have minor concerns and/or disagreements but little "*across the board concern*" regarding due process was said to have been voiced. With regard to the ongoing development and updating of PAS, the actor was not aware of any criticism attached to the PAS. The participant showed a high level of confidence in the due process of the standard. The fundamentals were described as '*pretty much spot on*'. Future work on the PAS is expected by the interviewee to involve a minor level of change.

6.3.a.iv Food Miles

The most highly criticised aspect in terms of the technicality of the PAS was the idea of moving away from the notion of food miles as it was purported not to be sufficiently accurate enough a variable to calculate the impact of food supply chains on climate change. In fact the participant was most vitriolic with respect specifically to food miles as can be read here:

"...one of the specific reasons for doing PAS was to get away from this idea of food miles because it isn't a good measure of the climate impact of food and food supply chains and that sort of thing. It's not a good indicator of overall emissions and transport emissions generally unless you're air freight something that's particularly low carbon, and then transport emissions are typically not that significant in supply chains."

6.3.a.v Double Counting, rules on averaging and seasonality

More specifically, the actor was keen to note that the PAS was designed to deal with the problems of double counting via allocation rules that are applicable to sectors across the board. Criticism was perceived as a notion borne from peoples' expectations of the PAS. A fairly extensive example was given to substantiate his point. This is outlined verbatim below:

Carbon Intensity

“The carbon intensity of electricity varies by the second. It varies by the hour. It varies whether its day time or night time. It varies whether it’s winter or summer. Do consumers expect that the carbon footprint of a light bulb would reflect the time of day that they use that light? Is that their expectation when they are looking at the carbon impact of lighting? Or are they a bit more realistic about it and go: well over a year, on average, well what typically is the carbon footprint of a 100watt light bulb running in my living room?”

Embodied Emissions of a Product

“You can look at it from the embodied emissions in products as well. In crisps, potatoes are used and in crisp manufacture, the carbon intensity of the electricity used varies by the second, so do consumers receiving this information expect to see a different footprint on the product depending on what second of the day the product was packaged? I think you can always find that...if you really want to break it down to that level of specificity of the product, I think you’ll always be able to find those sorts of criticisms. Equally, I don’t think those sorts of criticisms are necessarily relevant to the objective that’s being run here.”

Seasonality

“On seasonality of foods, I think that’s dealt with reasonably well within the PAS. In my mind, a simple way of thinking about this is that when a product is made available to a consumer are they being sold that on the basis of seasonality being part of the product or not? Are they being sold fresh British strawberries, so the seasonality of the product is at the heart of the thing that is being sold to consumers, or are they being sold orange juice? And, no differentiation of seasonality, or source, etc, etc. Are they being sold potato crisps? Again, no differentiation by season. That is why we have rules in the PAS around averaging and seasonality, etc., so that were consumers being presented by a product that is generic across the year, the results would reflect the average conditions under which that product would be made available.

It depends what it is that is being marketed. I shouldn’t say what’s being marketed. It depends what the functional unit is that is being footprinted. There is nothing wrong with doing a footprint of new season potatoes versus late season potatoes or a footprint of wine from early picked grapes versus wine from late picked grapes. But, if that’s not the functional unit, then there’s little value in talking about it. Arguably, it’s not a relevant part of it if that’s not part of the functional unit that is being described and footprinted. There’s also a component of being reasonable about it and standards have very little to do with being reasonable. You know, it’s this thing of electricity emissions varying by the second. Is it really to anyone’s benefit to try and understand that and present that information?”

Averaging

“You know, or to take a third example, if I’m mechanically picking the grapes for wine, should the grapes at the end of the row closest to the refinery have a lower carbon footprint because less diesel was used to move them to the refinery than the other grapes? If you look hard enough, you’ll always find these types of things. You’ll always find averaging in life cycle assessment. The trick is to find the appropriate level of averaging and part of that appropriateness is: what is the functional unit that is being assessed?”

6.3.a.vi Climate Change and Sustainability

Climate change is perceived by the actor as the over-arching concern driving carbon reduction attempts. Carbon footprinting is perceived as a practical and pro-active facilitator for the decarbonisation of supply chain products. Carbon footprinting is noted as simply a tool/method in which to assess emissions as the carbon footprint of a product affects global climate. The actor conceded that carbon footprinting has little to do with the overall sustainability of products and was keen to explain that the PAS in question has not been presented in any other fashion than that of a method to calculate carbon emissions. The participant explained that while carbon footprinting is not a solution for overall sustainability, the climate impact of a product would be a significant

component of any wider sustainability assessment. Moreover, having a consistent method to assess the climate impact of products was perceived as essential, irrespective of whether the information being presented would be a discrete value or act as some sort of command indicator.

6.3.a.vii Consumer Understanding of Labels

Dr Sinden said that consumer understanding of carbon labels could possibly be significantly compromised due the proliferation of labels particularly in the food market. He highlighted however, that this issue is not unique to product carbon footprinting though balance was what was needed in terms of consumer understanding. Yes, he repeatedly agreed more education would be beneficial in helping people understand carbon labels but this would equally be the case regarding other 'green' labels such as 'Fair Trade' and the 'Marine Stewardship' labels. Unlike the findings from the author's consumer survey regarding the consumer response to carbon labels (Gadema and Oglethorpe, 2011), Dr Sinden was quick to point out that market research undertaken by the Carbon Trust indicated a high level of consumer understanding of carbon labels:

“Actually, the market research that we have done shows a very high level of understanding of what a carbon footprint label is indicating amongst consumers. That's in relation to the Carbon Trust production label and that's on the back of basically no advertising and no education programmes...”

6.3.a.viii Comparability – Interpretation of Labels

In more detail, with respect to interpretation of labels it was explained that despite the probable likelihood that some consumers would not understand absolute figures, the provision of accurate information was still a major imperative as people would be able to physically identify the lowering of CO₂ emissions via labels. The interview participant noted that the difference would arise with point of disclosure. He explained that disclosure on cars in Europe is mandatory allowing for the ability of comparability in the market place. Therefore, there is the ability to compare in the market place. However, unlike in the pilot stage of PAS 2050, carbon labels no longer have the requirement to display a number at point of sale although the figure of carbon still requires to be publicly disclosed. Disclosure is typically published on company websites. It was pointed out that companies can choose to have a label or not though disclosure was seen as a positive step as it makes information publicly available and gives companies an incentive to ensure accuracy as the information becomes public. It was also explained that the carbon label is not solely aligned to disclosure of information on the footprint of a product but about displaying reductions of CO₂ consumption over time (typically by displaying a downward pointing arrow).

Measuring emissions was not perceived by the actor as the overall tool to deliver carbon reductions. The long-term 'reduction' incentive (typically a 2-year period) was referred to as a route to explicitly facilitate decarbonisation with disclosure as an option for the communication of carbon reductions. This was seen as way to incentivise reduction over time and as a key aspect in the implementation of footprinting at the Carbon Trust. According to the actor, carbon footprints are not a tool for issues surrounding the judging of ethics of local sourcing, measurement of nutrition and so forth.

6.3.a.ix International Applicability – Leading Exemplar

PAS 2050 is explained to have arisen in response to the requirement to drive consistency in the manner in which people undertake carbon footprinting as the lack of consistency is thought to confuse consumers and drive up business implementation costs. International applicability of the PAS is highlighted. Companies such as Mercedes and Dell were given as examples of multi-national businesses who wish to in doing carbon footprinting, have the ability and capability of feeding information into their supply chains, which are global. The standardisation process of carbon footprinting via PAS 2050 was explained as an essential component for such companies avoiding the bureaucracy nightmare of measurement of information against different benchmarks in different countries. This was explained to be as much of business relevance as it is of consumer relevance and why the actor also sits on the steering group for the WRI's work on the product protocol. Driving consistency and standardisation in carbon footprinting approaches was stated as '*absolutely essential*' by the actor. This is the principal motivation as to his involvement with the Japanese, Korean French carbon footprint schemes. This is why the actor also sits on the ISO Committee, which develops international standards for product footprinting. He believes development of the WRI protocol will have a positive impact, particularly in the US. It was highlighted that despite the US' general preference for '*home-grown stuff*' little difference between the WRI work and the PAS prevail.

The level of uncertainty attached to the result was raised as a factor that invariably comes under scrutiny yet; this does not parallel other areas of public assessment and communication it was claimed. Frustration was expressed regarding calls to calculate for uncertainty. Dr Sinden explained that complexities associated with attributing '*plus or minus 2 standard deviations*' would be incomprehensible to most consumers and that interpretation of these would be further hampered by the fact that changes would depend on whether consumers compare 'within' product categories and other brands, confusing consumers entirely. He points out that:

"Once again, these are not problems that are ever expressed in relation to other things such as vehicles. If I tell you one is 35 and one is 36, people don't start talking about the uncertainty and comparability of it, so from that perspective, I wonder whether we're creating a mountain out of a mole hill, and inventing problems when none actually exist."

In conclusion, it was said that the Carbon Trust often find that companies who implement PAS 2050 also discover emission reduction opportunities within their supply chains and implement them irrespective of whether they're communicating the result. The minority of businesses pursue communication of results.

6.3.b. Case Study 1, Riverford Organics: Guy Watson

Key actor, Guy Watson is the owner and Chief Executive of Riverford Organics (RO), the UK's largest organic farm co-operative and organic fruit and vegetable online box delivery service. RO offers an online platform for food shoppers as an 'alternative' to mainstream conventional

supermarket food grocery shopping. This is in addition to his company's reputation for producing and supplying high-quality produce with an expanding loyal and trusting customer base. Guy Watson was selected on the premise of his leading position in the food industry and because he is a well-known advocate for sustainable organic farming in addition to his stewardship of an expanding and successful business that operates in an ethically and environmentally conscious manner. The transparency and active engagement of Guy Watson's innovative and pro-active environmental business practices hold a significantly influential position within the realm of 'green' policy formation and adoption. His perceptions and underlying motivations with respect to the drivers and barriers to the adoption of carbon footprinting using PAS 2050 are explored.

Much of the narrative showed Guy Watson's perceptions in the context of carbon footprinting and PAS 2050 are largely underpinned by Guy's sense of environmental, ethical and social responsibility. This is twinned with his belief in the commercial feasibility of producing and delivering high-quality food with as little adverse environmental impact as possible. He explained that despite the decline of overall market conditions, RO had managed steady growth as a result primarily, of a recent overhaul of RO's marketing strategy and website and the continued efforts to assure his customers of RO's ongoing pro-active environmental business ethics and practice.

Key Informant for Case Study 1- Riverford Organics (RO) is the UK's largest organic farm co-operative. The Riverford Farm upon which RO is based is an organic farm and dairy located in Buckfastleigh, Devon. The Riverford Farm has been owned by the Watson family since the 1950s where conventional farming methods were practised until Guy Watson converted to organic farming in the mid 1980s. By the late 1980s, a fully functioning organic farming system was in place. RO started by delivering vegetables locally to 30 friends in Devon. Vegetables are grown, packed in boxes along with produce from farmers in the UK and abroad. RO has five sites around the UK who deliver (as near a regional basis as possible) directly to consumers' homes. Approximately 40,000 boxes a week are distributed through a system of around 100 franchisees that work locally. Guy Watson is the founder and owner of Riverford Organic Vegetables. Guy Watson is well-known in the food industry in the UK and beyond for his passionate approach towards running a sustainable food business. Guy Watson is also an Advisor to the Soil Association.

Many prestigious awards have been received by Guy, including: '*Best Organic Retailer 2013*' at the Soil Association's '*Natural and Organic Awards, 2013*' and '*BBC Farmer of the Year 2012*'. His continuing passion for running a commercially feasible sustainable business is regularly recognised. For instance, it is the second year running that Guy received the highly coveted '*BBC Farmer of the Year*' award. Other awards received include the Soil Association's '*Organic Food Awards*' in 2009 and 2012; winner of The Observer's '*Ethical Awards*' in 2009, 2010 and 2011; '*Best Independent Retailer*' in 2011, '*RSPCA Good Business Awards*' in 2011; '*Best Ethical Restaurant 2010*', '*Observer Food Monthly Awards 2010*'; '*Compassion in World Farming's Good Farm Animal Welfare Awards, 2012*'; and '*Food Hero*' at the Devon Life Food & Drink Awards 2012; '*Devon Tourism Awards 2012 – GOLD WINNER – 'Taste of Devon'*'.

Guy Watson's commercial astuteness is aligned with his first hand knowledge and practice of 'green' business behaviour. His knowledge of the adverse impacts of climate change and how these arise from farming, production, supply and demand factors is evident from his narrative and RO's detailed website coverage. RO's business model integrates a number of 'green' approaches including carbon footprinting. Carbon footprinting was regarded as a primary driver for the identification of energy efficiency savings. Equally, maintenance of customer confidence and trust in RO's ethical policies to pursue such a 'green' measure is perceived as crucial for continued business growth and maturity of its 'green' credentials in general.

RO's consumers are described as "*expecting*" the business to "*do the right thing*" in the context of adverse environmental impact including ethics, sustainability, provenance and climate change. Guy Watson explained that this level of customer expectation along with his strong pro-environmental values were some of the principal motivations for carbon footprinting. Other incentives for doing so extended to the hope for improved management of operational costs, competing with and providing an alternative to 'supermarket' buying and maintaining as well as enhancing the growing importance of RO's market position. The interview participant was keen to highlight that his business was very much at the forefront of carbon footprinting.

6.3.b.i Carbon Footprinting at Riverford Organics

Guy Watson collaborated with Exeter University and supported the creation of a work placement for a PhD student (Mark Howard) through a Knowledge Transfer Partnership (KTP) who studied RO's carbon emissions. A publication comparing farm shop and mass distribution approaches in the Journal of Food Policy materialised as a direct result of the Placement's study (Coley et al., 2009). It was explained that when RO first set out to assess their business's carbon consumption in 2007 a standardised method for carbon footprinting was impossible to find. Initially, much of RO's carbon footprinting work was based on '*common-sense*' approaches involving the identification of 'hotspots' of emissions.

Difficulties arose in the process including the point that RO's suppliers were not able to provide the required information leading to the sourcing of standard figures for different products (including cardboard, plastics and so forth) from government agencies such as DEFRA. These preliminary attempts produced a carbon footprint estimate of the contribution of RO's activities. Having undertaken a rudimentary carbon footprint measurement, RO then discovered a standard methodology being trialled on packets of *Walkers* crisps...the pilot being PAS 2050. Once it was known a standard method existed (PAS 2050), RO repeated the carbon footprint exercise using the PAS specification and guidelines based on their 2006 figures. Box 2 includes directly quoted rationale from the interview participant for carbon footprinting.

Box 2

"...I tell you what drove us to it in the first place, there were various decisions. I suppose you could say it was customer pressure, you know it was one of those, yes, customer pressure:

Why aren't we using compostable packaging?

Why do we use plastic bags you know?

Why do we import from around the world and you know, why don't we sell English tomatoes if we are going to sell tomatoes in February?

...You know all things which I had reservations about. You know, I had reservations about compostable packaging. I had reservations about hothouse tomatoes, um, and um you know, I had reservations about food miles.

But, you know, in order to make the right decisions, it turned out that when we started asking those questions, it was particularly the one about compostable packaging that pushed me over the edge.

I was getting a lot of pressure, actually from staff as a matter of fact, who were saying why aren't we using compostable packaging? It was four times the price. It was functionally not as good. It just failed. So I started doing a bit of research myself actually.

I went to suppliers, I found it very difficult to get a sensible answer out of them and I kind of thought I smelled a rat really so I started asking a few more questions and that's led to the...and I couldn't get an answer. I mean we were talking about something that was going to cost us literally hundreds of thousands of pounds a year to make this change. I wasn't going to do it lightly. So, that led to the project with Exeter University and actually it took about a week of desk research to come up with the conclusion that you know that BPA plastics are complete...environmentally they're ridiculous...that was probably one of the most useful things to have come out of it.

The food miles, you know looking at the carbon impact of bringing different products from around the world has been useful.

That's the sort of history of how it came about. At that time, there was no information available. It's about just wanting to do the right thing...I mean why aren't all our vehicles running on bio-fuels? So those were two key questions that we were being asked and you know actually our main competitor that were running their vans on bio-fuels...well actually they said they were when in fact they weren't."

6.3.b.ii Carbon Footprinting Perspectives and Organisational Culture

Identification of 'hot spots' in terms of carbon consumption is perceived as a relatively crucial step in managing RO's operational costs. As mentioned previously, early attempts in 2006/7 did not rely upon the guidelines or the PAS 2050 specification as it was not in existence in 2006/7 though a carbon footprint calculation based on the PAS 2050 standard was undertaken upon knowledge of its existence.

Guy Watson explains that the business culture of RO is strongly supported internally with a unified workforce of employees who participate widely in the formation of the business's ethical and environmental policies and practices. Whilst customer trust in RO's green practices is perceived of significant importance, employee involvement and motivation for such endeavours underwritten with *trust* is recognised as an essential component of its business model. Suppliers who tend to principally comprise of organic farm producers are expected to harness similar values with *trust* frequently referred to as the cornerstone of business relationships with RO.

Carbon footprinting and labelling are perceived as distinctly independent processes. While the due process of PAS 2050 is perceived to be useful in the standardisation of carbon footprinting, doubt is expressed as to the efficacy of carbon labelling either for business benefit or consumer benefit. The participant feels that much of the effectiveness in the application and implementation of PAS 2050 is compromised at the individual business and supply chain level by a piece-meal and fragmented response from the food sector. This is believed to contribute towards the lack of perceived market differentiation, competitive advantage and marketing potential of carbon footprinting. Rather, the participant's discourse with respect to the standard itself is skewed heavily towards the viewpoint that the standard is simply a pragmatic tool that businesses can either choose to use or not.

Much of RO's work on carbon footprinting is couched within the realms of carbon footprint measurement at the internal organisational level. Distribution to customers and the external logistics providers used by RO's own suppliers are also major points of concern in terms of carbon footprint consumption rates. However, it is acknowledged that the benefits of market differentiation via carbon footprinting are overshadowed by RO's certified organic status with the UK's Soil Association.

6.3.b.iii Carbon footprint reduction – Local Food versus Supermarket Food

Difficulties associated with attempts to harmonise production, procurement and distribution of local seasonal produce that is both commercially feasible and environmentally sustainable are said by the participant to be of paramount concern. The participant is keen to explicate that both the environment and food production are inexorably connected and that with this in mind, provision of local food is a dominant factor in RO's business practice rather than any specific focus on carbon footprinting.

Local food is perceived as an essential aspect in building a 'healthy' culture where people have a tangible connection with food production. The argument for local food is emphasised to be not so much an environmental one but more about RO giving customers the opportunity to connect with how food is produced. At the individual and acutely personal level, the interviewee is eager to relay his ideological predisposition towards providing an alternative to supermarket retail via local food networks. It is recognised that his support for local food is principally shaped by this philosophical stance.

“There are other reasons for supporting a more regional food offering and it's quite a philosophical thing. I think it's important to be connected to your food.”

Perceived benefits of procuring, producing and distributing local, healthy and seasonal food (which dominate RO's business model) are explained by the participant to often conflict with attempts to lower carbon footprint consumption. In addition, the concept of food miles is thought of as too simplistic a measure in the context of carbon footprint consumption and sustainability. In terms of carbon footprint, it was pointed out that the maximum RO's business would glean from carbon emissions savings would approximately be 7% as efficiencies are difficult to achieve with five sites delivering regionally as opposed to perhaps having a single consolidated site for national distribution.

Local food is seen as often negating a lower carbon footprint much of which is associated with modes of distribution. Frustration is recurrently expressed at the lack of agreed performance standards in terms of 'sustainable' food production and miles travelled in the distribution of food:

“Well local food often doesn't have a lower carbon footprint is the reality of it. Nothing can be more environmentally destructive than people chasing around either for small artisan producers or for those having their own carriers for distribution. Many of them use couriers for distribution to deliver tiny packages. The difficulty is that it is not often obvious what the right thing to do is. There is the assumption that a lot of environmental stuff to do this sort of thing is obvious and often it's not.”

6.3.b.iv Regional Distribution – to consolidate or not?

It is the distribution and 'end-user' stages of supply chains, which are highlighted as areas of primary consternation for RO in the context of carbon emissions. Much of the carbon emissions associated with RO's business are explained to arise from transport and local logistical operations as energy was found to be more concentrated at the final stage. It is approximated that 61% of RO's total emissions arise from transport. Of the 61%, broadly 36% is said to arise from the business's local delivery vans. Having regional distribution via RO's own vans from five sites as opposed to one is viewed as a way in which to limit carbon emission consumption. Though it is recognised that versus mass distribution by means of lorries, RO's approach is much more carbon intensive. It is in this vein that the participant states his belief that any intelligent food system will involve a degree of consolidation at some stage. Tesco is referred to as an example of a powerful retailer in the context of UK food supply chains that favours consolidation in order to twin efficiency gains with efforts to counteract adverse environmental impact. It is also acknowledged that this supermarket dominance and extensive logistical capacity of distribution is a key factor in broadening RO's product range.

“One of the very key things was that the energy consumption emissions were heavily concentrated towards the final step of distribution which are most peoples' cars getting back from the supermarkets and for us, it's our vans. So, I suppose that has led me to umm, we should be delivering a wider range of produce.”

RO's distributional capacity is claimed to be significantly more efficient than supermarkets due to the short and considerably greater transparency in supply chain structure. This is despite supermarkets' abilities to pursue inevitable efficiencies via economies of scale in terms of distribution. It is pointed out that supermarkets' logistical operations whilst extensive might not be quite as efficient as first thought by the participant due to the heterogeneous nature of supermarket commodities and excessive distances travelled prior to retail.

6.3.b.v Online Shopping: An Alternative to Supermarket Retail Deliveries

With respect to online shopping, RO claim to easily out-compete their supermarket counterparts in the numbers of deliveries to consumers per day and mile. However, supermarket 'drops' are thought to be of higher value. Further complexities are viewed as arising principally from consumer pressure for 1 hour or 2 hour deliver slots lessening supermarkets' effectiveness in distribution efficiencies due to greater distances travelled. To a great extent the carbon footprint impact at the end of a supply chain is believed to be dependent on consumer preference and behaviour. Specifically, end-user shopping behaviour is described by the participant to be complicated by the nature of the food industry in the UK which is dominated by supermarket consumption. Such shopping behaviour is explained to further worsen carbon inefficiencies if consumers who shop for 'local' food also shop in supermarkets.

"I think that our business...the argument against our business is that undoubtedly...per kilo of grocery items delivered, emissions of ours would be much lower than per kilo of Tesco's ones and even lower if you don't buy at Tesco. However, we have to be very careful that people don't come to us and go to Tesco as well because you know, because otherwise you're not really achieving anything."

It is explained that shopping by consumers can often and easily be misguided in terms of overall environmental impact. It is perceived that benefits of local food are compromised by fragmented shopping behaviour even if shopping for goods occurs within close proximity. This is explained as potentially destructive as consumers could potentially shop locally but from a number of different outlets.

"You know, Tesco do many other things that negate their...you know there's lots of things they do right but there's also lots of things they do wrong you know. I mean even if you were to say you know I'll drive to that Farm Shop to buy my vegetables and to the dairy. Even if it was all within 2 miles, your shopping trip would be an environmental disaster."

Carbon footprint assessments were based on the belief that for their business needs, measuring carbon consumption was a useful exercise in identifying where energy efficiency gains would be greatest. Use of the PAS 2050 specification to carbon footprint RO's business was said to provide an element of confidence in the method used to calculate carbon footprints and comfort in the knowledge that these were guided by a credible standardised approach. However, it was felt that the standard itself is too generic and open to corruption by competitors (largely supermarkets),

namely with regard to the choice of 'boundary setting'. Despite such concern, key lessons were said to have been learnt from carbon footprinting. These were said to have leaned strongly towards the areas of housekeeping, storage, packaging and the identification of critical points in supply chains.

The voluntary nature of the standard was perceived as largely inconsequential as much of RO's carbon footprinting efforts were driven by efforts to seek efficiency savings while demonstrably responding to customer pressure for the pursuit of 'green' practices. Findings from the carbon footprinting exercises were claimed to have contributed towards definitive and substantive changes in RO's business practices. For instance, it was pointed out that an alternative to conventional packaging forms was a pertinent issue not only for RO's customers but for RO's staff who are said to be equally ethically and environmentally conscious. As such various packaging types for different product categories were exhaustively and continuously researched with chosen methods being justified and explained in detail on the business website. Carbon footprinting itself while useful for RO, was not perceived as necessary to repeat:

"We're not doing it again now because I sort of feel that we've learnt what we needed to learn from it and there's not really much incentive to keep it up to date really...but I don't think if we did it again I wouldn't expect to learn anything startlingly new from it."

Similarly, external verification of results was not pursued. Rationale for not following through with external verification of results or labelling was said to have been based on the premise that many benefits of the carbon footprinting studies were identified and addressed during the process and concluded as sufficient for the purposes of internal auditing of operations. Communicating carbon consumption via carbon footprint labelling was not followed largely due to the perception of market proliferation and mis-understanding of labels amongst consumers. Complexities associated with claims of labels as well as related problems of mis-information/interpretation and understanding of labels by consumers in the food sector are explained as major causal points of concern. In general, perceptions relating to carbon labelling were viewed with cynicism. An extract from the interview details the participant's scepticism:

"I think there's a real danger that we're going to get label overload. I mean you just have to look at...we've just started selling this coffee (shows a bag of coffee to the interviewer)...I mean I happen know the bloke who set up this growers' group in Brazil. It's bio-dynamic coffee.

It's organic but it's about as Fair Trade as it can be but it doesn't have Fair Trade certification. It doesn't have Rainforest Alliance, I mean for coffee, to have it triple certified, nobody really knows what that means.

Nevermind start talking about whether it's carbon labelled or not so what are you going to do? Are you going to have it quadruple certified? And then you know if it's a food item you then start looking at all the nutritional stuff, you know I don't know where...

It's my view that in the end it comes down to whoever is actually delivering it to you, whether it's Riverford or Tesco, it's whether you know, and do you trust that person? Do you trust them to have done the thinking for you? Because, you know, these are all incredibly complex issues. And do you trust them to have done the thinking for you on these issues?

I mean we enjoy a huge amount of trust. That is our big thing and that is absolutely critical that we are sufficiently well informed to be able to justify the decisions that we have made and that's really all I'm interested in to be honest."

The interview participant explained that RO customers 'expect the right thing' to be done on their behalf. Such issues are expected by their customers to have been explored and considered in detail and for solutions to be offered. Some examples are given. The first relates to RO policy on selling seasonal produce. Guy explains how RO takes a strong line on provision of fresh seasonal produce in the main but for reasons of pragmatism also include the supply of imported goods.

"I think...for instance, were we to have a completely hard line: 'we will only sell seasonal vegetables' I don't think we would have a business."

The reasons for emphasising fresh, seasonal and local produce in conjunction with imports which are equally thoroughly assessed for provenance, quality, and other 'green attributes' are said by the participant to be driven largely from customer pressure to do so given the nature of RO's business culture. Imports are said to be given as rigorous a consideration and rationale in terms of assessment of the trade-offs to be had. Trust is a highly valued attribute throughout RO's business culture. As such, it is pointed out that the business website is frequently updated with detailed explanations given regarding RO's impact on climate change, their motivations for providing organic produce, issues on packaging and other 'green' information.

Packaging is highlighted as an area of interest for RO customers and a salient issue with which the business is expected to have researched prior to solutions being proffered. Eating healthily, ethics of trade, fair-trade are also cited as pertinent issues of interest for RO's customers. Again, it is explained how RO customers expect the business to consider and provide solutions to such issues. RO customers are perceived by the participant as being largely ethically and environmentally conscious. Customer trust in RO to pursue a pro-active 'green' business strategy in a holistic manner is explained as one of several elements that contribute towards overall customer trust rather than any interest in the specific nature of how the business functions.

Guy Watson's perceptions of carbon footprinting using PAS 2050 are largely to do with finding operational efficiency savings and efforts to control costs. Though customer pressure is stated to be a significant driver, the issue of cultivating and harnessing trust amongst the business's suppliers and consumers is an over-riding principle referred to frequently within the narrative. It was not thought to be necessary once the business had undertaken a carbon footprint measurement exercise to follow through to the route of carbon labelling. Carbon footprint information is instead provided on the business website. Frustration was expressed vigorously with respect to the perceived heavy handed nature of supermarket retailers towards suppliers.

6.3.c. Case Study 2, Sainsbury's Plc: Paul Crewe

Key actor Paul Crewe at Sainsbury's Plc was selected on the premise of his leading position with respect to the business's strategic and operational agenda. Paul Crewe is also a member of numerous external bodies and boards relating to sustainability, climate change and carbon. Some of these bodies include the lobbying organisation, CBI (Confederation of Business Industry), the BRC (British Retail Consortium), UK ETG (The UK Emissions Trading Group) and the European Climate KIC (Climate Knowledge & Innovation Community).

Paul Crewe's job title is: 'Head of Engineering, Sustainability, Energy and Environment' and perhaps indicative of the large number of challenges he faces in managing Sainsbury's efforts to reconcile business interests with the relatively contemporary difficulties associated with sustainability, climate change, energy consumption and the environment. Sainsbury's Plc are known as one of the 'big four' supermarkets in the United Kingdom. Recent figures from Kantar World panel indicated that for the first 12 weeks of 2013, Sainsbury's market growth performance topped that of their competitors from the 'big four' supermarkets.

Sainsbury's Plc was founded in 1869 and operates over 1,000 supermarkets across the United Kingdom employing around 150,000 people. Paul Crewe, the key informant who was interviewed is responsible for "*significantly reducing Sainsbury's operational embodied carbon footprint*". His official title is Head of Engineering, Sustainability, Energy and Environment. J Sainsbury's Plc is one of the UK's 'big four' supermarket retailers. Other supermarkets in this category include Tesco, Morrison's and Asda.

Paul Crewe's top management position within a giant retail supermarket is a prominent one in terms of his influence on the strategic positing of Sainsbury's performance, uptake and implementation of environmental practices, standards and tools to achieve internal and external sustainability targets that extend to the issues of carbon reduction and climate change.

Sainsbury's have a dedicated corporate sustainability website that details the work they undertake in this context. Paul Crewe's responsibility is for the areas of sustainability, energy and the environment. His spectrum is broad but he has a number of teams working for him that specialise in specific issues though it was unclear at the time of interview how many teams there were or what these specialised in. Paul's knowledge of the retail business and strategic influence were twinned with his good general knowledge of climate change, carbon and sustainability issues. Sainsbury's claim to integrate a large number of 'green' practices and have wide website coverage on the initiatives that are either in development, have been undertaken, a media toolkit, social media and blogger network facilities.

6.3.c.i Sustainability, Carbon footprinting and Environmental Perspectives

From the outset of the interview the participant highlighted how well he feels his business performs. He claims that the work his department undertakes is of the highest standard and says that they lead their competition in the respective marketplace. The participant notes however that a

significantly greater level of engagement with marketing organisations is needed in order to inform the public about what Sainsbury's does with respect to 'green' issues including specifically the ground-breaking and extensive carbon footprinting work on their dairy farms with the Carbon Trust and other businesses. It is felt that too little marketing of the 'green' work Sainsbury's does is a problem as it is perceived that their customers' and the wider public's awareness of such efforts is limited. Extensive, high impact marketing to illustrate and convey the 'good' work Sainsbury's does in terms of sustainability and green initiatives is what the participant says is not only required but absolutely essential given the competitive market place.

He notes that for him personally, their work is not about 'bottom-up' approaches to reducing carbon consumption and sustainability. He explains he has teams of people who are passionate about sustainability and green issues in general. For the participant, these issues are much more suitably aligned to being filtered via 'top-down' approaches from the CEO through their board, following with chosen strategic approaches being passed onto the interviewee directly. This is prior to any initiative being passed onto his respective teams.

The interviewee explained that Sainsbury's had undertaken a carbon footprinting project at the end of 2008 of their 325 dairy farms using PAS 2050. He was aware that the project had involved a number of collaborative partners including Associated British Foods plc but did not specify who the other collaborative businesses were as for him; personally it was the large-scale roll-out success of the initiative that was perceived as most important. General costing figures for levels of investment by Sainsbury's for this carbon footprinting initiative were not known by the participant though a significant level of fiscal investment was thought to have been required.

It was explained that Sainsbury's also pursue the certification and verification of carbon footprints for their milk with the Carbon Trust's logo. Marketing of such initiatives was said by the participant to have been poor given the extensive nature and stated success of the exercise. Marketing such initiatives effectively is said by the participant to require a greater level of prominence within Sainsbury's although details of the project are available on the Sainsbury's CSR website.

Decarbonisation and sustainability are said by the interviewee to be as equally important as customer satisfaction and profit though this view alternated at different points within the interview. In essence, the perceptions conveyed were that Sainsbury's would pursue 'green' and sustainability initiatives as long as the rationale for sustainability issues matches the commercial feasibility of any adopted measure including carbon footprinting.

The participant was keen to point out that Sainsbury's are conscious of the notion of 'greenwash' and said the business strive to avoid association with such connotations of false 'green' endeavour. Rather, as many attempts as possible are made by the business to convey that meaningful environmental initiatives are at the heart of Sainsbury's strategic decision-making. This says the participant, is as long as those initiatives make commercial sense.

6.3.c.ii Retail Market Position – ‘Green’ Strategies for the Environment

Sainsbury’s retail market position gives them, says the participant a high level of autonomy in internal target setting and decision-making with respect to ‘green’ issues as well as quality, seasonality and freshness of food products. It was said that at the internal level, extremely stretching targets are set so that the business can endeavour to do everything in its capacity to operate as sustainably as possible and with the lowest of carbon impact. He cites that ‘sustainability’ has been ingrained within the business from inception and that recycling of cardboard had started as early as 1941 whereas competitors had not done so until at least the early 1980s. Despite this the participant explained that Sainsbury’s viewed customers to be at the heart of the business, not carbon management or sustainability.

Energy is perceived as costly and set to become more expensive over time bringing with it an element of inevitable concern for the future in terms of the need to eventually reconcile a definitive route to decarbonisation. However, emphasis is said to be placed highest on customer service in line with the perceived foregone conclusion of the continuous provision of high quality of food. Unlike the constance of importance attributed to customers, sustainability and ‘green’ efforts are said to be dependent on largely how commercially feasible they might be. The participant said he favoured the pursuit of commercially feasible initiatives and technologies to facilitate carbon reduction and improve sustainability outcomes as long as adverse impacts on investment are avoided. Honing in on this point is the fact that customers are described as ‘king’.

An excerpt from the transcript demonstrating the importance attributed to commercial feasibility of ‘green’ initiatives is provided below:

“Everything that we strive to achieve has to be commercial and it has to be the best that we can do at that that moment in time with the technologies around us...so there’s a balance between how far we are willing to go against, without impacting on the investment that we will make for our customers because customers are king.”

Greening Sainsbury’s operations, their supply chains and retail stores was explained to include an emphasis on the management of carbon to drive down carbon emission consumption. Competing retailers in the group of the ‘big four’ were referred to by the interviewee as not pursuing as an effective or ‘balanced’ a philosophy as Sainsbury’s in addressing environmental and sustainability challenges. He admitted his inevitable bias but nevertheless expressed doubt at the potential tangible effectiveness of competitors’ ‘green’ strategies. The participant expanded upon this to say that the CSR website is consistently updated to reflect Sainsbury’s ‘green’ initiatives.

Frustration was expressed with respect to governmental formation of climate change policy, climate change and carbon reduction targets and initiatives. This frustration was specifically centred on the perception that government need to decarbonise the electricity grid in order to help businesses reduce carbon consumption and meet wider carbon reduction targets, otherwise carbon reduction attempts would continue to be largely reliant upon costly technological innovation, investment and implementation. An excerpt from the interview is provided below.

"...I believe that you know, we've got aspirations in the tens of years ahead to be zero carbon. Absolutely. Yeah? Do I believe we can get there? Absolutely. Can we do it on our own? No we can't. Because the only way we can be, the only way I can, the only way I can maximise my properties to be zero carbon is if the Government do the things they need to do to decarbonise the grid. If they don't decarbonise the grid I'll never get there. I might have a damn good opportunity to get to a very high percentage.

But it will be physically impossible if the electricity, which gets generated, and the way I get it isn't decarbonised, I will never get there. But I will get there with all the other technologies over the next ten, fifteen, twenty years.

You know the Government have set world-leading targets of fifty percent absolute reduction of carbon by 2035. You know it's a big number - it was thirty four percent by 2020. They'll never do that ever because they won't be able to decarbonise the grid. Impossible. Great target but I think by introducing the twenty fifty percent a bit later on is going to give them a bit of breathing space. But they've got to decarbonise the grid to enable industry, not just Sainsbury's, industry to become truly able to say that they're you know zero carbon."

This frustration was also extended to the perceived changing nature of the UK Government's Treasury in its decision-making with respect specifically, to the mandatory Carbon Reduction Commitment (CRC) which was introduced in 2010 for large public and private sector organisations that consume more than 6,000 megawatt hours (MWh) per year of half-hourly metered electricity. Aside from the ongoing changes to the mandatory CRC, the participant explained that as a retailer, he was certain his business did not have to follow any specific mandatory government initiatives or targets in his area of accountability.

6.3.c.iii Sustainability Targets: Focus of Endeavour

All sustainability targets are set individually internally by Sainsbury's and measured using a Balanced Scorecard approach. The participant was eager to stress that Sainsbury's targets were stringent, stretching and often strategically forward thinking and leading in terms of their market competition.

Carbon footprinting is perceived as a potentially important market differentiator by the participant though this is said to be dependent on the future of customers' preferences. Gaining competitive advantage via carbon footprinting is explained as possible but not a definitive outcome given the number of environmental and social issues under the corporate social responsibility umbrella of Sainsbury's.

The impact of the downturn in the economic climate was said to have polarised almost all food consumers towards price and value rather than environmental concerns although customers were said to continue being mostly concerned with reducing levels of packaging. For the business, it was not only packaging but also the costs of new technological solutions for carbon reduction that were of concern as stated here:

"Packaging is a difficult area. Because it's customer demand and customer driven. And NGOs can, they don't give us a hard time, but NGOs think packaging is an easy target. But customers' shopping behaviours and habits..., they, they say one thing and do another. And I'm the same, you know, I'm a customer as well as somebody who works for Sainsbury's, my wife and kids and yeah? So people say don't give me packaging, give me it loose and I'll do it myself.

Then you go and do it and think oh my god, squashed tomatoes, squashed strawberries, and you end up with a massive wastage issue which is probably more detrimental than, you know cause you're growing a product and it's actually being thrown away. So there are, there are issues and packaging is a big issue.

We've got a lot of technologies out there which are coming through that are so expensive that actually work, but they're not cost effective and we're trying to help them to work to drive them down.

So that's the big issues for us, is packaging and probably the cost of new technologies to help drive down the amount of carbon we actually use in our stores day by day from an energy perspective."

The participant notes that given carbon footprinting and labelling using PAS 2050 are voluntary, uptake in the market is difficult to ascertain. Rationale for uptake of carbon footprinting was explained to be driven primarily by the perceived need to decarbonise carbon heavy processes. Unlike a close competitor from the 'big four' retailers, Sainsbury's did not pursue a large-scale marketing campaign on their carbon footprint efforts.

Out of the 'big four' retailers it was explained that only one (Tesco) had actively advocated their own carbon footprint work with Sir Terry Leahy, Chief Executive at the time famously pledging in 2007 to carbon footprint 50,000 own-brand products. This was considered by the participant to be unnecessary given the low demand for carbon labels and the difficulty consumers are perceived to have in understanding labels. Carbon footprinting efforts using PAS 2050 for Sainsbury's were said to be driven by internal strategic positioning.

6.3.c.iv Food Consumers: Awareness and Understanding

In terms of customer understanding of carbon labels, the interviewee points out that comprehension is believed to be limited to a small minority of consumers. The participant said he thinks that consumers will eventually become more aware of carbon and climate change over time but for now consumer pressure for 'greener' packaging solutions is of most concern.

Carbon footprinting was perceived as a useful tool to decarbonise product emissions within a wider more holistic sustainability agenda. The cost of introducing new technologies to reduce energy consumption is stated frequently to be an important consideration for Sainsbury's in terms of the types of 'green' issues they choose to place emphasis upon.

The interviewee perceives that climate change as well as carbon footprinting are both of significant strategic importance with respect to Sainsbury's market position and believes this level of importance is set to become increasingly augmented over time, particularly within the next ten to fifteen years. It was explained that Sainsbury's have strategy groups that consider how best to meet the challenges of climate change and carbon footprinting issues. These challenges are said to include matters extending to the location of supermarkets, distribution, travel, locally sourced products and locally sourced sustainable materials and are said by the participant to all fall under the remit of Sainsbury's CSR. The participant gave an example of a number of building projects for 'green' stores. These are built with the minimum of environmental impact and for maximum carbon efficiency gains within a specification that enables Sainsbury's to repeat such projects. It is hoped says the interviewee that customers will eventually become aware of the retailer's 'green' efforts.

6.3.c.v Carbon footprinting using PAS2050

With respect to carbon footprinting using PAS 2050, the interviewee advocated the carbon footprint work Sainsbury's had undertaken across their dairy farms for milk. Each bottle of Sainsbury's milk displays the carbon label but very little was perceived to have been effectively done to promote through marketing campaigns what the participant felt was a major pioneering project. The due process of PAS 2050 itself was not of concern as it was said by the participant to have provided a credible benchmark in terms of carbon measurement within the wider market place.

Rationale for sustainability and carbon footprinting efforts were said to largely stem from the concern of rising energy costs which were explained to be inevitable given the reliance on the National Grid which itself is based upon conventional carbon heavy fossil fuels.

An excerpt from the interview is provided here detailing the participant's perceptions of his business's need to harness wider sustainability approaches to reduce adverse environmental impact and carbon consumption:

"... I think, you know, if you're a shrewd operator, then people will realise that if you don't invest in things sustainable it will come and bite you on the rear end in the future.

The main reason being is, you know you know, if you just look at the McKinsey Curve, which is the forecasted curve for energy costs and carbon cost and carbon price floor, they're going to exponentially go up significantly. So if you don't start invest in doing the right thing now you are going to have one heck of a problem in three, four, five, six years time, because people won't be able to afford the energy.

It'll be four, five times the cost it is now, and, so you need to think about that and that's what I do. That's what I'm paid to do, to think about what I'm going to do to try and make sure we mitigate those things which are absolutely, they're not Walt Disney written a lot of these things, they're real things that gonna happen, unless somebody comes up with cold fusion and you know electricity is free. You know then it changes it but based upon the things we know now, we need to invest. Or be wise to invest."

Sustainability efforts within Sainsbury's were said to be premised upon the need to continue investing in such efforts to:

- protect the retail business from possible future mandatory compliance;
- invest in leading sustainability initiatives to avoid adverse climate change impacts now and in the future;
- invest in technologically innovative carbon consumption solutions;

It was explained that from his business point of view investing in sustainability at present will reap rewards in the future in terms of customer assurance, ensuring quality, freshness and seasonality of food products and contribute towards achieving the triple bottom line. Competitive advantage was perceived to be a definitive outcome of such efforts.

6.3.d. Case Study 3, Colors Fruits: David Farrell

Key actor David Farrell was selected owing to his leading strategic role - Director of Sustainable Business at an international fruit production and export company that distributes over 150,000 tonnes of fruit to 'top-end' retailers around the World including the UK, Europe, North America, Asia and the Middle East. David Farrell has an environmental portfolio and a team reporting to him on multiple sustainability issues. In general, the business's marketing strategy is focused on serving large supermarket retailers. In the UK, Colors Fruits supply Asda, Tesco, Sainsbury's and Marks and Spencer.

Colors Fruits is an international fruit export company based in South Africa with offices in the UK, Belgium and Canada. Colors Fruits is South Africa's second largest fresh fruit exporter with a strongly vertically integrated business that owns many of its farms and fruit packaging operations. In terms of supply chain position, Colors Fruits engage at the early upstream stages – producing, procuring and supplying fresh fruit. The business was formed by a number of prominent South African farming families in 1997 - a year after the deregulation of South Africa's fruit sector. Colors Fruits' portfolio of farms is owned by its shareholders with a strong supply base of more than 300 farms. David Farrell explained that for Colors Fruits, ownership of many of their fruit packing operations gives the business significant levels of control over quality, product grading and packaging for final market. Offices in the UK, Belgium and Canada operate primarily as an import function. Approximately 150 people are involved in core commercial operations. If extended to include employees working on farms and packing houses that Colors Fruits owns, the figure was said to be around the 2,000 mark. Overall revenue is broadly estimated to be around £150 million sterling a year based on total sales at the import level.

6.3.d.i Carbon and Sustainability

Much of the narrative related to the need from an operational and business point of view to ensure insightful strategic positioning. This related specifically to the perceived necessity for pro-active engagement in social and environment issues given the increasingly competitive market environment. In particular, it was felt that the adoption of measures to effectively mitigate adverse climate change impacts is critical. The participant was keen to emphasise his perception that climate change and sustainability efforts are essential fundamental components for the future of the business in its entirety. Operational efficiency, energy savings, transportation issues, storage and distribution are stated as factors under constant scrutiny by his team.

The narrative is largely pro-adoption of carbon footprinting as the participant is adamant that climate change impacts are increasingly and alarmingly evident across their farms that produce fresh fruit for export. However, the participant points out that their carbon footprinting efforts have unveiled a number of complexities associated with the way in which PAS 2050 is interpreted by market competitors and the changing demands of supporting retailers. These difficulties are in the view of the interviewee, typically centred on the challenge of reconciling and unifying the business's own sustainability strategies, perceptions and conceptual awareness with those of a diverse range of downstream retail businesses. David Farrell says he believes that sustainability, driving down

carbon consumption and engagement with pro-active environmental management tools and policy are all crucial factors for food businesses to consider in an increasingly globalised and competitive commercial climate.

6.3.d.ii Climate Change Concern: Top Management and Carbon Footprinting

The interviewee explains that it is his job to keep carbon footprinting, climate change and sustainability on the agenda within a relatively small Executive Board comprised of six members including him. Since embarking and undergoing their carbon footprint work, he explains that such issues have moved away from the fringes of overall business strategy to being captured and formalised within set key performance indicators (KPIs). The participant believes that senior management “*at the very top*” are increasingly appreciative of sustainability efforts despite their tough questioning regarding longer term investment projects.

It is explained that at the second tier of management, heads of commercial teams are also increasingly able to make commercial sense of such initiatives and expresses a marked shift generally towards broader understanding that business needs to cover these areas to survive. The interviewee continues that the business culture of Colors Fruits strongly focuses on the notion that commercial wellbeing is dependent on long term investments in social and environmental issues. It was said that at the internal level transparency in communicating what the business is doing in the context of sustainability and carbon footprinting is positively regarded, particularly when retailers visit for pre-season planning and when overseas.

Initial thoughts on carbon and food miles were said to be associated with rising public awareness and debate around late 2006. Consequently, the decision to contact the Carbon Trust regarding carbon footprinting using PAS 2050 was said to be shaped by a unified business desire to be involved at the early pilot stages in the development of the world’s first standardised methodological specification for the life cycle assessment of products. It was said that by engaging early, it was believed that Colors Fruits would be advantageously positioned to learn about carbon footprint measurement. The expectation it was explained would be that this learning and experience would provide an influential level of relevant and context specific input from the perspective of Colors Fruits.

Decision to pursue a carbon label was said to be based on this notion of the perceived credibility of the PAS 2050 process in their business’s carbon footprint calculation. It was supposed that once a certified business number had been agreed, credibility of the entire process would be vindicated. Additionally, it was perceived that providing retailers with the prerogative to elect whether they want to label or not would possibly act or contribute towards market differentiation and achieve an element of competitive advantage.

It was explained that in early 2007 Marks and Spencer (M&S) had launched their ‘Plan A’ programme of sustainability followed closely with the launch by Tesco of their sustainability programme. In the participant’s opinion, these strategic shifts reflected growing concern amongst food industry and consumers around the misconception of products that were shipped long distances, which is the

type of business Colors Fruits is. Shipping products great distances to distant markets was described as presenting an opportunity for the business to proactively position themselves as leaders in the field of carbon management, footprinting and wider sustainability issues. Motives for pursuing carbon footprinting using PAS 2050 were believed to centre on developing a carbon reduction plan from a position of knowledge and credibility.

It was highlighted that as Colors' business model did not produce a branded product like *Walkers* (crisps which are clearly labelled with carbon footprints and displayed in shops across the UK), it was felt that Colors' products tend to lose identity given that all products are repackaged for specific supermarket retailers such as Tesco and Sainsbury's. It was stated that Marks and Spencer had been quite reticent about labelling whereas Tesco had always been more interested. Difficulties in undertaking carbon assessments it was said arise due the international base upon which the business procures their fruit. It was said that despite the complexity of having a significant number of international fruit suppliers, the productivity phase of fruit supply chains tend to be the simplest to assess.

An example was given on Colors' carbon footprinting and labelling work of the Jaffa brand. The Jaffa brand was explained to comprise of clear supply lines from different parts of the World. Given these transparent supply routes, the participant explained that pulling data together into a labelled carton was relatively logical and expected to be achieved in the near future. Final labelling of cartons would include a carbon footprint label and a generic label to indicate seasonality and geographical differences over 12 months of supply. For instance products would be labelled as: '*South African Season Jaffa*'; '*Standard Season Jaffa*' '*Israeli Season Jaffa*' and the number will change over 12 months of supply.

With respect to retailers, it was more difficult to achieve agreement in the process and application of the PAS 2050 standard. Tesco was referred to as an example of a retailer Colors Fruit's have worked closely with in carbon footprinting assessments. Collaborating with a retailer it was said was complicated since even with the PAS 2050 standard, the method, the use of the standard and how numbers are derived and calculated are open to different perspectives necessitating a level of agreement to 'normalise' numbers. The interviewee acknowledged that early carbon footprinting efforts were expected to require further work to normalise figures and ensure comparability. It was pointed out that these experiences were perceived as highly useful in terms of learning to manage carbon consumption internally.

The interviewee was keen to highlight that for the purposes of their business, much of the process of calculation using the PAS 2050 specification proved useful in terms of setting a gauge for internal auditing and management of carbon emissions.

"...if you look at where we are using it primarily which is to look at our supply chain and use it as a tool to drive our strategy; as long as we use for ourselves, the same basis of calculation, we will be able to see a relative shift up or down and that's almost good enough for us. That is good enough for us in terms of managing a carbon reduction strategy."

This capability for internal auditing is considered a significantly important tool in facilitating a transparent sustainable supply chain strategy for carbon management reduction across the business's global operations.

As before, concerns were largely suggested to relate to the uncertainty of the comparability of results with competing supply chain businesses. This relates directly to the interviewee's comments regarding his perception that competing businesses' carbon assessments have a high likelihood of producing diverse results based on different interpretations and implementation of PAS 2050 methodology. Doubt was expressed regarding how other competitors had approached carbon footprinting using PAS 2050 and how those businesses achieved certification.

The following statement from the interviewee clearly details these principle concerns which are specifically related to how the standard is interpreted and utilised by competing supply chain businesses:

"When we first saw what we went through to get our numbers and seeing how another company had approached it and achieved its certification, it raised questions about how solid or useful the standard is to be a standard and create a methodology that squeezed out in the end a comparable number. So I think there's a little bit of concern there that it may be too...it gives maybe a little too much latitude and as a result can result in numbers not being comparable between what are essentially competing supply chains. I must say we're a little bit nervous because we're not sure our people...I mentioned already that we're concerned about comparability. We're not sure how people are going to interpret that number. Whatever it ends up being – is it going to scare people off?"

The uncertainty Colors Fruits have with respect to unknown future perceptions and reactions of retailers regarding finalised carbon footprint figures were deemed of paramount concern to the strategic positioning of carbon footprinting within the sustainability portfolio of the business. Unknown consumer response was also what the interviewee repeatedly and specifically refers to. Uncertainty in the confidence of end-users and retailers reactions to published final carbon footprint figures were expressed as an unknown variable in the assessment of PAS 2050's marketing value. A negative reaction to high carbon footprint figures could it was felt, potentially trigger an adverse market response to the business's products as explained by the participant below:

"Because they can suddenly put a number and it almost... We might find the reaction to be might be 'my goodness, look how dreadful that number is!' ... So, there is that sense that we're taking the step of declaring without knowing how people are really going to react to it and we do fear that it could be a negative reaction. So, to give you an idea, our fruit types, I think bar one, are sitting with embodied emissions on the retail shelf of well over 1 to 1, so they're sitting with say, 1.5kg of emissions equivalent to a kilogram of actual fruit so what you're buying is more carbon emissions than the weight of the fruit. Do people, will people be really alarmed by that? Actually, it's more a warning light that these guys are responsibly managing their emissions? So that is the stretch into the unknown where this anxiety sits."

6.3.d.iii Climate Change Impacts

David Farrell explains adverse impacts of climate change are of major concern due to Colors Fruits' direct farming interests and dependence on a primary agricultural supply base. Mitigating climate

change impacts was said to be crucial given the likelihood of increased water stress, soil composition and rise in unpredictable and extreme weather events as future survival of fruit production is critically reliant on both temperature and water. He continues to state that:

“We know that physically we have to be able to consider environmental impact, climate change impacts on agricultural production and what are we going to do to mitigate that and manage that. It has a very direct impact on our means of production.”

The bigger challenge, it was explained for the business environment is to find a way in which to not only develop pro-active strategies to manage and mitigate environmental externalities but to find a way to integrate into an overall business strategy wider efforts to simultaneously improve the ethical and social welfare of the business’s farmers and their communities. He says: *“we must do something to pro-actively develop strategies to manage within and mitigate these realities of our business environment”*. The participant then continues to emphasise the importance attributed to climate change within their sustainability portfolio and explains that: *“in terms of resourcing funding and going into projects and trying to grapple with it, it is as important as any of the other areas in the sustainability portfolio.”*

6.3.d.iv Reputational Asset and Market-Standing

With respect to the internal strategic reasoning of the business, carbon footprinting and labelling via PAS 2050 were said to initially have been perceived to provide the business with a clear standing in the market place. This is particularly relevant to the business it was explained as PAS 2050’s life cycle assessment approach in the calculation of carbon footprints was perceived to provide definitive lines of credibility which was said to undoubtedly contribute significantly as a reputational asset.

The interviewee was keen to explain that over time, growing understanding of the risks climate change poses to the agricultural base the business relies upon provides sufficient enough rationale to form a stand-alone driver for uptake of carbon footprinting and sustainability efforts. Market benefits are said to have shifted towards being primarily viewed as a bonus given the business’s direct experience of adverse climate change impacts on fruit production.

“The issues of water stress and changing climate on fruit production, which we really are seeing some evidence of, and how we get our heads around that and ensure we don’t run into supply issues as a result of these changes, I think is becoming the over-riding motive in terms of the way we are approaching this.”

The participant explains further that for his business, climate change is of genuine and growing concern particularly as their own farms have experienced a rising number and range of extreme weather events, namely flooding over the last decade. In particular, high levels of incurred costs due to repeated annual extreme flooding events over the last three consecutive years across Colors Fruits’ farms have galvanised the business’s view that for them, climate change impacts are already distinctly apparent.

Tied with the aforementioned concern is what the participant explains is the marked decline in what are termed as 'chilling units' on their farms over the last decade. It was explained that chilling units or chilling hours refers specifically to an essential and precise period of time where fruit trees exposure to cool temperatures trigger a vital state of dormancy prior to later and consequential fruit production.

"I would mention too, that there certainly with respect to climate change there are aspects that are of concern to me. One of them is extreme weather events, particularly flooding. We've seen on our own farms over the last decade. For instance one of our farms that is over forty years old; it's never happened before but due to extreme flooding events, almost a year to the day for three consecutive years which has come at a huge cost, that's one bit of evidence. The other is that we have seen a decline in what we call chilling units which is when after cooling, it's what the deciduous trees are exposed to and if you don't get sufficient exposure to cooling they don't go into proper dormancy. It then has an impact on the subsequent fruits of the crop and we've seen very clear recorded evidence of that. You know, we've seen a steady decline in chilling units. So you know that would certainly be a concern to us because that would directly affect the productivity of trees."

A major challenge for Colors Fruits is largely the perceived issue of market-place comparability of carbon footprints. This is chiefly of concern with respect to marketing aspects relating to the comparability of final carbon footprint numbers produced by competitors. Making comparisons between two same category products from competing companies is said to be compromised as interpretation of the PAS 2050 standard is felt to be open to variances in the type and range of data that are chosen for use in carbon footprint calculations. These variances inevitably it was said give rise to differences in the overall construal and publication of final carbon footprint figures in the wider market place leaving it difficult to ascertain the perceived value of carbon footprint labels.

As such, lack of confidence in how standardised the methodology of PAS 2050 is explained to derive from the interviewee's scepticism of competitors' final carbon footprint claims via carbon labels. This is exacerbated by the shifting demands from supermarket retailers regarding what should be included and/ or excluded by Colors in the carbon footprint process.

Much of the process of calculation using the PAS 2050 specification it was explained requires a significantly greater level of rigour as in its present form it is excessively generic despite the adopted life cycle analysis approach within the standard's methodology. This was explained to provide too great a level of opportunity for multiple interpretations.

Voiced concerns relating specifically to the use of PAS 2050 included:

- difficulty in comparability of carbon footprints within same product types;
- supermarket retailer dissonance;
- supermarket retailers' shifting levels of engagement, demands and expectations; and
- uncertainty as to how competitors will interpret the PAS 2050 process for carbon footprinting and certification.

This perception that PAS 2050 poses a strong potential for multiple interpretations of its process by different users/businesses was said to have given rise internally to questions related to how solid or useful the standard is in providing across the board conformity in carbon footprint calculations amongst same product sectors as explained here:

“It might not be good enough for making comparisons between two seemingly equivalent products because people do interpret things slightly differently. I think as an internal driver, we’re very comfortable. There is a bit of discomfort about it if an environment were we put against another fruit supplier. We’d like to check and make sure that we complied with exactly the same calculation methodology step by step which obviously begs the question that we would have some doubt that the standard is providing that rigour sufficiently.”

Criticism prevailed that the PAS 2050’s specification and guidelines is too generic despite the methodology’s life cycle analysis approach. The ultimate sense was that the methodology itself lends itself open to a number of interpretations by different parties. In particular, it is perceived that carbon footprint attempts are open to external influences namely supermarket retailers. While it was voiced that PAS 2050’s LCA approach in the methodology was both welcome and strongly supported (as it was perceived to facilitate standardisation and conformity in carbon footprinting), much of the narrative referred to a number of experienced challenges in terms of confidence in comparability in the wider market place.

Despite the concerns expressed above, credibility of the carbon footprinting initiative was frequently referred to by the participant as a fundamentally important factor given what was perceived by the participant as opportunistic and insincere claims from market competitors. In particular, for the business’s needs, it was said that PAS 2050’s life cycle assessment approach which captures embodied emissions in products was (despite various difficulties encountered in the due process) perceived as a more tangible and meaningful measure than other alternatives such as entity measurement, the Greenhouse Protocol, measuring a company’s emissions using Scope II and so forth.

6.3.d.v Sustainability of Endeavour

Rationale for carbon footprinting adoption stemmed from the perceived need to mitigate climate change impacts via measurable and credible carbon management and reduction efforts. Strengthening market position in a strategic sense towards gaining competitive advantage and acting as market differentiators via carbon footprinting using PAS 2050 were perceived as inevitable consequential benefits directly stemming from adoption of internationally recognised, credibly verified and certified standards.

Overall, PAS 2050 efforts are viewed as a constituent of Colors’ pro-active ‘green’ management strategy that realises tangible benefits namely in the form of energy efficiency savings. While land husbandry, farming and welfare standards as well as a wide host of ethical measures fall under the umbrella of Colors’ sustainability strategy, carbon footprinting is perceived as a natural and almost

necessary element in efforts to identify 'hot spots' of carbon consumption and find ways to decarbonise their systems as effectively as possible.

Unlike environmental initiatives, for social standards external compliance is not perceived to be necessary and is therefore not sought by Colors Fruits. However, long-term engagement and commitment with ethical trade practices (validated by third party external compliance) are thought by the participant to be held in high regard across the market place allowing for collaboration, learning and development with supply chain businesses. Tesco was cited as an example of a business that Colors has worked closely with. This, it was explained was followed after bad press on Tesco's ethical trading practices:

"I know that Tesco were taken to task around ethical practices and that was particularly on South African farmers supplying them and that stirred them to work really hard to start working with people like us in terms of putting ethical trade programmes in place. But, I don't know if that's happening, that sort of lobby, that sort of aggressive lobby is yet in place to put pressure on the environmental side."

PAS 2050 is not viewed as a panacea to climate change impacts on fruit production systems. However, external compliance with PAS 2050 is held in high regard by the participant in the sense that he views the standard as a tool with a credible methodology underwritten by the Carbon Trust, accepted by a number of high profile food businesses (e.g. Walkers), preferred by certain supermarket retailers and recognised internationally especially amongst market competitors. Seasonality of produce is deemed a critical factor within the supply of fruit to market by Colors. Despite complexities associated with carbon footprint approaches adopted by market competitors, it was explained that PAS 2050 methodology is nevertheless the preferred route having collaborated with the brand *Jaffa* to carbon footprint cartons of oranges with footprints for different seasons. This is explained by the participant here:

"We've had great difficulties with fruit suppliers because you get fruit from many parts of the World but it looks like now they've found that productivity is simplest and one particular brand, which is the Jaffa brand, they've got quite clear supply lines from different parts of the World and they're looking to pull that up into a labelled carton and it'll say this is now: 'South African season Jaffa'; 'standard season Jaffa' 'Israeli season Jaffa' and the number will change as you work through the 12 months of supply."

It's complicated because even with the PAS 2050 standard – we had discussions with Tesco this morning, the method, the use of the standard and how numbers are derived and calculated, we picked up different perspectives used between our approach and the Israeli approach, so this takes quite a bit of work to kind of normalise those numbers and make sure they are comparable but I think that's all part of the learning. We're getting there and hopefully we'll have something out, not too far ahead."

6.3.e. Case Study 4, Northumberland Foods Manufacturer: Iain Elliot

Key actor Iain Elliot was selected owing to his role as an Environmental Manager within an SME that manufactures ready-cooked frozen vegetable products, namely potatoes and parsnips. Iain Elliot is responsible for every form of waste that comes out of the factory, whether it is in pallet form,

loose form, whether it is effluent that comes down through the drains. He also manages their anaerobic digestion plant. Essentially, as soon as a product becomes a by-product, then it becomes his responsibility. In addition, Iain is responsible for a number of sustainability issues largely based on attempts to manage energy consumption and ensuring compliance with quality assurance standards.

Northumberland Foods is an SME food manufacturing company situated on an industrial estate known as Coquet Enterprise Park in Amble, Morpeth, Northumberland. Northumberland Foods is an SME food manufacturing company that specialises in potato and parsnip vegetable products. Potato products range from a basic roast potato, which is a basic white potato with a batter and fried, to more specialist ranges of honey-glazed parsnips. This business is a main line supplier to supermarkets in the UK producing on average in the region of 150 to 180 tonne of products a day, whether that is potatoes or parsnips. The business has traditionally been the main employer in Amble, employing approximately up to 250 people. The site employs approximately 180 people on site, operating a 24/7 shift system.

As mentioned previously, Northumberland Foods is a business that processes principally potatoes and parsnips into ready-cooked frozen products that are supplied to a number of supermarket retailers including Tesco and Asda. Signature products produced and sold include: roast potatoes; potato croquettes; potato wedges; potato waffles; crispy potatoes; roasting parsnips; potato slices; potato fritters; potato crunchies; and mashed potato.

Northumberland Foods have also won a number of prestigious awards from the British Frozen Food Federation (BFFF) for "Best New Vegetable-Based Product" in 2010. Additionally, their "Tesco Finest" Orange-Blossom Honey Coated Parsnips product was named as Retail Product of the Year in 2009 and 2010.

Other notable achievements at the Amble site include the following:

- Jus-rol produced first ever frozen roast potato product Sector now worth over £50m
- First Honey Glazed parsnips under Aunt Bessie license Sector now worth £5m
- First Crispy Potato product under own label Sector now worth over £8m
- First Roast Potato enrobed with Goose Fat
Goose Fat / Premium Roasts sector now worth over £8m.
- Winner of BFFF Gold award in AVPP category 2007 & 2008
- Winner BFFF Best New Vegetable-Based product 2010
- Winner BFFF Retail Product of the Year 2010

Much of the account related to the perceived need of political and financial support for SMEs in the food-manufacturing sector to facilitate uptake of pro-active sustainability and carbon efficiency measures despite their relatively weak supply chain position. However, an increased competitive market base at the manufacturing level was said to add pressure to such firms in meeting the

demands of supermarket retailers, namely concerning quality standards leaving little wriggle room for sustainability and carbon efficiency considerations.

Specifically, the participant was keen to highlight his belief that mitigating climate change impacts via carbon efficiency and sustainability measures is crucial particularly within the food sector. Improving waste management was a salient feature of the participant's interview as were concerns regarding continued reliance on energy and water consumption at the manufacturing level for food processing and packing. Logistical issues were not of concern given the firm does not use its own transportation in the supply of products. Collaboration with their supermarket retail customers is instead undertaken in order to operate a mutually beneficial 'reverse logistics' strategy for road freight.

6.3.e.i Supermarket Customers

Supermarket retailers are the business's most important customers purchasing a considerable degree (85-90%) of Northumberland Foods' total annual produce. The participant explained that without maintaining a secure foothold within at least one supermarket retailer supply chain, the business would not be viable. As such, demands placed upon this business by supermarket retailers were also claimed to force a continuous cross examination of a host of quality, size, freshness and seasonality issues as well as packaging and marketing factors consequently leading to a series of in-depth analyses of operational systems and continual attempts for the re-alignment and optimisation of operational costing measures.

Adherence to and acceptance from supermarket retailers' demands are perceived as essential pre-requisites to agreed contractual arrangements for custom.

Assumption regarding retailers' demands regarding optimal taste, size and shape is based upon the notion of supermarket retailers' powerful marketing, purchasing capacity and experience. Despite this almost unified approach by supermarket retailers to place high demands upon an SME, *types* of demands differ more markedly amongst competing retailers.

For example, Tesco and Iceland are Northumberland Foods' largest customers. Northumberland Foods focuses on producing Tesco's 'Finest' range of products with high-end quality and relatively costly ingredients. Conversely, Iceland concentrates on buying high-volume produce with a more modestly costing range of batters. Yet, compliance to each supermarket retailer's demands is crucial and largely relate immediately to quality, size, shape and taste.

Essentially, Northumberland Foods was said to be market driven by the customers they supply (i.e. the supermarket retailers such as Tesco and Iceland). It is felt that despite the global recession Northumberland Foods has a strong 'home' market advantage given that raw materials such as potatoes and parsnips are solely sourced from the UK. Complicating provenance and competition issues it was said was the fact that the business is season driven as the raw food products manufactured for supply are not available all year long.

6.3.e.ii Carbon Footprinting: Perceptions

The interview participant upon questioning had heard of the PAS 2050 standard and understood the need to use the standard's guidelines and methodology to achieve a verifiable carbon footprint. It was explained that his knowledge of PAS 2050 and carbon footprinting in general was limited but he had come across several marketing emails from The Carbon Trust and had been invited to several seminars which had alerted him to the notion of carbon footprinting using a standardised set of guidelines and methods. Little attention had been given to PAS 2050's carbon footprinting standard given the business's *modus operandi* of continued efforts to focus on quality standards.

However, the interviewee stated that "*in truth*" carbon footprinting "*is likely to be on the agenda*" particularly as the business is keen to maximise energy efficiency given their dependency on the supply of heavy oil. No gas supply is available on site. Yet, it was water use that was of predominant concern to the interview participant. The interviewee explained that in the near future (no fixed dates were given) the business would be looking into drastically reducing water consumption via the Federation Health Committee.

"...the reduction of water because that is one of our biggest, biggest uses is water on site. We bring in something in the region of about 500 cubic metres of water a day to this site...so although electricity and heavy oil are high on the agenda, water is far, far higher. So, its the Federation Health Committee that I will be the first project I will push forward when I get time to do so. That will be the first one and then the Carbon Trust will be the one that will follow that."

The participant continued to explain how the business is and has been historically more driven by actively pursuing the British Retail Consortium's (BRC) quality auditing system. The government agency that drives the BRC standards is the Food Standards Agency (the FSA). It was further extrapolated that the majority of Northumberland Foods' data sheets, which contain details of all the food products produced on site are, all in fact FSA approved in terms of the process of manufacturing.

It was said that from a manufacturing perspective, supply is highly dependent on supermarket retailers' demands and preferences. According to the participant, this is further complicated by the fact that in the frozen-food sector, no unified or agreed performance standard exists.

6.3.e.iii Regulatory Food Regimes

Mandatory government health, hygiene and quality targets fall largely under the umbrella of the government agency's Food Standards Agency – the FSA, who drive much of the manufacturing process. Despite the FSA, it remains the supermarket retailers' prerogative to shape demand given their relatively economically strong supply chain position and it is the BRC system (with the backing of the FSA) that tends to be the preferred choice of retailers in terms of having a unified and standardised system that audits quality standards of manufactured products.

Some frustration was expressed that despite the business's commitment to the BRC system, some supermarket retailers while accepting of the BRC standards continue to demand and undertake internal audits autonomously.

Any type of failure or shortcomings in the outcome of a BRC audit which is primarily quality driven would be, it was explained catastrophic for the business. In this context, comparison was made between the BRC and an environmental management system.

For instance, if an environmental management system such as ISO 14001 was open to scrutiny or failure of any kind, the business's customers were unlikely to be put off trading with them as ISO 14000 had already been attained. In addition, the interview participant was keen to explain that many of their customers would take the view that Northumberland Foods would be able to refine such standards quickly and satisfactorily. In fact, it was said with certainty that the business's customers would not be put off trading should any failings arise given that Northumberland Foods had already achieved ISO 14000 and were known to actively pursue increasingly efficient sustainability targets. Essentially, it was expressed that from an environmental and sustainability point of view, retailers' demands were increasing though these demands differed markedly from retailer to retailer. Overall, however, it was felt that little concern would be shown by retailers should shortcomings arise in environmental and sustainability targets.

Conversely, should Northumberland Foods fail the BRC system it was said that it would be 'catastrophic' for the company as they could potentially lose 78% of trade business overnight.

6.3.e.iv Market Competition: Key Foci

Competitiveness amongst similar SME food manufacturing businesses was said to be fierce. Many comparable manufacturing and processing businesses were thought to similarly strive for greater levels of 'market share' given the increasing power of 'whole' supply chains (typically owned outright by supermarket retailers) leaving little wriggle room for SME business-to-business firms such as Northumberland Foods.

With respect to logistical operations, it was stated that their supermarket retailer customers drive external control. As such, all logistics are operated externally. Inevitably, co-operation between Northumberland Foods, its suppliers and customers was said to be essential. This is because producers as well as retailers operate a 'reverse' logistics function. It was further explained that all waste from the site is collected upon delivery of raw materials such as potatoes and parsnips. Manufactured goods are collected on site by retailers and distributed to regional hubs for national distribution and waste such as pallets and cardboard are then collected so that haulage carriers operate as efficiently and effectively as possible.

With respect to impact, it was reiterated that the business in its current guise is primarily driven by the BRC quality standards auditing system. Quality is perceived to be the most important motive for retailers procuring the business's frozen food products.

Given carbon footprinting is not currently in use by the business, little weight is given to the utilisation or usefulness of carbon footprinting via PAS 2050. It was explained that while carbon footprinting using PAS 2050 had not been overlooked, the sense of urgency for the business to pursue such a process was lessened in the short-term as it was a voluntary not a mandatory standard. As such,

carbon footprinting had been placed on 'hold' until deemed by the Board of Directors to be economically justifiable to pursue.

However, carbon footprinting using PAS 2050 it was said would undoubtedly be a standard the business would be willing to undertake/adopt in the near-future. This is rationalised by the participant as being largely driven by the need to drastically reduce energy consumption given the business's experienced fiscal difficulties associated with the site's dependence on heavy oil (which is delivered on site) for electricity generation. This is in parallel with the interviewee's perspective that it is vital for the business to pursue both efficiency gains and competitive advantage through market differentiation amongst SME food manufacturers with tools such as carbon footprinting using PAS 2050. However, given it is a voluntary measure, uptake of PAS 2050 was stated to be solely dependent on whether and how soon the business would have the fiscal capacity do so.

6.3.e.v Sustainability: Perspectives

According to the interviewee, dominance of quality control is prevalent across the entire business. Given the perishability of the business's raw products it was expressed that seasonality and freshness reign supreme as aspects of quality control. Overall, quality control efforts are implemented from procurement to production, packaging of products through to final point of sale.

Carbon footprinting at the time of interview was said to be 'on hold' in favour of the business concentrating on improving their manufacturing process.

Specifically, procurement of raw materials is perceived to be a critical point at which Northumberland Foods' govern the quality of supplied produce. It was explained that much of the potato stock is supplied from local farms. Stipulated criteria including sustainable, local (all supplied vegetables are UK grown), high quality produce that adhere to specificities such as size, shape and flavour have been largely successful for the business. This is attributed to strong long-term relationships with their UK suppliers. Equally stringent standards are also implemented internally for the formulation, manufacturing process and packaging of all end-products.

The term 'sustainability' however, is viewed by the interviewee as a wide term difficult to define but explained to be regarded as a fundamental principle not only internally but increasingly so within the food industry, particularly at the growing, manufacturing, packaging, distribution and waste stages of any given food supply chain.

Added to this, the participant was emphatic that finding 'sustainable' ways of doing business with ethically and environmentally conscious suppliers was becoming an imperative in terms of seeking market differentiation from other food manufacturers in a tough economic and competitive environment, even more so for SMEs. It was further explained that in the context of Northumberland Foods, their strategic focus lay predominantly upon efficient and effective procurement of raw materials based on proven, traceable and credible provenance of UK-only raw materials.

Sustainability practices such as reducing energy and water consumption as well as continually seeking efficiency gains were in the main viewed as an opportunity to improve levels of trust and widen the scope for enhanced supply chain collaboration, cohesion and strength.

Shared values amongst supply chain actors and their customers were explained to be crucial both for the purpose of maintaining existing contracts and for winning new contractual custom. Again, having demonstrable and transparent routes of supply which are verifiable, that can be communicated easily are viewed as essential in order to underline the premise of absolute quality.

Emphasis on shape, size and overall perceived quality is explained as being attributed to the business's customers, i.e. supermarket retailers' expectations, requirements and stipulated standards as in many instances, customers place explicit demands with respect to the formulation of products separately to those of the BRC standards.

Despite the business's continued efforts towards supplying what they perceive as 'sustainable' products it was felt that attempts to do so were very much governed by the market, i.e. supermarket retailers' demands. Here is a quote from the transcript:

"...Unfortunately, as green as we are and everything else, we are still commercially driven...they're pushing it to the manufacturing side and from the manufacturing side, we're pushing out from the supply chain to say this is where that's coming from...we are also market driven by the customers that we supply and they actually tell us in some circumstances which potato growers we're allowed to buy from, which types of batter products we can use. As I say, some of them are very particular and potato specific as to what we can and can't use."

From a manufacturing perspective, it was felt that being able to practise and demonstrate 'greener' more 'sustainability' credentials of the business's manufacturing process would provide a higher level of confidence in the end-product for its customers. Additionally, it was conveyed that such a position would inevitably open up the possibility for such an SME to achieve at least some elements of competitive advantage and/or market differentiation.

Such efforts were perceived to have the capacity to simultaneously enhance trust amongst supply chain actors given clients' increasing awareness of 'green' issues coupled with growing demand for sustainability credentials such as transparent credible provenance routes and modes of production.

Carbon footprinting their systems whilst not pursued at the time of interview, was said to be 'on the agenda' for future consideration. All aspects of quality control remain the primary focus of the business.

6.3.f. Case Study 5, Tragus Holdings Food Restaurant Retail: Philip Cooke

Key actor Philip Cooke was selected owing to his role as Head of Procurement at Tragus Holdings which operates a widely-known and relatively successful chain of French and Italian high street restaurants in the UK. This interview participant is responsible for the overall procurement of food and wine commodities served at the business's restaurants which extends to responsibility for

quality of end-products, its cost and forecast of supply and demand. Green issues including waste, recycling, responsible provenance and animal welfare are responsibilities that fall under the remit of procurement at Tragus Holdings.

Tragus Holdings Group Limited is a Venture Capital business that owns a number of high street restaurant retail chains providing a food service selling food and drink, specialising in French, Italian and other miscellaneous brands. As a food service retailer, Tragus Holdings employs approximately 8,000 people. Philip Cooke, the key informant interviewee is Head of Procurement for this business, sourcing food and wine for the high street restaurants Tragus Holdings manages including Café Rouge and Bella Italia. The spend on food and wine is said to be approximately £60 million per annum. Global procurement of commodities tends to be international, stretching from the sourcing of goods from South America to China as well as France and Italy for specific food commodities (such as Toulouse sausages from France and Parma ham from Italy) purposely for their French and Italian themed restaurant portfolios.

6.3.f.i Environmental and Sustainability Tools: Perceptions

Many of the passages within this interview illustrate that while concern for environmental issues within the food sector and food consumers is recognised, it is felt that 'green' standards and policy imperatives are open to burdensome and expensive external governmental policy requirements, often requiring some form of taxation on the business. The Carbon Reduction Commitment Scheme (CRC) was given as an example of unnecessary mandatory legal compliance with respect to electricity generated energy consumption, the responsibilities for which are outsourced to a company called 'Blackstones Plc' who manage mandatory legal compliance for Tragus Holdings. The business procures directly from source necessitating procurement to function openly with growers, farmers, importers, exporters, distributors and wholesalers. All commodities are chosen at source and stock-held for the business's restaurants where, dependent on the product type and volume, deliveries are made on a daily, weekly or monthly basis and distributed three times a week across the UK to its network of high street retail restaurants. For instance, South American steak served at the business's restaurants at the time of interview was sourced from Argentina. It was stated that a rigorous selection process in the choice of commodity is ordinarily undertaken including specific demands placed on quality control of the product at the farm level in Argentina. Transparency of provenance, food quality standards and its routes to the UK are assured contractually between the said farmer and Tragus Holdings.

Tragus Holdings contract Wincanton, a nationally and internationally operational third party logistics carrier (3PL) to handle distribution and supply operations. For instance, once a staple commodity for Tragus such as steak is imported to the UK, it follows further distribution to Derby through to Luton. Luton is the location of the hub for distribution of food and wine to the business's UK-wide restaurant base.

Carbon footprinting using PAS 2050 methodology was not viewed as an imperative to the business given their separate existent collaborative efforts with Wincanton to 'green' their supply chain activities. The following quote from the interview transcription details the key informant's comment on the matter of carbon footprinting when it was first introduced by the interviewer:

"It's not of importance to our business. We're aware of it and clearly with importing bottled water, bla, bla, bla, but only because that behaviour is stupid as opposed to climate change or being aware of how it impacts on the business. If someone declares they're carbon neutral to me, I would pay no attention to that at all because I do not believe it's true or measurable or accurate. I think it's only marketers driving this to make that more attractive. Nobody is carbon neutral."

Most mandatory regulatory regimes Tragus Holdings is required to comply with are largely driven by the FSA on dietary, health and quality issues such as calorific, fat, sugar and salt content.

6.3.f.ii Sustainability Targets: Choice of Focus

The interview participant felt the business was under little pressure to meet sustainability targets given their independent supply chain position as green efforts are largely dealt with at the operational level where and when it is deemed practical to. Green efforts at the business are stated to relate to pragmatic approaches largely driven at the strategic level to optimise efficiencies and maximise profits and are dependent on the nature of the issue. For instance, green matters such as waste and recycling sit within the remit of Procurement, while the mandatory UK Carbon Reduction Commitment (CRC) scheme is the responsibility of Property. The interviewee concedes that a number of environmental challenges such as transport miles, carbon consumption and animal welfare have cumulatively received increasing attention by the business and its logistical distributors Wincanton.

Wincanton, as the sole distributor company used by Tragus Holdings is responsible for environmental issues relating to waste and recycling related to distribution. However, it is stated that close collaboration at the strategic level within Tragus Holdings and Wincanton facilitates a mutually beneficial approach to 'green' endeavours between Wincanton operatives and the retail restaurants it delivers to. For example, it was explained that in the context of corporate responsibility, output waste from its restaurants such as cardboard, glass, food waste and so forth is also handled by Wincanton via a 'reverse' logistics function. As such, 90% of restaurant output is claimed to be recycled which generates revenue from recycled products and optimises use of its logistical carriers in terms of carrying capacity, fuel consumption and energy efficiency. 10% of all waste directed to landfill.

It was stated that while the environmental challenges are fragmented, the business places emphasis on seeking efficiency gains, enhancing quality control, reducing miles travelled, improving animal welfare and responsible shipping and importing of food and drink. The following excerpt illustrates this interviewee's viewpoint:

“...we have no interest other than our own interest in doing things more efficiently with a responsible attitude to shipping and importing all our food and drink because we recognise it's a stupid issue. Water from Italy so you stop it. On the other hand, if the government set targets that make sense, then you comply but they're not sensible and all they do is tax so...

It's like importing water from France and Italy. That stopped a year and a half ago because it's just ridiculous behaviour. It's glass, weight, shipping, fuel. It's not economic and it's just silly environmental behaviour. So why would you ship water from Fiji was a big one wasn't it? Because you were meant to live eternally forever with the beneficial health effects! So what we do and can, we do.”

Efficiency savings realised through autonomous collaborative efforts to reduce energy consumption and improve fuel economy, and the weight of goods, to control internal costs of operational activities and further seek efficiency gains externally via logistical operations is perceived to stem largely from efforts to maximise bottom line profits and maintain market share. Proactively seeking tangible efficiency gains and cost savings is perceived as fundamentally more important than corporate social responsibility or being seen to seek further compliance with legislation.

“If you get a fruit and veg merchant now... well ten years ago, they would have had cardboard coming out of their arses at the back of the yard and just getting rid of it...it's bulky. It's got no weight. It's difficult. There are now recycling boxes inside the warehouse. They're being a lot smarter. They're using less cardboard. They're making packaging lighter and cheaper to produce. They're doing it because it's more efficient and doing all the right stuff but only because it's more efficient for them...”

It's not a change of behaviour per se, from being whacked on the head tax wise. It's a change of behaviour because they want to because it's more efficient. As simple as that. Cost savings. Yes, it's cost savings, more efficient, less weight to distribute. So if you're shifting a pallet of spuds, that's a huge weight, so that's about fuel economy. If you can produce the packaging around that, you're helping a bit. So that is happening I think through the supply base people.”

6.3.f.iii Carbon Footprinting: Perceptions

With regard specifically to both the matters of climate change and carbon footprinting, the key informant expressed that almost all 'green' efforts adopted by the business are principally driven by efficiency. The effectiveness of any adopted measures is explained to be interpreted via separate tangible and measurable outputs such as a reduction in the volume of packaging and/or the reduction in fuel costs.

Any decarbonisation attempts and wider environmental objectives are repeatedly stated to be largely driven from a commercial sense of added value. However, the key informant stressed that beyond creating revenue for the UK Government and the Carbon Trust, the PAS 2050 carbon footprint is of little value to Tragus Holdings. It was explained that PAS 2050 does not engage interest with Tragus Holdings and questions what it perceives as its commercial focus. However, it was stated that should the voluntary PAS 2050 standard become mandatory, the business would comply for no other reason than to ensure compliance with government legislation.

“...Yes, we would comply. Because it's legal isn't it? But, again, only because it's...for us it's a lack of interest because it's not interesting. That's it. If it's Government legislation, then we do it... Again, it's not interesting. It doesn't bring anything to our business. It's

not helping anything beyond creating revenue for the government and...this again...What's the point actually?

My point is that all the effort is going into commercial. Its double standards. And, again, with this (PAS 2050) where would that apply to? Retail, food service. Not government. The government is the biggest food eating organisation in the country. Rant over. The whole thing is frustrating. Yes, we're about making money. But also, we get a lot of joy out of supplying good food to customers. Café Rouge is about food that has salt and sugar and we supply that because people like eating it."

Given the lack of agreed performance standards at the governmental and market level, the effectiveness of any 'green' measures or practices adopted within the business is dictated by efforts to augment bottom line profit and long-term economic viability.

6.3.f.iv Voluntary and Mandatory Food Policy Tools

The Interview participant, while aware of The Carbon Trust, and the notion of carbon footprinting and wider 'green' terms such as 'carbon neutral', 'food miles' and 'sustainability', suggested that unless the PAS 2050 standard was made a mandatory obligation, it was of little significance to the business. More importance is attributed by the business in seeking 'sensible' efficiency gains and reduction of operational costs than adopt the PAS 2050 carbon footprint standard.

Certainly, much of the narrative related to the perceived need for less external regulatory control from government agencies, especially the FSA. Here the FSA is talked about at length. A key frustration voiced by the participant is the FSA's foci on a number of issues (perceived as burdensome, unnecessary and not called for by consumers) including demand for nutritional information to be communicated to consumers as well as information regarding the ingredients of commodities offered on menus at the restaurants Tragus Holdings operate.

"Do consumers want traffic lights on the menus? Do they want green, amber, red. We don't think they do. Do they look at that when they go shopping at the supermarket? Do they look, oh, that's a green? Do they understand what it means? Is it about salt, sugar, fibre, calories, carbohydrates, oils, fats? What's it about? People don't understand that and if the government driving towards all green, is that a balanced diet? God knows! What's the government trying to do? Educate people?"

People know if you eat a MacDonald's every day, you get fat and you die or you don't. That to me is achieving nothing. The Fat team is thousands of people. The salt team is thousands of people. The sugar team, thousands of people. Again, what's the end goal? I don't think the government has an end goal really. I think the government think people should know more about it. But nobody enquires about RED TRACTOR, GDAs. We get people..."

The most common one is intolerances. People think they have an intolerance to wheat, lactose or celiac which is more of a food fad than anything else. So we say eat that or don't come in. Job done.

We have full nutritional break-down of every single...so we know, nutrition, calories, fat, the whole thing broken down. So if you buy Toulouse sausage with mash and red wine jus, we tell you exactly what's in there nutrition wise...The FSA would drive you towards as a consulting council of people representing high street, retailers, food restaurants. It's not a consulting process. It's an end to getting traffic lights on the menu which is a horror. So general public, Joe Bloggs has no interest."

The key informant was also vocal in his consternation regarding supermarket retailer behaviour towards food suppliers in the industry despite their claimed 'green' or sustainability credentials. It was stated that suppliers prefer to deal with food service organisations such as Tragus Holdings owing to the perceived long-term engagement and commitment of food service businesses over supermarkets. Additionally, it was claimed that financial margins are more easily realised and generally reinvested into supply base businesses with food service businesses such as Tragus, who collaborate to encourage spend on issues such as Health and Safety, quality assurance, responsible behaviour and environmental measures. On the other hand, supermarket retailers in general (aside from Waitrose) are referred to scathingly in the context of their approach to suppliers. It was stated that supermarkets generally drive margins down to 'the tenth' based on volume. While the key informant recognised the short-term advantages for retailers to premise price on volume describing it as 'good buying', it was stated that behaving in this manner squeezes supply businesses, constrains fiscal capacity, constricts economic viability and hampers the drive for improving the quality of products.

The participant explained that as with PAS 2050, the business is not engaged with the use or adoption of the voluntary ISO 14040 and ISO 14001 series. Indeed, it was reiterated that most environmentally responsible efforts are undertaken either by or in collaboration with its 3PL company Wincanton. Carbon footprinting is perceived as more of a 'green' marketing tool open to 'greenwash'.

6.3.f.v Consumer Choice and Preference: Perceptions

In terms of customer pressure, the key informant perceives that consumers would prefer English produce due to demands for provenance, fewer food miles and lower carbon footprints. However, it is emphasised that its retail restaurants are Italian and French and thereby serve French and Italian cuisine. If practical, economically viable and appropriate for the restaurants it serves, the interviewee stated their business does source English produce. Yet, the participant stated he remained unconvinced at the standard and quality of English produce. The below excerpt outlines an example presented by the interviewee to explicate his frustration:

"Jamie Oliver ran a thing on Channel 4 where he would say: 'Why would you buy French pig for your restaurants in the UK?'...

and we declined an interview with that because actually French restaurants selling French pig is not, you know...

If you want to run a French restaurant selling English pig, you'd call it 'Joe's Caff'. You know you wouldn't call it 'Café Rouge' but again where we can find quite deliberately a source closer to home, then we'll do that. But, equally, then the English are not good at producing goods. Full stop."

It was pointed out that in the context of 'sustainability', fish commodities had increasingly been subject to public scrutiny. This is said by the interviewee to be because '*fish is media driven*'. In response, Tragus Holdings utilise a company called CMI. This company offers what was described as '*multi-faceted back up services*' to conduct quality, production, provenance, legality and sustainability

checks on businesses supplying the commodity in question. Below is an excerpt from the interview detailing the key informant's comments regarding fish commodities:

"Say we list a tilapia or you know, something a bit more exotic. They would go back and check the company behind that sustainability resource, is it farmed, is it free, and so on and go back and check that. So we do not sell any fish in our restaurants that is not sustainable.

Fish is probably a good example probably because people are really up on fish but probably only because fish is media driven. Cod fishing, over fishing in the Atlantic and you know, all that palaver. We use a company called CMI who, they provide multifaceted back up services to us. Say we list a tilapia or you know, something a bit more exotic. They would go back and check the company behind that sustainability resource, is it farmed, is it free, and so on and go back and check that."

CMI are said to act as an effective intermediary in ascertaining the sustainability of food commodities served at Tragus Holdings' high street restaurants. The intermediary organisation is also said to provide a sense of legitimacy to its products via a valid and valued detailed analysis of all commodities the findings of which are transparent and easily communicated to the public. This is deemed of significance as it is thought of by the interviewee as a useful tool to respond to customer enquiries regarding the provenance, animal welfare, and other 'sustainability' credentials.

Another example regarding the type of customer query the key informant is familiar with is queries specifically relating to certain aspects of the commodities served at its restaurants such as questions relating to provenance. Here, it is proffered that in fact, animal welfare standards for chicken are much higher in Brazil (where the chicken for its restaurants is sourced from) than in the UK and therefore of a superior quality. They're also cheaper. This set of credentials is balanced against the supply and distribution miles resulting in a commodity of a higher quality, with a superior standard of animal welfare served at its restaurants despite the miles travelled. An excerpt from the interview in this context is provided below:

"...Very often we'll get challenged by Joe public saying is your fish is sustainable? You know, if a customer in a restaurant asks where does my chicken come from and the answer is Brazil and there's a hooha but actually in Brazil, there's much better standards, they're virtually free range living in the wild. They have their own sheds they sleep in at night and they are a per se, happy chicken as opposed to a UK chicken that is dull, miserable, lives for 32 days then gets chopped in a hugely compacted area. So, you see behind that it's about animal welfare and you balance that off against, I mean the carbon footprint. I mean, it's shipped in from Brazil, it's not flown and understanding that mechanism on the distribution as well, shipping that across. We would rather have that than UK chicken for animal welfare reasons and quality and price traded off against the carbon footprint."

To conclude, sustainability concerns are considered and actioned via an assortment of avenues dependent on the specific context and nature of a given product and business focus. What seems an ad-hoc approach to sustainability and other 'green' standards is in fact a systematic identification of issues that are outsourced to a number of businesses to ensure assurance of quality, sustainability and other environmental attributes and compliance in order to meet external regulatory compliance demands.

6.4 Summation of Case Study Interview Results

Out of the five key informant interviews from UK food supply businesses, all but one interviewee (the food service retailer) looked upon the PAS 2050 carbon footprint standard with some level of positivity. The key informant from case study 5 stated absolute scepticism at any form of environmental regulatory policy whether compliance is mandatory or voluntary unless tangible and relevant to its business. The four remaining key informants all at a broad level, indicated that use of PAS 2050 could potentially increase their business's reputational integrity amongst its suppliers particularly with its national and international applicability. Yet carbon footprint labels underpinned with PAS 2050 received a mixed response in terms of its perceived usefulness.

All interview participants expressed concern regarding climate change and perceived the reduction of carbon emissions, waste minimisation, packaging and pursuit of more sustainable modes of food production as well as logistical supply to be significant factors currently facing the food and drink sector. Aside from one interviewee (the food service retailer - case study 5), each key informant interviewee specifically talked about future climate change challenges and three of the participants (the alternative organic producer, the international conventional fruit producer and the SME food manufacturer) talked about past weather events having already directly and adversely impacted food production for their businesses.

Every interviewee articulated consternation at present and future scenarios of energy costs and hypothesised such price hikes would directly impinge on their businesses. Other specific concerns stated amongst the sample related to perceptions (typically vocalised as frustration) that despite present and potential decarbonisation activities at the internal business level and externally across supply chains, energy systems continue to be reliant on increasingly expensive fossil fuel resources that are equally likely to become more volatile in the future. This is attributed to the lack of national energy security, growing demand, geopolitics, depletion and insecurity of supply. It is recognised by most interviewees that the PAS 2050 standard in terms of its content, specification and applicability was designed to overcome the diversity of LCA approaches used to underpin carbon footprint calculations for products and services given the increasing imperative to reduce GHG consumption in times of climate change. This is corroborated by the technical author of PAS 2050 who suggests the impact of PAS 2050 is seen to stretch to a broad but distinctive range of benefits for food businesses including:

- Reduction of adverse environmental impact, principally climate change
- Credible/authoritative emissions reductions and efficiency gains
- Emissions reductions are quantifiable and verifiable
- Raise awareness of carbon footprints
- Provides clear market leading edge
- Creates wider reputational credibility amongst end-consumers and supply chain actors

While part of the policy entrepreneur response to the development and launch of PAS 2050 was to espouse the above, the stated benefits of the policy imperative were not perceived uniformly across different food supply chain businesses. The extent of adoption of carbon footprinting using PAS 2050 and pursuit of carbon footprint labelling amongst the sample is outlined in Table 18 on the following page. Most businesses at the production and manufacturing stages further upstream of their respective supply chains expressed frustration as to the time, effort, cost, level of commitment required, changes in demands from retailers and uncertain market demand for carbon footprinting and labelling via PAS 2050. Conversely, the supermarket retailer (here, supermarket retailer dissonance in response to PAS 2050 is also recognised) and restaurant retailer were most scathing and outwardly critical of governmental influence and/or intervention in mandatory target setting for green consumption via regulatory legislative frameworks, especially the CRC.

With respect to the level of engagement with the PAS 2050 standard amongst the food supply chain businesses interviewed, this also varied across the sample. Notably, the restaurant retailer, while conscious of elements of carbon footprinting and other sustainability measures, assigns the responsibility for these aspects by outsourcing either through their external logistical carriers and/or specialist companies who address all mandatory legislative requirements pertinent to the organisation. The supermarket retailer however, was at the forefront of PAS 2050 development and implementation with their pioneering work in the PAS 2050 carbon footprinting of its dairy farms and subsequent carbon footprint labelling of conventional milk sold at its stores. However, the impetus to continue carbon footprinting products using PAS 2050 and following through with carbon footprint labelling appears to have waned given the uncertainty of market uptake of the scheme which appears to be overshadowed by a wide number of other 'sustainability' initiatives and 'green' schemes the retailer has chosen to actively pursue. At the manufacturing level, no engagement with PAS 2050 has been possible given the priorities for the business to seek operational efficiencies, quality control, to ensure freshness and the seasonality of produce supplied to its supermarket retailers.

At the producer level, both businesses fully engaged with carbon footprinting using PAS 2050 although the producer that supply to supermarket retailers also followed through with carbon footprint labelling. The remaining producer supplies direct to food consumers via local box delivery schemes as its business model is based on a co-operative network of regional UK farms that produces and supplies its goods as an alternative to conventional supermarket retail. Given the nature of the product types offered to its consumers, this producer did not deem the communication of its carbon footprint exercises via the carbon footprint labelling certification process as relevant to its business either from a marketing perspective or from the provision of information point of view.

Table 18 Carbon Footprint and Carbon Label Uptake: Perceptions

UK Food Supply Chain Business	PAS 2050 Adoption	Commitment to continue PAS 2050 work	PAS 2050 use brings operational & logistical efficiencies	PAS 2050: competitive advantage	PAS 2050: Effective tool for identifying & reducing carbon emissions	PAS 2050: Welcomed standard/initiative	PAS 2050: commercial sense	PAS 2050: enhances supply chain collaboration and trust amongst suppliers	Carbon Label Adoption	Carbon Label: Effective tool drive behavioural change amongst consumers	Carbon Label: Effective Marketing Tool
Riverford Organic Vegetables	✓	×	✓	×	✓	✓	✓	×	×	×	×
Sainsbury's	✓	✓	✓	×	✓	✓	✓	✓	✓	◇	◇
Colors Fruits	✓	✓	✓	✓	✓	✓	✓	◇	✓	◇	◇
Northumberland Foods	×	×	●	●	●	◇	●	●	●	◇	●
Tragus Holdings	×	×	●	●	●	×	×	●	●	×	●

Key:

✓ = Yes

× = No

◇ = Partially/Unsure

● = Not applicable

6.5 Key Findings against Research Propositions

The Key Findings drawn from the food chain case study data and are listed below. The Research Propositions were derived from a detailed reading of the literature around the PAS 2050 carbon footprinting regulatory regime and parallel contexts. These are also numbered and detailed below together with a snap shot summary of the key findings against each of the research propositions (from Proposition numbers 1 to 12) and outlined in Table 19.

Key findings from the food chain case study data

1. Gaining competitive advantage is not considered a key driver for uptake of carbon footprinting but is perceived as a potential ancillary benefit.
2. The marketing potential of carbon footprinting via carbon labels is uncertain and not considered as a significant driver for uptake.
3. Key barriers to uptake relate to lack of know-how, perceived high-costs for implementation, time constraints, lack of commitment at the internal strategic level within businesses and supermarket retailer dissonance.
4. Another significant barrier for uptake is the pressure for food supply chain businesses to focus on food safety, quality and cost control and to comply with other existent governmental and market-led regulatory policy frameworks.
5. There are inherent challenges for food supply chain businesses in their carbon footprint attempts. These largely relate to the need to avoid technical confusion in communicating carbon footprint information via labels. These barriers at a more specific level comprise:
 - i. supermarket retailers' shifting levels of engagement, demands and expectations;
 - ii. uncertainty as to how competitors will interpret the PAS 2050 process for carbon footprinting and certification; and
 - iii. the difficulty in comparability of carbon footprints within same product types.
6. Analogous to demonstrable proactive 'green' behaviour, UK food supply businesses also consider the seeking of substantial operational efficiency gains as key drivers for uptake. More specifically, the following benefits of uptake derived from the findings of those participants that adopted PAS 2050 and pursued carbon labelling are highlighted here:
 - i. Adoption enables the use of a pro-active nationally and internationally applicable policy tool to reduce adverse environmental impact by seeking efficiency gains parallel with carbon reduction;
 - ii. Demonstrable commitment to mitigate climate change and comply with international climate change targets;
 - iii. Credible/authoritative emissions reductions and efficiency gains;

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- iv. Emissions reductions are quantifiable and verifiable;
 - v. In its use, PAS 2050 helps raise awareness of carbon footprints especially if labelling at the product level is pursued;
 - vi. Provides clear market leading edge (for adoptees); and
 - vii. Creates wider reputational credibility amongst end-consumers and supply chain actors.

- 7. Despite the requirement in PAS 2050 for a bottom-up process analysis approach for product carbon footprinting, most carbon footprint efforts are top-down in nature as most are retail-led and thereby driven, interpreted and stipulated by downstream retail participants.

The following sections explore these findings in the context of the propositions relating to the supply chain element of the food chain (propositions 1 to 12). These are summarised against each of the key findings, and then, against each of the supply chain case studies which are outlined in tabulated form in Table 19 on the next page.

In the area of food policy making, corporate interests dominate but the theoretical basis for food policy making remains individual change. Corporate engagement in environmental issues around food policy is less about concern for environmental change but more about fending off any threat through environmental legal regimes that would influence trade. There seems little link between food products and environmental policy except to using environmental labelling to suggest a 'feel good' factor among purchasers. The supermarkets are essentially an oligopoly that can choose to accept or abandon any constructive environmental governance. Regulation is essentially relying on a version of nudge economics where there is no pull factor from the State that implies better socio-political decision-making in the food chain and thus there is reliance only on a push factor which is not sufficiently strong to encompass and drive social change. Green supply chain management generally ends up as 'greenwash'.

In the parallel contexts, of food safety and nutrition and health, standards are underwritten by science because the science is less complex than that of the carbon issue but also the regulatory regime is more enforceable. However, adoption of these standards addresses individual responsibility rather than the social problem of climate, or broader environmental concerns. The push for omni-standards and labelling is laudable because its origins are set in thinking through food policy issues as a socio-political process. The weakness of omni-labelling however, is that the very categories assumed are not measurable by conventional positivist science.

Table 19 Propositions relating to findings from food chain case studies

Key Propositions		Key finding number against Proposition	Individual Case Study Number ¹² against derived findings
Proposition 1	Carbon standards and labelling are not robust but in decline. Continued non standardisation of carbon accounting tools brings them into disrepute.	Key findings 1, 2, 3, 5 and 7	Case studies, 1, 2, 3, 4 and 5
Proposition 2	Carbon footprinting is a techno-political solution that substitutes a false science for a robust food policy.	Key findings 1, 4, 5, 5.i, 5.ii, 5.iii and 7	Case studies, 1, 2, 3, 4 and 5
Proposition 3	There may be universal access to PAS 2050 but there is no universal uptake. The policy framework is from strong food security to weak sustainability.	Key findings 4, 5, 6, 6.i, 6.ii, 6.iii and 7	Case studies, A, 1, 2, 3, 4 and 5
Proposition 4	There is little link between food production, consumption and environmental policy. The fragmentation of science informing food policy is influenced substantially through the private and corporate control of science.	Key finding 1, 2, 3, 4, 5 and 7.	Case studies, 1, 3 and 4
Proposition 5	Corporate uptake of environmental issues, especially climate change is largely precautionary due to the threat of an international legal regime.	Key finding 6.i, 6.ii, 6.iii, 6.iv, 6.v, 6.vi and key finding 7	Case studies 1, 3, and 4.
Proposition 6	Near consumption actors (supermarkets) are the powerhouse of oligopoly that control food policy making. Corporate interests, not that of the State, is the arena for food policy making.	Key findings 6.i, 6.ii and 6.iii and key finding 7	Case study: A, 1, 3, 4 and 5
Proposition 7	Choice architecture has a fall-back position of nudge economics. Nudge economics is the economics of 'push' with no 'pull'.	Key findings 1, 2, 3, 4, 5, 5.i., 5.ii, 5.ii and 7	Case studies, 1, 2, 3, 4 and 5
Proposition 8	Green supply chain management is 'greenwash' – ISO 14001 is as close as it gets.	Key finding 7	Case studies, 2, 3 and 4
Proposition 9 Food Safety	Regarding food safety, standards are underwritten by science and law but this is complex, confusing and sometimes contradictory.	Key finding 4	Case study 2, 3, 4 and 5
Proposition 10 Nutrition and Health	Regarding nutrition and health, food behaviour is targeted and changed but only at the individual level, never summarised to the social and the environmental problem which is essentially social.	Key finding 7	Case study 2, 3, 4 and 5
Proposition 11 Omni/Meta Standards and labels	Omni standards and labelling regimes would require a humanistic and social science approach that is neutral to corporate and private gain but the science of food policy is physical science of distance from human beings, while social science is increasingly for corporate and private gain.	Key findings 5.i, 6.i and 6.ii	Case study 3
Proposition 12	There is need to move from the consumer with individual responsibility to consumers with collective social environmental responsibility.	Key findings 1 through to 7	Case study 1, 3 and 4

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Case Study A – The Carbon Trust: Civic Society Organisation

Case Study 1 – 'Riverford Organic Vegetables: Alternative' organic fruit and vegetable producer and supplier

Case Study 2 – Sainsbury's: Supermarket Retailer

Case Study 3 – Colors Fruits: Conventional fruit producer, distributor (supply to UK supermarkets)

Case Study 4 – Northumberland Foods: Manufacturer (supplier to UK supermarkets)

Case Study 5 – Tragus Holdings: Food service retailer

With regard to Propositions 6, [That near consumption actors (supermarkets) are the powerhouse of oligopoly that control food policy making; and that corporate interests, not that of the 'State' are now the arenas for food policy making] the dominant theme from the supply chain case studies is that supermarkets control the supply chain, not allowing for independent action to address environmental concerns, even though the individuals interviewed openly expressed support for environmental initiatives. The key suggestion is that the drive to free trade in international markets would make voluntary uptake of carbon footprinting and labelling more likely but also more expensive. Yet, this is limited by the role of voluntary standards and labelling as levers for behavioural change given as Proposition 7 suggests, all food chain actors collectively concede that such 'novel' and 'contemporary' social and environmental standards are quite different to those which emphasise 'quality' attributes and therefore, the choice architecture in which carbon footprinting and labelling regimes occur, rather than becoming a launchpad for transformative change, instead become a fiscally centred framework of 'choice', resulting in a fall-back intervention position of 'nudge' economics. Indeed, the case material, specifically with respect to all food chain actors, bar Dr Sinden from the Carbon Trust (the civic society NGO), indicates that irrespective of supply chain position or type, all food chain actors expressed frustration with respect to the 'space' in which such private regulatory schemes function. This is against a context in which each of the key actors also express growing levels of awareness of, and need to demonstrate CSR credentials. However, a business's ecological agenda often competes with other functional agendas for resources. The widening series of pro-environmental and social, market-led regulatory standards and labelling schemes for different environmental and social issues simply exacerbates the increasing haphazard proliferation and variation in the uptake of such 'nudging' tools in the food market. Such nudging tools like carbon footprinting and/or carbon labelling, despite their 'robust' scientific and 'standardised' accounting methodologies end up being heavily driven by the most 'powerful' actors within any given chain, leading to top-down forms of chain governance, largely dependent on the strategic orientation of downstream retailers and their own conceptualisations of 'sustainability'. This corroborates Proposition 7 – that nudge economics is simply an economics of 'push' with no 'pull'.

Regarding Proposition 5 [Corporate uptake of environmental issues, especially climate change is largely precautionary due to the threat of an international legal regime.], the case study interview data largely indicate a pragmatic response to market conditions rather than to regulatory regimes. With reference to Proposition 4, [There is little link between food products and environmental policy.] only the organic producer and supplier of food recognises the link between food and the environment by action and external involvement directly linked to food production and supply to environmental policy. Supermarkets capture control of both the supply and demand functions of the market. This in fact works against the notion of a 'food chain' because what is evident is a series of food nodes, the most dominant of which is the retail supermarket. The case studies imply that there is a primacy of supermarkets in the supply chain, confirming oligopoly status. Environmental concerns are not the dominant concern but an incidental nudge. Competition between suppliers and quality and price for consumers are the essential drivers which demonstrates that with respect to the case material in this

sample, carbon standards and labelling are not robust but in decline. This also demonstrates that continued non-standardisation of carbon accounting tools brings them into disrepute (Proposition 1).

In the interviews, there is a consciousness of the 'voluntary' EMS series (ISO 14000/1) but adoption is perceived as essential in order to function and compete within the manufacturing sector especially. ISO 14000/1 reinforces the power of the supermarket up the supply chain who often pass responsibility onto non-governmental but market-led institutions such as the British Retail Consortium who administer the uptake of ISO 14000/1. Essentially, for conventional production and supply chain businesses, it is a wall that must be climbed in order to function within the market at the very minimum as suggested in Proposition 2 [Carbon footprinting is a techno-political solution that substitutes a false science for a robust food policy.] The outcome is not to address the environmental issues directly but to have a record/audit trail for supermarkets, allowing 'soft' governance without mandatory regulation, thus providing legitimacy for government intervention in the food industry. However, increasing regulation is highly unlikely in a market dominated by the power of supermarket retailers whose influence on policy making is legitimised through non-governmental organisations such as the British Retail Consortium who oversee the market-led voluntary standards for the food chain. This limits competition in that it creates a barrier for entry into the market. These points support Proposition 8, that: Green supply chain management is 'greenwash' – ISO 14001 is as close as it gets.

Food safety and food quality in the context of nutrition and health are a necessary condition for entry into the market but even here, backed by strong 'science', the regulatory regime is robust but the movement to labelling is confusing. Food safety and quality is particularly important in food manufacturing and final preparation (retail restaurants). Food safety and quality appears to become more important the closer it gets to consumption across the food chain. According to the interviews, this is the case for food manufacturing, preparation and supply to consumers via retail (supermarkets and restaurants). Food behaviour targets change but only at the individual level. With environmental policy making, policy makers are dealing with a social problem not an individual problem. With climate change, policy making is concerned in dealing with a range of inputs (carbon equivalents) that are difficult to control as a totality (for example, a change in the electricity problem would probably save more carbon than individual carbon footprints). The overall sense from the interviews is that no-one frames this as a social problem requiring a social contract but is perceived as an individual isolated element that can be addressed. This corroborates Proposition 9 and 10 respectively, i.e. that regarding food safety, standards are underwritten by science and law but this is complex, confusing and sometimes contradictory. Regarding nutrition and health, food behaviour is targeted and changed but only at the individual level, never summarised to the social and the environmental problem which is essentially social.

The interview data suggests a strong disconnect between producers and consumers in an urbanised food provision environment within a developed country context such as the UK. These findings across the each of the industry case studies, support Proposition 3 (that there may be universal access to PAS 2050 but there is no universal uptake). Sustainability is largely regarded as a biophysical process

rather than being a necessary social contract. Therefore, the policy frame appears to move largely from food security towards sustainability (Proposition 3). However, sustainability tends to be based on biophysical measurement of individual items for individual consumption, i.e. product carbon footprint labels. As suggested in Proposition 4, i.e. that the fragmentation of science informing food policy is due in the main, to an increasing level of the private and corporate control of science, means that in the context of policy making for food sustainability, this has simply reinforced efforts to provide 'robust' science-based, standardised standards and leads to a decrease in the recognition of food as a social good. Rather, with respect to sustainability efforts and thereby, in the move from food security to sustainability as a policy framework, there is a re-emphasis on the individual contract rather than food as a social good. This finding fits with Proposition 11 [There is need to move from the consumer with individual responsibility to consumers with collective social environmental responsibility].

The most dominant voice from the interviews that regards the political economy of food as a social system that has to be addressed is that of the international fruit producer and supplier and the UK based organic or 'alternative' food producer and distributor. Here, sustainability objectives are viewed as a necessary component of their local and global business operations that must be approached in a 'holistic' manner and integrate the individual needs of their employees, including employed farmers as a social system. This implies not just social sustainability within the food chain itself but also active consideration of social sustainability at each node of the food chain as with Proposition 12 [Omni standards and labelling regimes would require a humanistic and social science approach that is neutral to corporate and private gain, but the science of food policy is physical science of distance from human beings, while social science is increasingly for corporate and private gain.]. Because given the different scale of issues across the case study sample set, transport is not an issue 'on farm' or for manufacturing/processing but is an issue from wholesale to retail. Logistical operations are thus not an issue beyond retail as logistical operations tend to be absorbed and provided by the supermarket and food service retailers who convene individual tender contracts for supply across the upstream nodes of a given food chain as necessary.

The next chapter focuses on a discussion of both the consumer case study survey data first presented in Chapter 5, and food chain case study interview data charted above in Chapter 6.

* * *

Chapter 7 – Discussion

7.1 Introduction

This chapter discusses the findings from the consumer case study survey in Chapter 5 and findings from the food chain case study interviews outlined in Chapter 6. It is useful to refer to the diagram of the policy triangle adapted from Walt and Gilson (1994) to show that the context of carbon footprinting and carbon labelling, content, processes and key actors have been considered, including a description of the key actors utilising a case study approach. The latter sections of this chapter incorporate a discussion of the findings deduced from both survey instruments which were utilised to assess the consumer and food supply chain response to carbon footprinting and labelling in the UK in an attempt to address the main research question and sub-research questions defined in this thesis. The next section begins by discussing the descriptive quantitative findings first presented in Chapter 5.

7.2 Public Knowledge and Awareness of Carbon Footprinting and Labelling: Consumer and Food Chain Business Context

Consumers tend to largely lean towards the more traditional consumption priorities of price, quality and taste over other altruistic purchase behaviours in the first instance. This is despite the fact that 68% of consumers in this study expressed significant shopping habit changes over the past ten years, with consumers shopping more for free range, fair trade and more locally sourced food products. These purchase habit changes amongst consumers were stated to be influenced largely by concern for the environment and associated with school and education. Conversely, only 9% of the sample stated their shopping habits had shifted towards purchasing carbon labelled products which is perhaps indicative of the emergent state of carbon footprint label proliferation in the downstream/demand element of the UK food market's supply chains.

The findings also illustrate that within the sample, consumers nevertheless would like to see carbon footprint labels on products with 72% of the sample stating so but because poor-market proliferation and lack of understanding in terms of interpreting carbon footprint information persists; this hinders consumers' attempts to compare carbon footprints within 'same' product categories. This suggests that while general confusion and misunderstanding of carbon footprint labels is evident amongst UK food consumers (with a total of 89% of the sample agreeing or slightly agreeing that carbon footprints are confusing), this is not due to apathy or a lack of willingness to engage with carbon labelling as consumers do want to be able to make choices regarding the carbon credentials of food products (as demand for carbon labels in this sample is 72%). Essentially, consumers are not well informed about carbon footprinting or carbon footprint labelling more broadly. Given carbon footprint labels are relatively new to market and the prevalence of confusion in interpretation of information amongst the sample, consumers ultimately do not feel empowered to base purchase decisions on the comparison of carbon footprint labels alone.

Despite the sense that consumers feel disempowered to discern carbon footprint label differences across and within product categories, the overall consumer response to carbon footprint labels is positive given the high demand for carbon footprint labels at 72%. This is also reflected in this study's

findings. In total, 53% of consumers stated they perceive climate change as either an 'important' or 'very important' factor when purchasing food. Additionally, although the attributes of quality and taste, price and special offers are prioritised by consumers, the contribution food products make to consumers' health and nutrition are also considered as important factors within the sample. Interestingly, while 83% of consumers do not know their own personal carbon footprint, the highest number of the sample that did claim to know their personal carbon footprints are the youngest consumers of the sample with 13% of up to 20 year olds and 10% of 21-30 year olds. At the polar opposite end of the spectrum, those aged between 56 and 65 were the least likely to know their own personal carbon footprints. This indicates there is scope for the delivery of carbon footprint labelling and improved environmental attributes for food given the existence of a receptive audience. Notably, the greatest level of willingness to engage with carbon footprint centred efforts is expressed mostly by younger shoppers who are the future generations that will be around to deliver carbon reduction targets set for 2050.

This is an important result relating to the purpose of carbon labels and the future delivery of carbon-related targets. If policy makers hope to achieve carbon reductions through food purchasing, then consumers have to be given appropriate within-category choices by retailers and that premiums on low carbon products may not be paid. However, this immediately presents a challenge to the retailer because as soon as two comparable and substitutable products are offered, one with a higher carbon footprint than the other, the carbon-conscious consumer is likely to choose the latter but only if price is comparable. As a result, sales of the high carbon product may fall and sales of the low carbon product may rise but without a price differential, there is no increased revenue to recover the costs involved in measuring the carbon footprint of either (Shewmake et al., 2015; Cohen and Vandenberg, 2012; and Galizzi, 2012). As the market evolves, one would of course expect a price premium to be attached to the low carbon product (or conversely for the price of the high carbon product to be eroded). However, the lack of maturity of carbon labelling and the emergent market for low carbon products possibly illustrates why retailers' initial efforts to carbon footprint products have been in quite dissimilar and distinct product categories (for example, light bulbs versus orange juice).

The consumer survey corroborates similar findings from the literature (Reisch et al., 2013; Cohen and Vandenberg, 2012; Vandenberg, 2011; Upham et al., 2011; Black, 2010; Peattie, 2010; Hayes, 2009), firstly that stated preference is not necessarily matched by purchasing behaviour and that stated preference might also be biased by the survey instrument itself, which prompted responses to environmental concerns in food production. Secondly, that although there was little differentiation by gender, there seemed to be a stronger shared preference by the younger age group. Thirdly, the more specific findings include: (i) consumers are increasingly aware of climate change and many consumers' shopping habits over the past ten years have shifted towards considering: free range, fair trade, locally sourced food, organic, and less processed food products; (ii) despite growing awareness of 'green' issues when shopping for food, consumers continue to be primarily concerned with price, special offers, quality and taste when shopping for food; (iii) carbon footprint labelling does not address other environmental impacts or wider sustainability issues that consumers are also increasingly aware of; (iv)

consumer demand for carbon footprint labels is relatively strong but this is also contradicted by the fact that consumers find carbon footprint labels confusing and difficult to compare especially within 'same' food product categories; (vi) the carbon labelling of different product categories has not so far stimulated further carbon labelling efforts of competing product lines, exacerbating the difficulty for consumers in comparing footprinted products; and (vi) carbon footprint labelling for communication and information is unlikely to generate a lower carbon food basket for UK food shoppers.

While the findings from the consumer case study in Chapter 5 confirm to a large extent the peer-reviewed literature outlined in the Parallel Contexts in Chapter 3, the data also show the inherent difficulties in integrating and balancing the need to avoid technical confusion in attempts to carbon footprint food and communicate carbon footprint labels on food products for consumers. These difficulties are exacerbated by the fact that much of the debate on food supply chain sustainability and climate change continues to take place at the discursive level. As mentioned towards the end of Chapter 3, and evidenced in this study's findings, this has, in part, probably been caused by the increasing convergence of climate change and energy policy agendas, especially in the case of the UK (Taylor, O'Brien and O'Keefe, 2016 and Bulkeley and Owens, 2009). The analysis of this study's consumer survey data has led to the following key conclusions of this research study.

- PAS 2050 carbon footprinting and carbon labelling are both voluntary policy imperatives that focus on carbon and as such do not consider other key sustainability issues.
- Given PAS 2050 and carbon footprint labelling are both voluntary initiatives in the UK, the market and consumer response is non-uniform as not all food products are carbon footprinted or display carbon labels at the point of sale.
- Due to low market proliferation and uncertainty of demand, the overall effectiveness of PAS 2050 carbon footprinting and carbon labelling of food products in decarbonising UK food supply chains remains difficult to ascertain.
- Voluntary schemes require time and sufficient demand to become embedded in the psyche of key food supply chain actors across the entire food supply chain spectrum prior to widespread adoption and diffusion.
- The ad-hoc and punctuated scene of uptake is largely due to the emergent stage of such policy initiatives at the market level in the UK.

From the analysis of the contemporaneous environment of UK food policy literature as well as the findings of this study, it is increasingly clear that policy orientated carbon footprinting and labelling is largely top-down in nature (despite the bottom-up LCA process analysis requirement of PAS 2050). This will facilitate decarbonisation but not necessarily comprehensively drive a fully decarbonised food chain. Thus, reducing carbon-heavy consumption through voluntary carbon footprint policy imperatives may possibly do little to mobilise a transformation of the food system (Mayes, 2014;

Marsden et al., 2013; Galizzi, 2012; and Shove, 2010). Further, despite its standardised LCA method, the PAS 2050 standard may do little to reduce carbon loaded food product chains or promote proactive engagement with environmental initiatives and 'green' behaviour amongst food supply chain actors and end-users alike. This is largely because voluntary policy imperatives centred on a single-issue product-process such as carbon are not all encompassing (Garnett et al., 2015; Geels et al., 2015; Lang and Barling, 2013; Upham et al., 2011). Further, and as shown in this study, PAS 2050 carbon footprinting and subsequent carbon labelling may not necessarily effectively promote within 'same' category comparisons given disparate uptake and the non-uniform response by food supply chain actors in the adoption of PAS 2050 carbon footprint and carbon label initiatives. Indeed, such schemes require time and sufficient demand to become embedded in the psyche of key food supply chain actors across the entire food supply chain spectrum prior to widespread adoption and diffusion (Shewmake et al., 2015 and Marimon et al., 2012). At present, this has led to an ad-hoc and punctuated scene of uptake and is largely due to the emergent stage of such policy initiatives at the market level, as demonstrated with the existent 'state of play' with respect to carbon footprint labelling in the UK.

A distinct challenge for the food industry also relates to seasonality, where the relative differences between the carbon footprint of substitutable products varies depending on time of consumption and their location of origin. For example, although domestic soft fruit may have a lower carbon footprint than an imported alternative during the summer months, the imported soft fruit may be more carbon-competitive when the domestic alternative requires heat induced growing in greenhouses. In such categories, the label would have to ensure the consumer recognised some annual aggregate value, a further potentially confusing attribute (Dendler, 2014; Grunert et al., 2014; Edwards-Jones et al., 2009; and Lillywhite and Collier, 2009).

Given the latter focus within this section on the role of consumers in contributing towards delivering a lower carbon future, (principally via the purchase of low-carbon food products), the next section moves to consider more specifically the supply chain response to PAS 2050. This is because it is food supply chain businesses that are ultimately involved in the provision of food to the market place. The following section accordingly begins by discussing the interview findings of this study that is the food-supply chain response to the PAS 2050 carbon footprint standard.

7.3 Food Chain Case Study Findings – Perceptions of PAS 2050 in UK Food Supply Chains: Process and Content

The interview data within the 6 case studies illustrate that despite widespread knowledge of the overarching challenge of climate change amongst the sample, together with direct experience of its negative net effects on production and supply, most emphasis by upstream and mid-stream suppliers relates to price and conditionality agreements together with contractual specifications stipulated by supermarkets as dominant concerns. For these upstream and mid-stream suppliers, stress on quality

control, market competition, resource base depletion, energy price hikes and supermarket supremacy are also cause for consternation.

In general all participants were carbon 'worried' but were not sure whether end-consumers would want carbon footprint labels on products or translate expressed 'willingness to say' into 'willingness to pay' for carbon footprinted products. In terms of their own effectiveness however, most suppliers' emphasis is placed on the minimisation of operational costs. With respect to retail downstream businesses, both the supermarket and restaurant retail business seek preventative market positioning. For instance, though the restaurant retailer is scathing of most environmental regulatory policy imperatives, the business is adept at responding to and pre-empting market demands. For example, all fish sold in its restaurants is from sustainable sources.

In light of the food industry case study findings of this study, and the correlations highlighted by Chkanikova and Lehner, 2015; Freidberg, 2014; Marimon et al., 2012; Arimura et al., 2011; and Mueller et al., 2009 (between uptake of the environmental management standard ISO 14001 and further pursuit of other green measures such as carbon footprinting), it is useful to ascertain which of the food businesses that participated within this study are ISO 14001 accredited. Across, the sample, no particular standard or policy either at the internal or external level aside from ISO 14001 had any real influence on whether a business chose to pursue uptake of PAS 2050 and/or follow through with carbon labelling. As outlined in Table 20 below, every food business that was interviewed as part of this research is ISO 14001 accredited aside from Tragus Holdings. However, each of these businesses differ markedly in terms of whether PAS 2050 was adopted or not and in this regard, again varied in terms of their level of engagement, perceptions of environmental legislation and the extent to which PAS 2050 had been utilised.

Furthermore, those food business that chose not to adopt PAS 2050 expressed different sets of rationale for doing so, although aside from one (the food service retailer, case study 5), conveyed genuine concern regarding the degradation of the resource base for agricultural production and water stress. Climate change impacts, the globalised nature of supply, energy intensity of logistical operations, and the overall weight and embedded carbon associated with the distribution and transportation of commodities were all perceived as significant challenges to food businesses. These findings suggest that while the studies by Marimon et al. (2012), Arimura et al. (2011) and Mueller et al. (2009) are useful in terms of highlighting that organisations (irrespective of sector) that pursue environmental standards such as ISO 14001 tend to behave more proactively in terms of pursuing 'green' measures. However, unlike these studies, this research finds that adoption of ISO 14001 in the context of UK food supply chain businesses may not necessarily follow through with carbon footprinting or other 'green' measures either for the business in question or their associated supply chains. This is because for some businesses, the PAS 2050 standard is most useful in the operational sense especially in terms of identifying operational efficiency gains as put forward by Glover et al. (2014), Cohen and Vandenberg (2012), McKinnon (2010), and Coley et al. (2009).

Table 20 Table Outlining Level of 'Green' Policy Engagement against 'Green' Concerns

Food Chain Actors ¹³	ISO 14001 accredited (EMS) Yes/No	PAS 2050 Carbon Footprint Adoption Yes/No	Carbon Footprint Labels Yes/No	Aspirational Carbon Footprint and Label Adoption Yes/No	Climate change concern	Concern re Resource Base use Yes/No	Concern re Water Stress Yes/No
Civic Society Organisation	N/A	N/A	N/A	N/A	Yes	Yes	Yes
Alternative Organic Producer and Supplier	Yes	Yes	No	No	Yes	Yes	Yes
Supermarket Retailer	Yes	Yes	Yes	N/A	Yes	Yes	Yes
Conventional fruit Producer	Yes	Yes	Yes	Unsure	Yes	Yes	Yes
SME Manufacturer	Yes	No	No	Yes	Yes	Yes	Yes
Food Service Retailer	No	No	No	No	Yes	No	No

Excepting the civic society organisation, concerned with carbon policy making for carbon reduction, two of the five UK food supply chain businesses had adopted both the carbon footprint standard, PAS 2050 and followed through with carbon footprint labelling based on the PAS 2050 methodology. The two food businesses who adopted PAS 2050 are the international food producer and supermarket retailer. A third food business, the alternative food producer and supplier had also used PAS 2050 methodology to carbon footprint their internal operations but did not use the standard for verification of its results or follow through with the carbon footprint labelling. This differentiated response reflects a number of variances across the sample that occur in terms of motivations, perceptions modes of application and the extent to which the pursuit of a label on products is made.

In terms of relevance, PAS 2050 is regarded by each food supply chain business, dependent on the context, supply chain type and position of every business. All business participants were more concerned with maintaining market share over the pursuit of voluntary legislative schemes such as PAS 2050. For instance, at the manufacturing level supply chain managers attribute most priority to price which is determined by supermarkets as the dominant concern. Indeed, in this light, it is also market share maintenance that is prioritised over the pursuit of voluntary standards, given the prevailing need to minimise costs and adhere to other quality-centric standards demanded for by supermarket retailers.

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Case Study A – The Carbon Trust: Civic Society Organisation – neutral supply chain position
Case Study 1 – Riverford Organic Vegetables Alternative Organic Producer and Supplier (upstream and downstream)
Case Study 2 – Sainsbury’s Plc: Supermarket Retailer (downstream)
Case Study 3 – Colors Fruits: Conventional fruit Producer (upstream)
Case Study 4 – Northumberland Foods: SME Manufacturer (mid-stream)
Case Study 5 – Tragus Holdings: Food Service Retailer – (downstream food service retailer)

At the producer level, the international producer that supplies UK supermarket retailers is driven by its climate change perceptions, the credibility that the PAS 2050 standard is designed to provide, potential market-share retention, expansion and prospective reputational enhancement in the adoption of PAS 2050 carbon footprinting. Conversely, the UK producer that supplies its organic products direct to food consumers via local deliveries (and thus operate independently of retail supermarkets with 'short' local food supply chain networks) interpret the PAS 2050 standard as a tool that helps optimise efficiency savings that could, in parallel potentially improve market share maintenance rather than a market imperative that would effectively limit adverse climate change impact given scepticism is expressed as to its overall potential effectiveness in driving system-wide carbon reductions.

For the supermarket retailer, the relevance of PAS 2050 is also pertinent to its efforts to maintain market share but largely relates to the capacity for retailers to demonstrably exercise a national retailer response to the launch of the carbon footprinting standard and pursuit of subsequent carbon footprint labels.

Another perturbing issue for the international producer is related to the level of effectiveness of the PAS 2050 standard in terms of its interpretation by users through carbon footprint labels given its premise to provide a standardised LCA methodological approach to calculate carbon footprint emissions. Internal and External Drivers and Barriers. In order to make sense of the variances expressed across the sample, it was necessary to categorise the discourse concerning drivers and barriers for the implementation of carbon footprinting and labelling using PAS 2050. This approach builds on that of Walker et al. (2008). For instance, it transpired that many of the perceived determinants for or against adoption of PAS 2050 tended to relay to internal and external business concerns as was found in the study by Walker et al. (2008) who looked into the drivers and barriers to environmental supply chain management in seven different private and public sector organisations. Similarly, given the dichotomous split of concerns expressed at an internal and external level, such drivers and barriers are categorised as *internal* and *external*. Internal issues relate to organisational factors whereas external factors extend to regulatory and legislative regimes, consumers, market competition and society (Walker et al., 2008).

Table 21 outlines the drivers and barriers for the adoption of carbon footprinting/labelling using PAS 2050 elucidated from this study's interview participants. Specifically, these were extrapolated from the profiled findings of each key informant interview which resulted in specifically identifiable features. These features are evidently generic in nature, though upon closer investigation are typically characteristic of each participating business's supply chain position. For instance, the focus on lowering operational costs is emphasised by the SME food manufacturer though this was not of primary concern to the supermarket retailer.

Table 21 Internal and External Drivers and Barriers to the Adoption of Carbon Footprinting

<i>Internal Drivers (organisational)</i>	<i>Internal Barriers (organisational)</i>	<i>External Drivers</i>	<i>External Barriers</i>
Internally 'green' driven value culture	Costs	Regulatory	Voluntary nature of policy – perceived as a burden
Desire to pre-empt mandatory policy	Initial costs of implementation	Pre-empt legislative and regulatory compliance	Complexity of standards and guidelines
Desire to reduce energy costs	Ongoing costs of upkeep/continuous improvement	CF and CF labels provide prospective for demonstrative proactive 'green' behaviour/commitment	Time constraints
Desire to lead 'green' initiatives and differentiate from competitors	Lack of knowledge and understanding	Marketing potential	Verification for external communication costly
Reflects the values of owner/s and investors	Priority to focus on lowering operational costs- 'green' initiatives perceived as additional burden	Potential to contribute to policy formation – policy entrepreneurs	Difficulty in exchange of information amongst suppliers and buyers
Employee involvement	Focus on price/bottom line to satisfy/compete	Pre-emption of mandatory legislative and regulatory compliance	Weak buyer commitment
Enhancing know-how/expertise	Lack of commitment from management	Customer demand (retailers)	Customer (consumers) demand focused on price and quality attributes
Management commitment	Lack of training	Customer demand (consumers)	Lack of consumer demand for CF labels
Existent environmental standards such as ISO 14001 'pave' the way to higher level of proactive 'green' engagement.	High costs for SMEs	Marketing pressures – 'green' marketing	Weak supplier commitment
Often involved as stakeholders in the development of environmental policy	Pressure to adhere principally to stringent quality standards	Potential for greater collaboration with suppliers and buyers	Lack of supplier collaboration, knowledge and economic capacity
CF perceived as potential benefit in terms of energy, production and broader operational activities	CF perceived as additional governmental driven burden	Potential for greater cohesiveness and security in supply chain position	Heterogeneous nature of the food industry
		Pressure on producers' capacity to sustain quality and volume of supply due to climate change	Lack of confidence in methods of calculation and verification/display of results from competitors
		Gain competitive advantage	Poor supplier commitment
		Potential for 'green' marketing	Lack of public awareness, knowledge and relevance
		Improve organisational performance	Perception that public focus on the environment, carbon footprinting and labels is disparate.
		Public pressure and pressure from environmental advocacy groups	The food sector is already flooded by and subjugated to a large number of voluntary and mandatory labelling schemes that relay amongst others to organic versus conventional production, animal welfare, provenance and calorific values.

The case study data from the six key informant interviewees, show there was general enthusiasm for discussing the practicalities and implications of PAS 2050 carbon footprinting. However, adoption of PAS 2050 is disparate as is the pursuit of carbon footprint labels. The response to PAS 2050 amongst the interview participants was most positive and evident in upstream supply chain businesses, where concern for climate change, sustainability and energy costs is also greatest.

Engagement with PAS 2050 does not necessarily follow through with certification for carbon footprint labelling, either because carbon labels are not perceived as suitable for certain product types or relevant for marketing purposes. However, most businesses do pursue carbon footprint labelling, particularly as this is largely supported by supermarket retailers that collaborate with their suppliers in PAS 2050 carbon footprinting efforts. The marketing potential of carbon footprint labels is perceived as potentially useful across most businesses if relevant to the product type. However, this is tempered with concern by most interviewees at the perceived lack of a cohesive and uniform response to carbon footprinting uptake by supermarket retailers. The efficacy of carbon footprint labels to deliver brand reputation credibility is largely uncertain given the emergent stage and relatively early market proliferation of such labels.

Uptake of PAS 2050 carbon footprinting is driven largely at the external and internal level within food supply chain businesses. For instance, those businesses that adopted PAS 2050 carbon footprinting, irrespective of supply chain position considered internal strategic positioning towards decarbonisation as a key driver. Most key informants were also driven by the desire to be 'seen' to respond to public opinion and the growing awareness of climate change. Other key drivers for businesses were to lead in policy formation and adoption, to pre-empt mandatory compliance, to pursue operational efficiency gains and to seek potential competitive advantage through market differentiation.

Barriers to uptake of PAS 2050 principally concern the perceived set-up costs involved for smaller food businesses and the need for such businesses that are dependent on supermarket custom to adhere to retailers' overriding demands for price-conscious products, quality control, freshness and the seasonality of goods. Lack of know-how and commitment from 'top-tier' management at the internal business level are also concomitant with the relatively constrained capacity and leverage for carbon footprinting at the mid-stream stage of food supply chains given the prevailing necessity to retain market share, emphasis on quality control and need to minimise operational costs.

Despite its voluntary policy orientation, some interviewees expressed outward vitriol for government driven climate change policies. Here interviewees readily criticised what are perceived as paternalistic and burdensome regulatory government-led initiatives, explicitly citing the Carbon Reduction Commitment (CRC) amongst other initiatives as an example. Such criticism is most evident at the retail spectrum of food chains including the supermarket retailer and restaurant service retail organisation. However, the supermarket retailer outwardly advocates uptake of PAS 2050 and the pursuit of carbon footprint labels. Conversely, the restaurant retailer which is most concerned with profit maximisation and lean production of its supply chains associate the PAS 2050 carbon footprint standard most strongly with what is perceived as unnecessary interference by the UK Government and its agencies to generate further revenue from the private sector.

On reflection, introduction of PAS 2050 and its related carbon footprint labels has come at a time when the impetus for carbon footprinting has received increasing attention at the policy, industry and consumption levels. The launch in 2008 of the world's first standardised carbon footprint, PAS 2050

(updated and revised in 2011) has been quickly followed by a number of industry-specific carbon footprint approaches. More importantly, at the international level, six other world-wide cross-sectoral initiatives have been published. However, the UK's PAS 2050 which is nationally and internationally applicable remains the most detailed and comprehensive standard to date (Baddeley et al., 2012). Of note, is the fact that PAS 2050 developers at The Carbon Trust alongside DEFRA have worked closely with the WBCSD and WRI to align carbon footprint standard setting under the Greenhouse Gas Protocol's carbon footprint standards. While PAS 2050 is a voluntary policy imperative, in the UK, it is necessary to follow should businesses want to communicate carbon footprint information via labels on SKUs.

However, uptake of PAS 2050 carbon footprinting in food supply chains is dependent mostly upon the business context, supply chain position and supply chain type. For instance, the qualitative findings reveal that much of the economic and policy decision-making in terms of the extent to which sustainability, carbon reductions and wider environmental objectives are pursued, take place at the strategic level and mostly at the downstream, supermarket retail elements of food supply chains. Although, with short, less complex and local delivery type supply chains, the evidence shows that cultural values (namely with respect to environmental consciousness and sustainability issues) of the organisation itself strongly influences the extent and level of engagement with pro-active, emergent environmental policy standards (such as PAS 2050).

The findings of this research study indicate that UK food supply chain businesses are mostly aware and concerned with climate change and sustainability issues, particularly carbon consumption. However, food supply chain businesses have been shown to be largely concerned with seeking operational efficiencies, quality control, and profit maximisation over more altruistic tendencies to drive carbon reductions via carbon footprinting using PAS 2050. Conversely, the voluntary PAS 2050 carbon footprint standard is regarded by most food businesses as a functional tool that facilitates the identification of 'hot spots' of energy consumption and ultimately helps drive lower-carbon emission consumption, first and foremost in the operational sense.

PAS 2050's standardised LCA approach, its accredited status and the need to follow PAS 2050, seek verification of its results prior to pursuit of the certification process for labelling is viewed by adoptees as providing an element of certainty in the communication of results, certainty and credibility in the food market arena. Despite this level of optimism amongst food supply chain businesses at the production and manufacturing stages of supply chains, scepticism is evident of the dominant role of supermarkets in working with upstream suppliers where supermarkets are bitterly blamed for shifting demands on how and what should be measured and included in carbon footprint attempts. This is despite the standardised LCA approach outlined in PAS 2050.

Although the standardised LCA approach within the PAS 2050 is largely welcomed, food supply chain businesses that collaborate with their supermarket customers feel vulnerable to and constrained by the diktats of supermarket retailers. On the other hand, large corporate-led retail businesses operating

at the downstream ends of UK food supply chains are increasingly concerned with market positioning, pre-empting and compliance with mandatory carbon-centric legislative schemes (such as the CRC).

The internal and external drivers and barriers identified from the interview data illustrate that with respect to the perceived use and usefulness of PAS 2050 and carbon footprint labels, adoption and non-adoption choices amongst food supply chain businesses are also influenced by a number of key drivers and barriers at the strategic level. These findings have been tabulated below in Table 22 and are discussed more broadly in the following sections.

Table 22 The Key Drivers and Barriers to PAS 2050 Adoption

Key Drivers	Key Barriers
<ul style="list-style-type: none"> • Desire to 'lead' in policy formation and adoption 	<ul style="list-style-type: none"> • Regulatory burden
<ul style="list-style-type: none"> • Internal strategic driver 	<ul style="list-style-type: none"> • High costs for SMEs
<ul style="list-style-type: none"> • Potential added value activity 	<ul style="list-style-type: none"> • Expensive Implementation costs
<ul style="list-style-type: none"> • Achievable efficiency gains (particularly with respect to energy) 	<ul style="list-style-type: none"> • Lack of know-how
<ul style="list-style-type: none"> • Optimisation of supply chain operations 	<ul style="list-style-type: none"> • The Food Sector already faces multiple governmental regulatory and market-led schemes
<ul style="list-style-type: none"> • Climate change 	<ul style="list-style-type: none"> • Pressure to adhere to other existent private and governmental regulatory and policy frameworks
<ul style="list-style-type: none"> • Market differentiation 	<ul style="list-style-type: none"> • Alternative operational pressures largely focused upon quality control impinge level of engagement
<ul style="list-style-type: none"> • Competitive advantage 	<ul style="list-style-type: none"> • Retailer dissonance
<ul style="list-style-type: none"> • Demonstration of proactive green behaviour 	<ul style="list-style-type: none"> • Time constraints
<ul style="list-style-type: none"> • Pre-empt mandatory regulation 	<ul style="list-style-type: none"> • Heterogeneous nature of the food industry
<ul style="list-style-type: none"> • Response to public opinion 	<ul style="list-style-type: none"> • Lack of commitment from management
<ul style="list-style-type: none"> • Marketing potential 	<ul style="list-style-type: none"> • Retailer dissonance

Key determinants that tended to be associated with the drivers and barriers to uptake of carbon footprinting in food supply chain businesses largely related to the extent of commitment and level of engagement to wider sustainability initiatives at the strategic level and market structure.

Other key factors relate to the capacity of the business to embrace and undertake environmental measures such as PAS 2050. For instance, at the manufacturing level, size, supply chain position, focus on operational cost reductions and quality control as well as supermarket retailer demands were constraint factors that prevented engagement and uptake with PAS 2050 efforts.

At the retail level, engagement with and commitments to long-term sustainability initiatives is prevalent but disparate (as shown in Chkanikova and Lehner, 2015; Richards et al., 2013; Chkanikova and Mont, 2012; Janssen and Hamm, 2012; and Edwards et al., 2010). However, capacity to engage and commit to such measures is strong given the scale, size and dominant influence of supermarket retailers in the UK food supply chain landscape more broadly (as surmised by Bockel et al., 2011). Nonetheless as mentioned previously and especially at the retail level, food businesses are driven by their own definitions and levels of engagement with sustainability and climate driven imperatives as much by commercial interests as by commitments to pursue carbon efficiencies via single-issue processes such as carbon footprinting. This was also found by Jones et al. (2011) who suggest that at least at the UK food retail side of chains, despite retailers' varied interpretations of sustainability, commitments to sustainability as well as single-issue processes such as carbon footprinting and carbon labelling, efforts are often driven primarily by commercial imperatives to reduce costs (Senge, 2010) as they are by commitments to sustainability.

7.4 The Policy Context to PAS 2050

With respect to the usefulness and overall relevance of carbon footprinting via PAS 2050, the initial interview with the Carbon Trust (Key Informant Interview A) reveals that much of the focus on the development of PAS 2050 relays to attempts to provide a standardised LCA approach for carbon footprinting that is both ground-breaking and nationally and internationally applicable to business and supply chains across all products and services. While DEFRA and the BSI developed the PAS 2050 with The Carbon Trust, the UK Government also played a major role in the structural provision and leadership in terms of influencing the direction that the food sector's businesses take in responding to the demand to reduce carbon emissions. The relevance of this standard is associated with its focus to identify measure and reduce carbon consumption which is perceived to provide a number of efficiency gains and 'win-win' results for businesses that can adopt the standard across all sectors, not least the food sector. This is considered a 'leading' pro-active tool that can contribute to the decarbonisation of respective systems.

Despite its voluntary policy orientation, PAS 2050 at the programme level requires credible internal and external validation which is perceived to give businesses a significant level of assurance in the certainty and credibility of communicated results. Indeed, all the key informants that adopted the PAS 2050 standard in this study recognised the value in working with a standardised LCA based approach to carbon footprinting which was also considered to provide a level of credibility and certainty in the calculation of results irrespective of supply chain position, size and business context.

The standardised LCA method of PAS 2050 at the policy level is thought to provide businesses with a world-leading and pragmatic tool that could potentially contribute to enhancing overall supply chain efficiency through the identification of and reduction of carbon consumption (Upham et al., 2011). This is advocated at the policy-making level as a process that could also potentially result in elements of comparative advantage and competitive advantage to those businesses that pursue PAS 2050 through to fruition. In reality, potential comparative and competitive advantage alone

are not drivers for uptake across the sample as most participants' felt it difficult to quantify or tangibly recognise the level of competitive advantage each business gained as a result of adopting PAS 2050.

With regard to impact, PAS 2050 is said to offer businesses the opportunity to harness such a tool to mitigate/adapt to climate change impacts namely through reduced energy consumption and thereby raise carbon footprint awareness at the strategic organisational level as well as within and across internal operational activities. This was certainly true for much of the sample (discussed in more detail in the next section). The standard is also said to offer a form of credibility as well as certainty in the internal and external verification and validation of carbon footprint results whereupon certification for carbon footprint labelling may be sought to communicate information to consumers (Liu et al., 2016; Freidberg, 2015; Garnett et al., 2015; and Upham et al., 2011). However, this study finds that the extent to which carbon footprint labelling has been effective in raising carbon consumption awareness, driving behavioural change and providing unambiguous, interpretable information to consumers remains questionable.

The policy programme, in its novelty and its attempt to provide the most comprehensive and detailed LCA based specification, not previously matched is believed to give businesses the opportunity to demonstrate a 'leading' market position and build reputational credibility. As well as early engagement and commitment to PAS 2050 amongst those participants within the sample, all users of the standard perceived PAS 2050 as pioneering and world-leading and given its voluntary legislative premise, something that not all market actors are pursuing but will need to in the future given the continued pressure to reduce carbon impact. Here, PAS 2050 is perceived to give users or adoptees, a level of market advantage, an element of differentiation and the opportunity to pre-empt potential mandatory legislation regarding carbon footprinting. However, for businesses, carbon footprint labels are not always pursued as the product-process aspect of the PAS 2050 carbon footprint standard is considered across the board, more useful for operational use. Pursuit of a label also depends on the product type and context of a given business. For instance, the alternative upstream fruit and vegetable producer business (Case Study 1) did not pursue carbon footprint labelling of its products. The business chose not to follow through with certification for labelling as labelling was thought to be inappropriate for their product type (primarily fruit and vegetable boxes), limiting a prospective label's marketing potential. Here, carbon footprint information is instead provided online within their website.

7.5 Usefulness of Carbon Footprinting and Labelling using PAS 2050

The PAS 2050 carbon footprint standard is primarily regulatory and information based in nature as it sets out specific guidelines and requirements involved in the due process of carbon footprinting, the method of which is essential to follow and verify for the pursuit of carbon footprint label for information in the UK via The Carbon Trust. In this sense, PAS 2050, although a voluntary policy imperative, it is regulatory and an information based tool designed to encourage 'greener' behaviour at the business and supply chain level. Indeed, the evidence from this study shows that reducing carbon emissions may lead to reductions in costs for supply chain businesses, increase

operational efficiency and help increase profit maximisation efforts, although the extent to which this is the case remains unclear. In the food supply chain context, most food supply chain businesses at the retail spectrum especially are (as Chkanikova and Mont, 2012; Richards et al., 2013; Jones et al., 2011; and Creese and Marks, 2009 suggest) engaged in efforts to manage their carbon footprint emissions for which their business and respective supply chains are directly responsible for.

Although little of a food product's carbon footprint occurs at the retail point of a supply chain (Lillywhite and Collier, 2009), because most emissions arise at the production and processing phases, supermarket retailers are encouraging engagement with carbon footprinting in food supply chains, especially at the internal strategic level. This is demonstrated by Tesco's work with a number of carbon footprint and carbon footprint labelling initiatives and in this study, as demonstrated with Sainsbury's and their work with ABN-Agri to carbon footprint conventional milk sold at its stores. However, while retail led chains may invest in reducing carbon from their operations to differentiate themselves and increase efficiencies, so do other supply chain entities, namely at the production phases of the food supply chain, who also seek to differentiate themselves from market competitors in terms of their climate change and carbon friendly reputation.

For food supply chain businesses dependent on retailer-led chains, evidence of market retailer dissonance is most apparent regarding PAS 2050 carbon footprinting specifically. In this case, Tesco's shifting demands to an international fruit producer and exporter (case study 3) is a good example. This provides a confusing landscape at the downstream level in terms of the extent and at times, shifting states of engagement amongst retailers with carbon reduction efforts such as PAS 2050 and their food supply chain businesses. This indicates that retailers also need to engage more strongly and cohesively with supply chain businesses across their chains to increase efficiencies within such value-driven chains.

For UK food consumers, carbon footprint labels (based on PAS 2050 carbon footprints) aim to influence consumer behaviour to less carbon heavy product choices based on the information provided within the product label. As such, a carbon footprint labelling scheme for communication and information is a 'nudge' behavioural and information based policy tool (Hansen and Jespersen, 2013 and Hartlieb and Jones, 2009) that aims to influence consumer behaviour at the consumption end of supply chains. However, as previously stated (in Chapters 2 and 3), the notion of carbon footprinting and labelling food as a mechanism to generate a transition to a lower carbon future fundamentally rests on the view that consumer-purchasing habits will switch to low-carbon alternatives and these will be available but the findings from Chapter 6 illustrates poor market proliferation, lack of knowledge and awareness of carbon footprint label information amongst consumers.

As demonstrated by all food businesses that adopted PAS 2050 in the sample and suggested by Marsden (2013) and in earlier work by Shove (2010), the problem for food businesses concerned with pursuing voluntary 'innovative' policy interventions such as carbon footprinting tends to be the

fact that despite sustainability and climate change concerns, much of the impact of PAS 2050 use for business lies within the identification and streamlining of operational efficiencies. This achieves in terms of the usefulness of PAS 2050, little more than the optimisation of operational efficiencies at the internal and logistical level rather than generating the radical sea-change needed to generate system-wide decarbonisation. Indeed, much of the logical response of the dominant regime, in this case being the corporate retailer-led chains such as Sainsbury's and Tragus Holdings, tend to respond to innovative policy developments (such as PAS 2050 carbon footprinting) by either incorporating such efforts as another type of process-product innovation within the realms of strategic and sustainability departments or outsourcing such tasks, particularly if such schemes are mandatory, rather than developing what Marsden (2013, p.125) describes as: "*a wider platform for changes in systems and structures of provision...*". Despite this difficulty, all the businesses that adopted PAS 2050 in this study recognised its benefits as a tool that in its use, potentially facilitates the optimisation of supply chain efficiencies in the identification of 'hotspots' of carbon consumption, allowing for pro-active business efforts to reduce carbon-heavy processes. More importantly, carbon footprinting is viewed by each 'key informant' involved in PAS 2050 uptake and the following stage of carbon footprint labelling of products, to provide an element of certainty and credibility in the communication of results and is perceived to provide a strong element of positive brand reputation. Carbon footprint labelling although not uniformly adopted across the sample is perceived by almost all food chain actors, as a potential ancillary benefit in terms of marketing and CSR more broadly. As such, the principal advantage of seeking certification for labelling purposes is the possibility for businesses to market their 'green' credentials although the extent to which this has been successful or not is uncertain given the emergent nature of carbon footprint labels in the UK food market place.

7.6 Conclusion

It has been highlighted by each of the supermarket suppliers (the international fruit producer and exporter and the frozen food manufacturer) that the nature of supply is highly dependent upon the demands and preferences of supermarket retailers. Added to this is that within the broader UK food sector no unified or agreed performance standard specifically with respect to carbon footprinting exists. Further, continuous monitoring and control is not a PAS 2050 requisite (as it is in an ISO 14000/1 EMS), meaning businesses who are interested in use of the standard as a 'one-off' exercise are unlikely to update or continue the impetus for carbon footprinting or labelling once relevant information and opportunities for improvement have been identified. Findings also illustrate that relationships within food supply chains and across respective business are sometimes arbitrary but almost always, are entirely transactional resulting in the emphasis of quality and cost control over adoption of the voluntary PAS 2050.

The evidence illustrates upstream suppliers are 'squeezed' and pressurised by downstream retailers to reduce costs. Indeed, as suggested by (Burch et al., 2013; Richards et al., 2013; and Senge, 2010) the findings of this PhD research also demonstrate there is very little trust generally across the chain which also appears to impinge innovation and can undermine collaborative attempts between retailers and their suppliers as suggested by Dendler (2014), Marsden et al.

(2013) and Richards et al. (2013). This is particularly the case when retailers collaborate with upstream businesses with work on innovative policy interventions such as carbon footprinting. However, despite the standardised methodological approach of PAS 2050, problems do arise in terms of the extent to which food businesses engage with carbon footprinting. This is the case even with a contemporary standard designed to combat the inevitability of capricious market behaviour (Freidberg, 2014). This is largely due to the voluntary premise of PAS 2050 and carbon footprinting itself in the UK and perhaps because carbon footprinting is a relatively new experience for most food supply chain businesses (Upham et al., 2011). Although guidance is available at the governmental and business level on the due process in the measurement, reporting and communication of carbon emissions, the genericism of the PAS 2050 method means that businesses devise their own approaches on target setting and measurement and are sometimes motivated more by marketing potential than environmental concern (Freidberg, 2014).

For instance, demands by downstream businesses to producers upstream can vary and may shift over time dependent on retailers' instructions, motivations and perceptions of the value in carbon footprinting. Here, Tesco is an example of a retailer whose initial enthusiasm for carbon footprinting and labelling in 2007 shifted to announcements in 2012 that the retailer would be phasing out use of carbon footprint labels. The impact of such a move to upstream suppliers engaged and committed to carbon footprinting and labelling with powerful downstream retailers is that such shifts at the strategic level largely frustrate and constrain suppliers' sense of value in their carbon footprint attempts. Indeed, retailer dissonance is conspicuously evident regarding the adoption of carbon footprinting and labelling but retailers who do collaborate with upstream producers are just as likely to become recalcitrant when uptake and implementation across the market-place is not well established, perceived as weak and thereby thought to impede the speed of development, proliferation of such efforts and keep costs of such efforts high. Added to this is the extent of retailers' scepticism of governmental intervention, especially with respect to climate change driven agendas. Complete vitriol for governmental driven targets, green schemes and policies, particularly if any become mandatory to follow is evident especially at the retail end of the supply chain spectrum.

Mayes (2014) who examines the food label through the lens of governmentality argues that the 'normalising' effect of neoliberal governmentality stems from the growing conflation of food labelling and the food industry which ultimately reinforces and shifts responsibility to individual consumers for behavioural change. Similarly, Hartlieb and Jones (2009) in their study of ethical food labels in the UK find such 'voluntary' nudging tools in the form of voluntary standards and/or labels tend to support individual contract and are therefore dialectically opposed to any form of social contracting. Individuals and individualism are however, the psychological lynch pins of modern market capitalism which is why there is need for the 'humanising' of business (Taylor, 2016; Mayes and Thompson, 2014; Burch et al. 2013; Richards et al., 2013; Fuchs et al., 2011; Hartlieb and Jones, 2009). This research has looked at two social contracts, namely one for food and the other for the environment. It is not surprising that interventions based on individual contract such

as carbon footprinting and labelling cannot adequately address the social problems of food and the environment, particularly one that is as complex as the matter of climate change (e.g. climate change as an 'omni' value, or key issue, tends to be simplified and reduced to a 'catch all' umbrella term that nevertheless traverses a series of diverse social and environmental issues).

In light of the preceding discussion, Figure 14 below illustrates the order in which the research propositions, the sub research questions and finally, the overall main research question are each collectively addressed in this research study. Specifically, Figure 14 pits the research organisation against the research findings, and in effect, reorganises Figure 5 from Chapter 2, showing a reversal of the placing of the 'propositions' and 'main research question' elements. Essentially, revisiting the total research outlined in this thesis suggests a reworking of Figure 5 by presenting the literature from which the main research question and sub questions were drawn. This allows conclusions not just about the research itself but explores the authenticity of the broader theoretical literature.

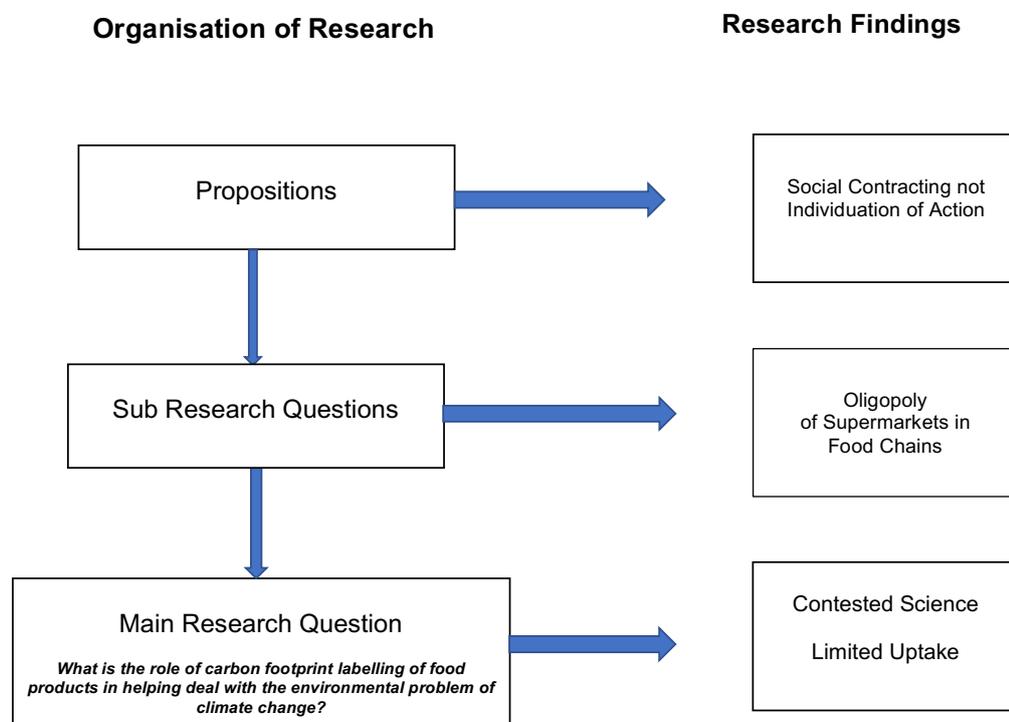


Figure 14 Addressing the Propositions, Sub Research Questions and the Main Research Question

Following from Figure 14 above, Table 23 on the next page explores the literature against what might be considered major canons of conventional business economics. From these major canons, a series of propositions were derived. These propositions in turn, have been placed against the empirical evidence to derive conclusions that stem back to the original canons of literature.

Table 23 Theory, Propositions and Empirical Conclusions

Theoretical Base	Propositions derived from Theory	Contributions to Theory from Empirical Findings
Social Marketing of Carbon Pro environmental Behaviour ABC (Attitude, Behaviour, Choice) Theory	1. Carbon standards and labelling are not robust but in decline. Continued non-standardisation of carbon accounting tools brings them into disrepute.	Limited scientific agreement is evident in the food labelling regime on what essentially is carbon equivalent labelling. No basis for justiciable judgement.
LCA – Life Cycle Analysis/Assessment	2. Carbon footprinting is a techno-political solution that substitutes a false science for a robust food policy.	The value of the environment cannot be captured as a market function. It requires a broader discussion in a framework of a social contract with the environmental problem of climate change.
Regulatory Frameworks	3. There may be universal access to PAS 2050 but there is no universal uptake. The policy framework is from strong food security to weak sustainability.	The policy framework of 'weak' sustainability is driven on the supply side by potential loss of market which in turn, is dominated by the oligopoly of supermarket chains. The policy framework does not acknowledge the power of supermarket control.
Political Economy of Regulation	4. There is little link between food production, consumption and environmental policy. The fragmentation of science informing food policy is influenced substantially through the private and corporate control of science.	Food policy is essentially a social contract. Market based initiatives produce a fragmentation along the whole food chain.
International Trading Regimes	5. Corporate uptake of environmental issues, especially climate change is largely precautionary due to the threat of an international legal regime.	Voluntary uptake of carbon footprinting regimes is based on a fear of losing market predominance, not on a commitment to maintaining good practice in environmental services.
Monopoly and Oligopoly Political Economy of Private Standards – e.g. Polanyi (1944) Private Governance	6. Near consumption actors (supermarkets) are the powerhouse of oligopoly that control food policy making. Corporate interests, not that of the State, is the arena for food policy making.	State actions are relatively weak against a mature private market that emphasises the primary return of capital to shareholders.
Nudge Theory (Behavioural Economics and Psychology)	7. Choice architecture has a fall-back position of nudge economics. Nudge economics is the economics of 'push' with no 'pull'.	There is currently no social contract that emphasises models of good practice that must be adhered to by all actors in the food chain. Nudging is a weak policy intervention with little impact in the case of food labelling for the environment.
Sustainable Supply Chain Management Organisational Behaviour Theory Decision Theory Complexity Theory	8. Green supply chain management is 'greenwash' – ISO 14001 is as close as it gets.	Greenwash is a form of light touch sustainability where sustainability is ultimately used for marketing purposes and CSR purposes rather than transformative change behaviour.
Parallel Context: Food Safety Labelling Risk Management Decision Making Risk Assessment Perceived Control Perceived Risk of Individual Behaviour	9. Regarding food safety, standards are underwritten by science and law but this is complex, confusing and sometimes contradictory.	Despite the contradictory nature of food safety response, there is a positive uptake based on labelling because it relates to individual health within a broader context of public health.
Parallel Context: Health & Nutrition Labelling Consumer Behaviour Motivation-Ability-Opportunity Framework	10. Regarding nutrition and health, food behaviour is targeted and changed but only at the individual level, never summarised to the social and the environmental problem which is essentially social.	While there is some progress in labelling to address nutrition and health, this progress relies on individual uptake and is poorly supported by broader campaigns to address the issue, e.g. the obesity pandemic.
Parallel Context: Omni/Meta Labelling Consumer Behaviour Constructivist institutionalism Institutional entrepreneurship Willingness to Pay Attitude-Behaviour-Context Model	11. Omni standards and labelling regimes would require a humanistic and social science approach that is neutral to corporate and private gain but the science of food policy is physical science of distance from human beings, while social science is increasingly for corporate and private gain.	Omni labelling at best, can give an indication of carbon intensity across a range of food stuffs but also requires a measure of sustainability within particular groups (e.g. meat versus vegetables).
Personal versus Social Contracting	12. There is need to move from the consumer with individual responsibility to consumers with collective social environmental responsibility.	The economics of the business school model assuming individual choice with full knowledge of environmental impact requires substituting with an exploration of social contracts that include environmental issues.

The propositions explore the empirical data against the theoretical arguments that commentators have made in the relevant literature but it is also possible to approach this inquiry into carbon footprinting and labelling as a story. This story is reflected in the main question and sub questions. The problem with dealing with real world business issues is that it is a bit like a holly wreath with a prickly weave around the outside but with an empty hole in the middle. The hole is frequently addressed by a call to theory that shines light on the wreath through the middle. However, currently, theory seems a little weak to do this. For this reason, this thesis has constructed a series of propositions to highlight those weaknesses. The outside of the holly wreath is woven, a complex web where prickly questions have to be asked including sub questions about how reality can be explored in the absence of theory that encompasses the whole reality. This exploration is done with a main question and sub questions. With respect to the case material and the findings generated from this study, the following paragraphs revisit the sub research questions and provide research-informed conclusions before addressing the overall main research question defined for this thesis.

S.Q.1. What is the possible space and form of carbon labelling for both the food industry and consumers?

The drive in the form of carbon labelling for consumers is a broader drive to omni-labelling, sustainability or meta labelling for a series of numerous environmental and social concerns. For food suppliers, carbon footprinting using a voluntary measure provides no guarantee of good environmental performance but encourages producers to think about these issues even if it is only to maintain market share.

S.Q.2. From case studies, is it possible to assume a certain consumer and industry response?

The case studies show from a consumer perspective, a willingness to think about environmental issues but not a willingness to pay. From an industrial perspective, there is clear knowledge of environmental impact but not necessarily the use of that knowledge to change environmental performance.

S.Q.3. How will UK food shoppers perceive carbon footprint labelling?

The perception of consumers of carbon footprint labelling suggests it could contribute to a 'feel good' factor when purchasing but it does not embed environmental concerns on the individual or social psyche.

S.Q.4. Is it possible to capture in a label the complexity of carbon content from a supply chain with multiple processes and multiple producers?

No label can capture the complexity of carbon equivalent content in a supply chain with multiple processes and producers.

S.Q.5. How will producers perceive carbon footprint and label schemes?

Ironically, the research on the supply chain did not see producers shouting about the need for a bonfire of red tape, i.e. the scrapping of all regulation but the regulatory regime is perceived as being so light, they do not necessarily have to follow it. In fact, resistance to regulatory regimes was expressed most strongly at the retail end of the food chain.

S.Q.6. How will perceptions of voluntary carbon footprint standards and labels shape business motivations for 'ecological responsiveness'?

Overall, the research shows that voluntary carbon footprint standards and labels will not necessarily shape business motivations to produce an ecological response. This could well be because the ecological response is essentially a social movement and the carbon footprint standards and labelling only address individual concern.

Carbon footprinting and labelling will not on its own, drive a green agenda through the food industry. It is probably a necessary step, in a broader omni-labelling effort but it is not sufficient by itself to deliver change. It is essentially, a status quo or 'weak' reform initiative.

Considering the preceding paragraphs, the main research question defined for this thesis asks:

What is the role of carbon footprint labelling of food products in helping deal with the environmental problem of climate change?

In answer, at the present moment, the assumption that carbon footprinting and/or carbon labelling in their current form means that the effectiveness of such nudging instruments in achieving any form of behavioural change to mitigate climate change impact is largely aspirational. In short, the evidence from the case study findings indicate as (Dendler, 2014; Cohen and Vandenberg, 2012; and Upham et al., 2011) highlight that while there is acknowledgement of the need to decarbonise and 'green' food chains in times of climate change, it is more difficult to reach consensus on the 'how' from the milieu of multi-stakeholder groups. This problem seems to be exacerbated further given the heterogeneous nature of contemporary food chains and the voluntary mandate within which many of the food stakeholders operate (Scrinis and Parker, 2016; Hornibrook et al., 2015; Chkanikova and Lehner, 2015; and Hartlieb and Jones, 2009). In addition, relating to legitimacy, competition and issue saliency concerns (as derived by Bansal and Roth, 2000 in examining using a case study approach why companies go 'green') the response to any such voluntary, practice based standards and labels occur within a space in which the dominant 'choice architecture' essentially comprises emergent 'nudging' policy tools such as carbon standards and labels as put forward by Hartlieb and Jones (2009). These multi-stakeholder initiatives have instead generated the proliferation within the food arena of a series of 'private' self-regulatory market tools which are perceived, adopted and absorbed differently by different food chain actors. This non-uniformity in response to voluntary environmental practice based standards and labels inevitably results in forms

of governmentality within and across food product chains and can, as Freidberg (2014) points out lead to the 'science' or practice-based element, namely the LCA in this instance, translated into a form of techno-politics, where more powerful actors in the chain push their own interpretations of governance requirements, dependent largely, on their particular conceptualisations of the sustainable development concept (Hopwood, Mellor and O'Brien, 2005). The evidence from the food chain case studies, indicates that indeed, more powerful downstream retail actors tend to dictate to their arguably less powerful upstream food businesses their own terms of reference in terms of how an LCA exercise should ideally be addressed as shown, especially with Case Study 3, the international citrus fruit producer and distributor, Colors Fruits. These stipulations are argued by such stakeholder actors to typically fall in favour of the downstream retailer's focus on what should be measured within an LCA and how. The evidence shows that this is because there is a missing middle of the 'social' values that cannot deal with the broader environmental issue of climate change, making it difficult for such carbon footprinting and labelling to form a solid basis on which to build further standards that could capture other environmental concerns such as embedded water, social, welfare and labour issues. This is because there is little recognition of climate change itself being a wider social problem as put forward by Marsden (2013) in his study of transformative environmental change and Mueller et al. (2009) who, through a legitimacy lens examined the uptake of the voluntary international EMS standard series, ISO14001.

The following chapter focuses on concluding the findings examined in this chapter. Chapter 8 provides a series of conclusions to this overall study, considers resultant implications and begins by discussing the above findings and the consumer survey results relative to this qualitative study against the research propositions first raised in Chapter 3. It also explicates this research study's contribution to knowledge, highlights its research limitations and proposes recommendations for further research.

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Chapter 8 – Conclusions

8.1 Introduction

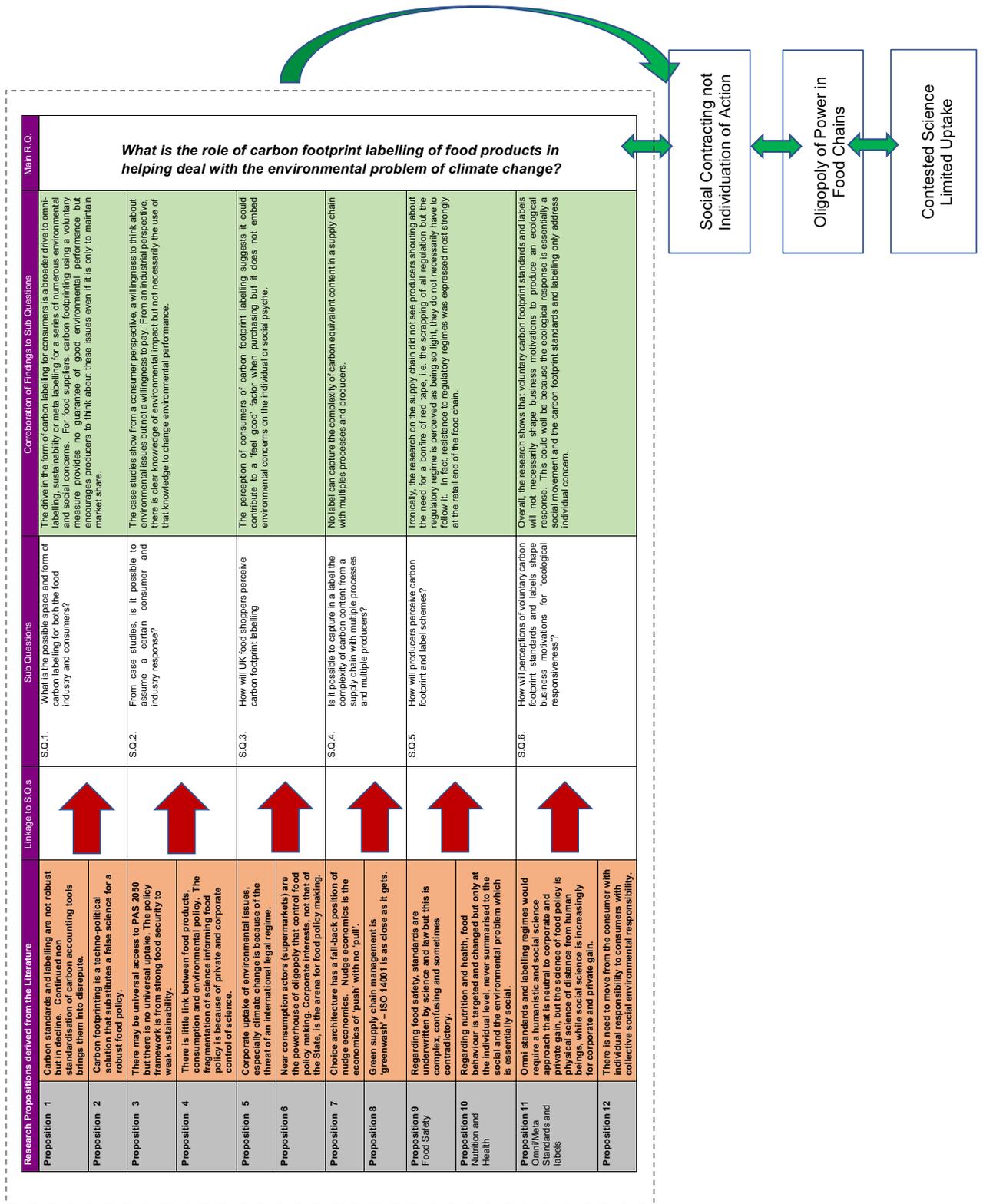
This chapter considers the conclusions of the research outlined in Chapter 7 in a broader context of the literature reviews in Chapter 2 and 3. The penultimate sections to this chapter outline the limitations of the research method employed and offers a series of recommendations for further research. Essentially, this final Chapter returns to the derived propositions from the literature streams, namely on food policy, governance, sustainability and the parallel contexts of food labelling on food safety, nutrition and health and omni-labelling. A summary of the propositions would be the theoretical limits of individual contract theory as an explication of social change (Taylor, 2016). To help contextualise the conclusions drawn for this study, a detailed diagrammatic illustration showing the linkages between the derivation of research propositions, sub research questions and the main research question defined for this research inquiry is provided on the following page in Figure 15.

The evidence of this study shows that the policy response to PAS 2050 could, as Cohen and Vandenberg (2012) and Vandenberg et al. (2011) suggest, through the medium of carbon footprinting, 'bridge' the climate policy gap by driving behavioural change towards lower carbon consumption amongst consumers and supply chain businesses respectively. The differentiated response amongst the sample reflects findings by Heyes (2009) who conducted a survey inquiring whether environmental regulation is bad for competition. They found that environmental regulations can benefit large firms and generate greater levels of concentration and therefore cohesiveness and power across given chains but this is largely at the expense of smaller businesses and can thereby prevent entry and engagement with 'green' policy measures and initiatives. Indeed, the evidence from this study shows that the small to medium sized manufacturer, a mid-stream supply chain business was driven more by supermarket demand and pressure to minimise and control costs over carbon footprinting. This is due to its dependency on its retail customers, its limited fiscal capacity, know-how and need to pursue market share maintenance and quality control by adhering to private governance standards called for by supermarket retailers.

Certainly, market influence at the retail level on upstream suppliers is evident in this study given the perceived necessity for food supply chain businesses (that are linked to retail chains) to follow market-led regulatory stipulations administered largely through the British Retail Consortium. This also aligns with findings by Fuchs et al. (2011, p.354). They put forward (as the author of this thesis does) the ubiquitous dominance of private food governance and private retail food governance institutions within the food market and correlate this overall dominant regime of private market-led regulation to the power of private food actors, particularly supermarket chains which make private standards *obligatory for any actor who wants to participate in the (global) market* (Fuchs et al. 2011, p.354). In the same vein as the findings of this study, these authors also state that:

"big supermarket chains have developed initiatives to ensure a certain quality of retail food products by committing suppliers to a specified set of standards. Importantly, private governance institutions, in general, and private retail food governance institutions, in particular, frequently tend to acquire a de facto compulsory role despite their de jure voluntary nature (Blowfield, 2005). By adopting such standards, private food companies and especially retail corporations can constrain market access and thereby basically force suppliers to accept them." Fuchs et al. (2011) p. 354

Evidence from Case Material and Peer Reviewed Literature



Evidence from Peer Reviewed Literature

Figure 15 Totality of the Research Inquiry – Linkages between the Research Propositions, Sub Research Questions and the Main Research Question

This study finds (as also inferred by Marsden (2013) and Jones et al. (2011)) that innovative, contemporary environmental policy imperatives such as PAS 2050 and carbon footprint labelling are essentially voluntary regulatory standards that are very likely to be adopted and absorbed within wider sustainability initiatives amongst supermarket retail businesses as well as large producer businesses dependent on supermarket custom. This is largely given the single-issue product-process nature of such standards that tend to address particular and singular elements of the wider sustainability and climate change agendas. Scepticism of supermarket behaviour and the influence of such retailers on food supply chain dynamics is prevalent across the sample.

For all food supply chain business participants, efficiency savings, cost control within operations and externally via logistical operations, as well as the optimisation of overall operational activities are dominant concerns. PAS 2050 is perceived principally by those most actively engaged with the standard to provide further opportunities to control operational costs through the identification of energy consumption and in doing so, present opportunities to pursue further operational efficiencies. This is what is called for in the paper by Vandenberg et al. (2011) who suggest businesses are more likely to focus on brand reputation even if consumers' willingness to pay is weak. Here, it is suggested that many supply chain businesses could mistakenly overlook the substantial potential opportunities to proactively pursue supply chain efficiencies via carbon footprinting. Findings from this study however illustrate that most supply chain businesses, irrespective of size, supply chain position or dominance recognise the value of carbon footprinting mostly with respect to its capacity to drive operational efficiencies within individual supply chain businesses and across supply chains more widely.

The pursuit of carbon footprint labelling is perceived amongst those food chain businesses that followed through with labelling as an ancillary benefit. It is also viewed upon as a potential driver to encourage consumer uptake of less-carbon heavy products. However, the marketing effectiveness of carbon footprint labels is not immediately evident given the emergent nature of carbon footprint labels to market although the marketing potential of carbon labels is recognised. At the same time, some food businesses may choose to adopt certain labelling standards and communication labelling tools such as carbon labels to detract from other, less 'healthful' attributes of a given food product. Such practice-based standards and nudging tools in the form of carbon labels in this vein may, as Freidberg (2014) suggests, simply hide more of a product's attributes than it reveals. This to a certain extent, shows an inclination by many of the food chain actors to at least consider the capacity of 'marketing' to effectively advocate certain environmental labels in the market place. It also reflects to a certain degree, that an environmental marketing approach to labelling as suggested by Rettie et al. (2014) may potentially contribute towards the social 'normalisation' of such initiatives amongst consumers, i.e. mainstreaming the shopping for a 'greener' food basket but this would require unanimous and universal uptake of such standards across the food chain – an inconceivably contentious and potentially expensive undertaking, not least inherently contradictory given the fragmented nature of the science behind such practice-based labelling regimes (Tzilivakis et al., 2012). However, the UK food supply chain businesses in this study recognise that ultimately, the dilemma of poor market proliferation despite the pro-environmental behavioural context in which such labelling standards are designed and disseminated. This means that

comparatively weak, ad-hoc market proliferation is more than likely due to the early introduction of carbon footprint labels to the food consumer market. The fact that supermarket retailers have differing levels of engagement with and priorities regarding carbon footprint labelling at the demand stage of their respective stages reflects the non-uniform uptake of the PAS 2050 carbon footprint standard that sits behind the label. Indeed, market retailer dissonance with respect to uptake of PAS 2050 and carbon footprint labelling is evident and is viewed across the sample as a significant barrier to uptake, overall general effectiveness and impact in terms of decarbonisation efforts (Reisch et al., 2016).

However, enhancing wider supply chain strategies and internal and external strategic positioning within markets are other efficiency attributes associated with the voluntary PAS 2050 carbon footprint standard. This is much like the findings of Arimura et al. (2011) and Mueller et al. (2009) where uptake of ISO 14001 across different businesses tended to follow with similar beneficial outcomes. At the international producer level these attributes are viewed as opportunities to also pursue collaboration with other international fruit producers and supermarket retailers. This is in line with Marimon et al. (2012) and Mollenkopf et al. (2010) who highlight that adoption of the ISO 9000 quality standard has been found to correlate strongly with subsequent adoption of the ISO 14000 environmental standard. However, collaboration with supermarket retailers to date with its PAS 2050 carbon footprint and carbon label work has largely been dependent on the shifting stipulations and foci on market regulation driven by supermarket retailers and supported by administrative food industry organisations such as the BRC. This is a concern raised across the literature with respect to 'power' (Fuchs et al., 2016; Burch et al., 2013, access and the legitimacy of voluntary market regulation (Richards et al., 2013; Mueller et al., 2009; and Hervani, et al., 2005).

While both upstream and downstream businesses that adopted PAS 2050, pursued certification for carbon footprint labels, neither was sure of its marketing potential or appeal to food consumers given the early stages of market proliferation and lack of ability for consumers to consider 'like for like' carbon footprint comparisons within individual product category types. This is a factor that consumers (within this study) also find challenging given the lack of market proliferation and ability to make carbon footprint comparisons within 'same' product categories. Despite this scepticism, carbon footprint labels for information on SKUs are considered by most supply chain actors as an effective means of communicating carbon footprint information to consumers (see Upham et al., 2011) but there is little evidence of the level of effectiveness of such labels in driving behavioural change towards more carbon conscious consumption (Hornibrook et al., 2015). This is perhaps because as Berry et al. (2008) suggest, providing climate information via tools such as carbon footprint labels on food products may do little to drive system wide behavioural change as much of the value (also suggested by McKinnon (2010) and Vandenberg et al. (2011)) of such a product-process policy is embedded in the measurement and proactive engagement with carbon reduction efforts further upstream of supply chains.

For instance, this study finds that while 72% of food consumers state they would like carbon footprint labels on food, 89% of the same sample (Chapter 5 of this thesis) think carbon footprints are confusing and difficult to interpret. Heyes (2009) proffers that the effectiveness of such 'green labels' is based upon

the assumption of the existence of 'green' consumers willing to pay a premium for a product's credentials. However, this study finds that while 72% of consumers want carbon footprint labels, 76% of the sample consider quality and taste as the most important factors when shopping for food. Price is almost equally important to 75% of the sample.

However, significant confusion remains surrounding the understanding of carbon footprint labels with a total of 89% of the sample agreeing or slightly agreeing that carbon footprints are confusing. Confirming this consensus from this particular survey is the high proportion of consumers who have no knowledge about their own personal carbon footprint. Nevertheless, a large number of respondents positively supported carbon labels on food products. As Grunert et al. (2014) Temple and Fraser (2014) and Schor et al. (2010) in studies related to nutritional FOP labels found; consumers find that health and nutrition information is often conflicting and confusing, exacerbated in the UK, by the plethora of labels in the food market arena. As such, the effectiveness of any voluntary environmental labelling, as with nutritional and safety labels, largely depends on whether consumers know the meaning of the labels and have basic motives of environmental and social responsibility, thereby making corresponding ethical and altruistic purchasing behaviour (Hartlieb and Jones, 2009). Unsurprisingly, this conflicting consumer response to carbon footprint labels suggests consumers may not translate 'willingness to say' into 'willingness to pay' (Black, 2010) for carbon footprint labelled products which as McKinnon (2010) also suggest, could limit the effectiveness of carbon footprint labels in driving behavioural change amongst consumers towards less carbon heavy products.

Similar to a study by Siriex et al. (2011) of UK consumers' perceptions regarding individual and combined sustainability labels, the findings from this study's consumer case study suggest that consumers have positive perceptions of the more mature voluntary Organic and Fair Trade labels but tend to be less certain regarding unfamiliar labels and general claims such as 'climate friendly'. Yet, the consumer case study data shows that shopping habits appear to be changing and for a large group, these habits are increasingly influenced by environmental concerns. In total, 68% of respondents stated definitive changes in purchasing behaviour and in particular respondents affirmed that their purchasing habits had largely shifted towards purchasing more free-range, more Fair Trade, more locally sourced food, more organic and less processed food products. The factors that are influential in shaping such purchasing habit changes were principally associated with education and increasing environmental concern but within the data, the contribution food products made to consumers' health is an important factor. This supports the findings of Van Kleef and Dagevos (2015) who suggest that nutritional labels, if well designed and familiar to consumers, could potentially have a positive influence on national diets, health and wellbeing. From an ecological economics perspective, Shewmake et al. (2015) highlight that private solutions such as labelling and educating consumers about carbon footprints may be a cost-effective second-best or interim strategy in the absence of a politically viable comprehensive carbon policy.

The positive response for carbon labels in this research study cannot be taken in isolation to other food attributes (environmental and non-environmental) and not if positive attributes become associated with price premiums. In relation to other attribute information, uptake and understanding of carbon labels

products is still low but this is possibly understandable, as carbon labels have not as yet been assigned to many competing products so consumers have not become accustomed to using carbon labels to make purchasing decisions (Shewmake et al., 2015). This implies that as Hartikainen et al. (2014) and Upham et al. (2011) indicate, that LCA process based standards are important in driving consumer change but this is largely dependent on the market conditions under which such labelling schemes function. Simply communicating a product's carbon footprint or reduction commitment, via a carbon FOP/BOP label is largely hinged upon consumer understanding and behavioural response in a market place dominated by a plethora of food labelling schemes. While Upham et al. (2011) argue that large information asymmetries between producers and consumers exist in the UK, particularly regarding the environmental and social performance of products; it is recognised that labelling for information performs a function that ideally enables consumers to make informed purchasing decisions. However, despite such efforts, consumers are known to subconsciously 'screen' out unfamiliar labels in the search for food products, typically within very short time intervals (normally a few seconds according to Temple and Fraser, 2014 and Sorensen, 2009). The data shows that as Scrinis and Parker (2016) find, that food labelling and the voluntary and regulatory dialogues concerning the politics of nutritional policy 'nudges' occur within a dynamic competitive space between public health-driven nudges and corporate-driven nudges. Here, the non-universal proliferation of carbon labels on food and drink products further reinforces the limitations of an architecture of 'choice' within which consumer nudging is expected to function. This underscores the power of food corporations in influencing consumer choice, largely geared towards price and quality attributes.

The evidence from the case study data also contextualises the inherent difficulties in integrating and balancing the need to avoid technical confusion with respect to carbon footprinting food and communicating carbon footprint labels on food products for consumers. These difficulties are exacerbated by the fact that much of the debate on food supply chain sustainability and climate change continues to take place at the discursive level. Sustainability perspectives across the data sets are shown to be typically bound up with conceptualisations of sustainable development as put forward by Dendler (2014). This has, in part, probably been caused by the increasing confluence of climate change and energy policy agendas, especially in the case of the UK.

Within the current backdrop of UK food policy, it is clear that carbon footprinting and labelling policy is relevant but largely top-down in nature, which will facilitate but not necessarily drive a decarbonised food chain (Richards et al., 2013; Burch et al., 2013; Mutersbaugh, 2005). Driving down carbon consumption via carbon footprinting policy imperatives that remain voluntary may do little to mobilise genuine efforts to effectively reduce carbon consumption and promote proactive environmental behaviour (Chkanikova and Mont, 2012). This is because voluntary schemes are not all encompassing and do not promote within category comparison. Such schemes tend to require time and sufficient demand for widespread adoption and diffusion, leading to ad-hoc and punctuated uptake at the early stages of such policy drives as demonstrated with the present carbon-labelling situation in the UK. Instead, as found with research by Dendler (2014) who critically scrutinises 'meta' sustainability labelling schemes, constructions of legitimacy are evident, are frequently conflicting and are highly dynamic. These conflicts are likely to

intensify with the introduction of any new 'environmentally' centric labelling scheme. However, knowledge dissemination and education are suggested to potentially alleviate such inherent difficulties with a view to facilitate understanding amongst consumers. Yet, in any such 'sustainability' oriented and voluntary product labelling scheme with its limited regulatory capacity, such understanding and information provision is likely to be particularly challenging given the highly contested notion of 'sustainable development' itself.

This research supports the suggestion by Dendler (2014) who also emphasise that different labels might in fact pose one of the major challenges in the institutionalisation and overall effectiveness in driving sustainable consumption. Indeed, the 'success' of such labels could only be possible if supported as Peattie (2010) and Rettie et al. (2014) with the support of industry promotion, advertising and perhaps the 'normalisation' of such labels. This is problematic from an ethical point of view as for instance, as first raised in Chapter 2, evidence from research by Hartlieb and Jones (2009) shows that market actors who adopt voluntary controls tend to make moral choices to do so, instead of merely complying with State diktats. However, for ethical, environmental and socially oriented labelling schemes the reality is more complex than autonomous moral choices. Instead, such reductionist efforts tend to result in the gradual mainstreaming of ethical initiatives such as Fairtrade. This means corporations' strategies may simply serve to subsume ethical goals within a business participant's competitive and profit oriented logics. Such foci on the arguably amoral and technical process of the latter means ethical issues are frequently consigned to a less manifest socio-political dimension tied to the broader issues of 'private' or 'civil society regulation'.

While such forms of private retail standard development, implementation, dissemination and practice occur within the private sphere of food governance, these private retail governance institutions inherently lack democratisation given private actors are not subject to or legitimised through mandatory legislature. This context is also raised by Freidberg (2014) who echoes this broad conundrum where the surge in interest and of carbon footprint and life cycle development within the food sector especially, is increasingly amounting to a form of 'techno-politics' driven by corporations' own interpretations and motivations embedded within their own strategies for sustainability. The consumer case study data also supports the findings by Temple and Fraser (2014) who conducted a critical review of food labels, Grunert et al. (2010a) who looked specifically at the parallel context of nutritional labels, their use and understanding of information amongst food consumers and Grunert et al. (2010b) who specifically examined food label use and understanding of nutrition information in the UK. Essentially, the extent to which such 'nudging' or voluntary labelling schemes can lever positive behaviour change is suggested to depend upon the strength of design and overall format of any informational food label. In a similar vein to Van Kleef and Dagevos (2015), again with respect to consumer perspectives of FOP nutritional labels, the evidence from this research study indicates food consumers though primarily concerned with the traditional factors of quality, taste and price are increasingly interested in the environmental impact of food. However, while Shewmake et al. (2015) recognise that consumer demand is a fundamentally important element in the introduction of private voluntary carbon labelling schemes for food products, educating consumers about carbon footprints is just as important. However, food consumers do not feel

well informed enough to make purchasing decisions based on carbon footprint labels and do not have the opportunity to select substitutable products through carbon-based value judgements.

In reality, any positive environmental, social and economic impact via carbon labels depends on the functionality of carbon footprinting and carbon labelling efforts, rather than being able to rely on some notion of consumer guilt. Consumers may have increasing preferences for 'greener' products, but the reality of the modern food shopping experience is that consumers can ultimately only buy what retailers offer to them. Consequently, looking to the demand side of food supply chains and informing consumers about the relative GHG emissions of a product is only part of the challenge as any impact will depend on whether consumers are able to make genuine choices within specific product categories. This suggests that carbon footprint labelling is a long way from translating consumer-expressed preference into action.

From the retailers' perspective, this is understandable because the placing of labels on different product categories, only serves to boost sales of those 'special' products rather than encourage a comparison within categories and thus risk increased sales of a product only at the expense of decreased sales of another. If such 'nudge' labelling is really to be used to help consumers deliver a lower carbon food system, retailers (and their suppliers) will have to forego sales in high carbon products. To avoid this, what the retailers would need is an immediate and wholesale switch by all competitors to suddenly have all their products carbon footprinted so that the playing field was immediately flat and competitive again. This is clearly utopian.

In the UK, the recalibration of institutional frameworks and policies over the past couple of decades has not necessarily complemented preceding policy regimes. As shown in this thesis' research findings and put forward by Lang and Barling (2013), Burch et al. (2013) and Barling and Lang (2007), in the UK this backdrop of policy formation has led to a multifaceted institutional architecture, a multi-layering of food policy, and an apparatus comprising a structuralist system comprising of multi-level governance regimes. Such regimes include national laws that are increasingly influenced by the dominance of corporate power and highly concentrated food systems (Richards et al., 2013). Carbon footprint standards such as PAS 2050 will need to be refined to individual sector and further, to specific product categories and would benefit from the promulgation of sector-specific approaches to ensure improvements in consistency and comparability. To facilitate reproducible results at the methodological level, the clarification of technical difficulties amongst and across food supply chain actors is needed.

To address the demand-side of UK food supply chains, a reasoned and logical widespread targeted labelling policy that includes a strong social learning campaign with respect to environmental impact and carbon footprints specifically is recommended. Further, carbon footprint labels should, as suggested by Cohen and Vandenberg (2012) integrate existent knowledge gathered from earlier labelling studies. Illustrating this point is that carbon footprint labels administered and developed by The Carbon Trust in the UK since the initial stages of this research have been revised and updated with clearer, more logo-centric label designs which suggests that at the very least, it has been recognised at the policy design

and development level that consumers should not require any more than mental mathematics to make simple comparisons between products. However, given the relatively nascent stage of carbon label proliferation in the UK market, it is yet to be seen whether such simplification translates into greater levels of 'green' purchase behaviour by UK food consumers. This is possibly due to the parallel issue of disparate uptake of PAS 2050 carbon footprinting amongst food supply chain businesses. However, carbon footprint labels for food alone are not sufficient even if simplified (in terms of the information presented) to drive significant and meaningful levels of decarbonisation across the food system.

For UK food supply chain businesses, switching from a 'soft' voluntary policy approach to mandatory measures to encourage uptake amongst food supply chain businesses is necessary to ensure the widespread and synchronous uptake as well as augmented market proliferation of within category labelling. This could provide a focused and explicit conduit for the facilitation of a more coherent policy drive towards a state where suppliers' claims of carbon credentials is commonplace. This would provide consumers with the opportunity to further meaningfully differentiate carbon footprinted products within and across product categories.

From the efficiency perspective as inferred by Garnett (2013), the LCA approach adopted within the PAS 2050 programme is designed to provide a basis upon which to calculate and reduce carbon emissions although from this study, it is unclear how effective use of PAS 2050 and the pursuit of carbon labels respectively has been in terms of driving carbon reduction across individual supply chain businesses or the food system at large. In terms of the sustainability of PAS 2050, its relevance, content and applicability is administered and governed by The Carbon Trust who advocate and emphasise the strategic importance of carbon reduction within and across industry sectors. PAS 2050 developers at The Carbon Trust have also closely collaborated with the WBCSD and WRI in their attempts to standardise and align measurement of GHG emissions across supply chains under the Greenhouse Gas Protocol (Baddeley et al., 2012). This ongoing close alliance and collaboration with external policy makers and standards setters is perhaps because the developers of PAS 2050 and its administrators are keen to ensure its credibility, robustness of method and its detailed specification to ensure it remains nationally and internationally pertinent at the policy and business levels.

The demand restraint perspective also put forward by Grunert et al. (2014) involves the consideration of consumption habits driven by consumers or the food producers and suppliers that seek to generate demand. The consumer survey conducted in this study finds that while carbon footprint and label demand is high amongst UK supermarket shoppers, these results also corroborate with assurances by The Carbon Trust of strong consumer demand for carbon footprint labels. However, the findings in this PhD research project indicate that consumers find carbon footprints confusing, difficult to interpret and compare. Added to this is the fact that price, as well as quality and taste attributes were most sought for when shopping for food, implying that the prevalence of '*a willingness to say*' but '*not to pay*' also suggested by Black (2010) and in an earlier, seminal study by Kollmuss and Agyeman (2002), to exist when expression for environmental concern and awareness may not necessarily convert into behavioural change, though in this study, this is due to the prioritisation by food consumers of quality

and taste, price and special offers over climate driven factors when purchasing food. For businesses in this study, demand and uptake for PAS 2050 is most prevalent at the producer and retailer stages of supply chains.

In essence, it is the architecture of delivery that is of paramount importance in delivering desired outcomes. As such, should the decarbonisation of food systems remain centred upon carbon footprinting and labelling policy initiatives, the consumer case study findings indicate that at least several key factors need to take place for the successful fruition of overall policy objectives. Firstly, the clarification of technical difficulties amongst food supply chain actors is required to facilitate reproducible results at the methodological level. Secondly, what is needed is a coherent, comprehensive and cohesive targeted labelling policy that encompasses a vigorous social learning campaign with respect to environmental impacts and carbon footprints specifically. These findings corroborate with those put forward by Cohen and Vandenberg (2012); Baddeley et al. (2012); Upham et al. (2011) and Berry et al. (2008) on carbon footprint labelling. Essentially, reliance on the demand side of supply chains, that is the end-consumer to act as agents of change towards 'greener' consumption may well disguise and distract supply chain businesses from the potentialities and ultimate benefits to be gained through system changes in operational activities within production and distribution systems.

8.2 Contribution to Knowledge

A PhD thesis at Northumbria University is required to make an original contribution to knowledge. This knowledge can be broadly fashioned to inform policy-making through theoretical or empirical analysis. The following sections distinguish this thesis' contributions to theory and empirical research findings.

To date, most studies concerning the perceptions of carbon footprinting and labelling focus on either the retail and/or consumption stages of supply chains over a broader chain perspective that considers multi-phases of production, manufacture, retail and consumption (end-use) (see for example: Hartikainen et al., 2014; Guenther et al., 2012; Rööös Tjärnemo, 2011; Upham et al., 2011; Vanclay et al., 2011; Berry et al., 2008; and Creese and Marks, 2009). This study contributes to knowledge because it looks at supply and demand in the context of carbon labelling to address the problem of accelerated climate change.

Contribution 1 is a holistic view of supply and demand in relation to the environmental problem of carbon in times of climate change.

Empirical Contributions: Supply Chain Management

In the context of food supply chain management, this research adds to the work of Vasileiou and Morris (2006) who assessed perceptions of sustainability in UK fresh potato supply chains and Ilbery and Maye (2005a) who also undertook primary research utilising a case study approach to explore notions of sustainability in UK food supply chains premised on a number of specialist food producers

in the Scottish/English borders. However, these research efforts focused solely on the production stage of the food supply chain, stopping short of a holistic or 'whole chain' perspective.

As highlighted by a number of authors in the supply chain management literature, (Mollenkopf et al., 2010 and McKinnon, 2010), little academic research with respect to studying the perceived impacts of carbon footprinting and labelling (specifically with reference to PAS 2050) in a supply chain context has taken place and even less so in the food supply chain literature particularly. This study notably adds to UK food supply chain research having responded to widespread calls for holistic inquiry exploring notions of 'sustainability' (Sarkis et al., 2011). This is pertinent given climate change, food supply chains and carbon footprinting are aspects of the 'sustainability agenda'.

Contribution 2 is to frame the environmental problem within the sustainability business chain debate.

Contributions to Policy and Practice

The empirical survey on consumer understanding and awareness of carbon footprint labelling ultimately showed that while there was a willingness to address environmental issues, there was little understanding of the meaning of the labels themselves and more importantly, of the imprecise nature of the science behind the labelling. There was little understanding of what life cycle analysis, the theory behind PAS 2050 entailed.

Empirical results from the survey of UK shoppers' perceptions (n=428) were published in the journal, *Food Policy* in December 2011 (Gadema and Oglethorpe, 2011). In retrospect, this survey confirmed what many other surveys of green issues record, namely that people say they are willing to address the issue but on the bottom line, price and quality dictate consumer choice.

Contribution 3, drawn from the same survey, emphasises that consumer response was to price and quality, not broader socio-environmental concerns. This parallels findings in the literature where green perceptions do not dictate consumer choice. See for instance, (Grunert et al., 2014; Upham et al., 2011; Black, 2010; Kimura et al., 2010; and Zander and Hamm 2010; Napolitano et al., 2008; and De Pelsmacker et al., 2005). The empirical survey showed that while there was a willingness to address environmental issues, there was little understanding of the meaning of the labels themselves and more importantly, of the imprecise nature of the science behind the labelling. These findings corroborate the positions of (Upham et al., 2011; Black, 2010; Kimura et al., 2010; and Zander and Hamm 2010; Napolitano et al., 2008; and De Pelsmacker et al., 2005).

This work also contributes to the broader food policy and land-use policy fields given the focus on assessing the UK food consumer response to carbon footprinting and labelling and ascertaining the policy drivers and barriers to uptake of PAS 2050 and carbon footprint labelling in UK food supply chains.

The supply chain survey covers the broad areas of production, distribution, and retail was thin but there was a distinctive suggestion from the qualitative statements that commitment to good

environmental practice was stronger with the producers rather than the retailers (Chkanikova and Lehner, 2015). Insights revealed from the qualitative key informant interviews provide leverage for a contribution to the field of Marketing Management on the marketing potential of carbon footprint labelling. This doctoral research shows that essentially carbon footprint labels largely equate to a level of 'greenwash' given the difficulty in harmonising decarbonisation efforts – a climate change policy imperative with the difficulty of what carbon footprints actually measure. Contribution 4 shows that carbon footprint labels cannot capture the totality of the environmental issue given the science addressing the environmental issue is not perfect and the environmental consequences of environmental change are uncertain.

The producers and distributors both emphasised the power of the retail sector in determining production and distribution choices, findings for which are also corroborated in earlier research by Burch et al. (2013); Richards et al. (2013); and Mutersbaugh, (2005). This strongly suggests that market share, particularly with the large six supermarket chains that dominate UK grocery retail by some 75%, determines production choice rather than resting with the producers themselves: Contribution 5.

This research contributes to the field of 'green' consumption behaviour, business management, sustainable (or green) supply chain management, environmental management and a number of other scholarly fields that criss-cross the interface between economics, environment, the political economy and broader social science realms.

Towards Placing the Contribution of Knowledge in Context

Empirical data from the qualitative key informant interviews corroborate the findings from earlier work by Bansal and Roth (2000) who, in their 'mixed model' approach examined '*why companies go green*'. As with Bansal and Roth (2000), this research shows substantive evidence that a single paradigm to corporate ecological responsiveness is insufficient in order to gain theoretical insights. Thus, applications of organisation theory within research on organisations and the natural environment necessitate and facilitate the bridging of theories that are often treated in silo.

While the question of why businesses 'go green' was investigated, this does not extend to examination of the rationale for the adoption of voluntary environmental standards such as EMSs', ISO 14001, PAS 2050 carbon footprinting, carbon labelling and other more contemporary forms/types of sustainability initiatives pertinent to the food sector. It is also constrained to the 'retail' or downstream element of a supply chain. However, the model developed by Bansal and Roth (2000) provides a useful set of insights to further examine twenty first century food businesses' motivations for 'ecological responsiveness'. The empirical findings indicate that few businesses are motivated by ecological responsibility. However, given the conceptualisations and environmental mechanisms present across organisations, such research on organisations and the environment is relevant for management practice.

To address these theoretical lacunae (Propositions 1 to 8 – see Table 23 on the following page), the Researcher addressed the neo-liberal market economics model that underlies market capitalism as well as the parallel contexts of other interventions to change individual behaviour. As such, the explicit contribution to theory is to assemble complementary and competing explanations and to see them as partial explanations, not to generate an overall synthesis for behavioural economic change.

The empirical consumer data confirms parallel findings from research on green marketing: that there is a willingness to consider green issues, although final choice is dictated by final price and quality of the goods. Of the supply chain analyses; again, there is corroboration that retailers, not producers and distributors dominate markets; sometimes at the expense of good environmental practice.

The theoretical contexts of neo-liberal market economic theory are laid out in twelve propositions, although these propositions might be better understood as central claims in particular bodies of theory. These are outlined in Table 23 on the next page.

After a relatively exhausted mining of these claims, Contribution 6 is that none of these theoretical frameworks sufficiently underpins a holistic understanding of changed consumer behaviour with reference to green behaviour in particular.

Table 23a Contributions to Knowledge from Empirical Findings

Theoretical Base	Propositions derived from Theory	Contributions to Knowledge from Empirical Findings
Social Marketing of Carbon Pro environmental Behaviour ABC (Attitude, Behaviour, Choice) Theory	13. Carbon standards and labelling are not robust but in decline. Continued non-standardisation of carbon accounting tools brings them into disrepute.	Limited scientific agreement is evident in the food labelling regime on what essentially is carbon equivalent labelling. No basis for justiciable judgement.
LCA – Life Cycle Analysis/Assessment	14. Carbon footprinting is a techno-political solution that substitutes a false science for a robust food policy.	The value of the environment cannot be captured as a market function. It requires a broader discussion in a framework of a social contract with the environmental problem of climate change.
Regulatory Frameworks	15. There may be universal access to PAS 2050 but there is no universal uptake. The policy framework is from strong food security to weak sustainability.	The policy framework of 'weak' sustainability is driven on the supply side by potential loss of market which in turn, is dominated by the oligopoly of supermarket chains. The policy framework does not acknowledge the power of supermarket control.
Political Economy of Regulation	16. There is little link between food production, consumption and environmental policy. The fragmentation of science informing food policy is influenced substantially through the private and corporate control of science.	Food policy is essentially a social contract. Market based initiatives produce a fragmentation along the whole food chain.
International Trading Regimes	17. Corporate uptake of environmental issues, especially climate change is largely precautionary due to the threat of an international legal regime.	Voluntary uptake of carbon footprinting regimes is based on a fear of losing market predominance, not on a commitment to maintaining good practice in environmental services.
Monopoly and Oligopoly Political Economy of Private Standards – e.g. Polanyi (1944) Private Governance	18. Near consumption actors (supermarkets) are the powerhouse of oligopoly that control food policy making. Corporate interests, not that of the State, is the arena for food policy making.	State actions are relatively weak against a mature private market that emphasises the primary return of capital to shareholders.
Nudge Theory (Behavioural Economics and Psychology)	19. Choice architecture has a fall-back position of nudge economics. Nudge economics is the economics of 'push' with no 'pull'.	There is currently no social contract that emphasises models of good practice that must be adhered to by all actors in the food chain. Nudging is a weak policy intervention with little impact in the case of food labelling for the environment.
Sustainable Supply Chain Management Organisational Behaviour Theory Decision Theory Complexity Theory	20. Green supply chain management is 'greenwash' – ISO 14001 is as close as it gets.	Greenwash is a form of light touch sustainability where sustainability is ultimately used for marketing purposes and CSR purposes rather than transformative change behaviour.
Parallel Context: Food Safety Labelling Risk Management Decision Making Risk Assessment Perceived Control Perceived Risk of Individual Behaviour	21. Regarding food safety, standards are underwritten by science and law but this is complex, confusing and sometimes contradictory.	Despite the contradictory nature of food safety response, there is a positive uptake based on labelling because it relates to individual health within a broader context of public health.
Parallel Context: Health & Nutrition Labelling Consumer Behaviour Motivation-Ability-Opportunity Framework	22. Regarding nutrition and health, food behaviour is targeted and changed but only at the individual level, never summarised to the social and the environmental problem which is essentially social.	While there is some progress in labelling to address nutrition and health, this progress relies on individual uptake and is poorly supported by broader campaigns to address the issue, e.g. the obesity pandemic.
Parallel Context: Omni/Meta Labelling Consumer Behaviour Constructivist institutionalism Institutional entrepreneurship Willingness to Pay Attitude-Behaviour-Context Model	23. Omni standards and labelling regimes would require a humanistic and social science approach that is neutral to corporate and private gain but the science of food policy is physical science of distance from human beings, while social science is increasingly for corporate and private gain.	Omni labelling at best, can give an indication of carbon intensity across a range of food stuffs but also requires a measure of sustainability within particular groups (e.g. meat versus vegetables).
Personal versus Social Contracting	24. There is need to move from the consumer with individual responsibility to consumers with collective social environmental responsibility.	The economics of the business school model assuming individual choice with full knowledge of environmental impact requires substituting with an exploration of social contracts that include environmental issues.

Learning from Other Fields

The literature on the parallel contexts, laid out in Table 23 (as Propositions 10, 11 and 12) of food safety, nutrition and health, and omni-labelling was dominated by public health issues where two approaches were apparent. The first, for example, with salt and sugar, was a proven uptake for individual health benefits, i.e. do no harm to self. This was different from the uptake of broader social considerations where there was evidence that society was willing to be risk averse, e.g. food safety labelling (best before dates) (Hall and O'Connell, 2013; Gortmaker et al., 2011; Siriex et al., 2011; and Millstone, 2007).

To date, the dominant but typically singularly applied, theoretical lenses to understand behavioural change within public health research, include Risk Management, Decision Making Risk Assessment, Perceived Control, Perceived Risk of Individual Behaviour and the Motivation-Ability-Opportunity Framework. Even with the social considerations, the empirical research indicates there seemed more immediacy directed towards what are perceived as 'tangible' problems, i.e. food poisoning/contamination than that posed by accelerated climate change and increased extreme weather events. This would suggest that these latter problems are largely perceived more broadly to happen to other people 'over there'. Contribution 7 is that while a social good can be produced by individual change behaviour in public health, in particular, it does not transfer easily to a social problem such as climate change.

Contribution to Theory

Future work will involve due consideration of these propositions from a perspective of political economy theory. The core reason for rejecting the theoretical approach of conventional economics, singularly and together, is that it suggests problem solving through individual behavioural change when the problem of climate change is essentially a social problem. This inadequacy is recognised by Van Kleef and Dagevos (2015) in the context of public health and nutritional 'nudging' tools for behavioural change who argue that such interventions tend to focus specifically on individuation of action. Marsden (2013) through the perspective of transformative change argues such 'innovative' policy tools as carbon footprinting are unlikely to lead to the sea change needed given the complexities associated with 'science-based' initiatives reliant on individual and voluntary uptake. Shove (2010) also points out the difficulty of drawing upon theories of social change and in particular, ABC (attitude, behaviour and choice) theory for behavioural change for a broader drive towards transformative social change within the realm of climate change policy. To this end, the search of the parallel contexts was in reality, a search for an explanation of successful uptake of innovative policy approaches for the food sector.

The insufficiency of the conventional and parallel contexts theoretical scholarly streams led to consideration of policy change. It was noted that in the uneven uptake of PAS 2050 and by implication, carbon footprinting and labelling, that the organisation which gave legitimacy to the encodement of good practice had itself become a monopoly of endorsement and had cornered the fee market for

approval (e.g. via certification). Contribution 8 is that as such, the empirical data implies that the political legitimacy of the usefulness of PAS 2050 was called into question (Chkanikova and Lehner 2015 and Chkanikova and Mont, 2012). Yet, while PAS 2050 is the world's first standardised carbon footprint standard, it also remains the most comprehensive and detailed LCA based carbon footprint standard to date (Liu et al., 2016 and Baddeley et al., 2012). Moreover, the Carbon Trust did not point out the commissions and omissions of 'good science' in the building up of carbon footprint codification.

Essentially, carbon footprinting is almost a parallel example to the problems of Private Finance Initiatives (PFI) where costs increase to the final consumer, where the private sector uses the vehicle to maintain market share, and where Government claims, against the odds, that it is effective and efficient practice.

The overall sense of contribution is not to building a stronger empirical base on which to judge green marketing. Nor, is it to reach a single penetrating theoretical insight. Instead, the overall contribution is to show a level of wisdom in rejecting theoretical claims for total explanation, while simultaneously realising that the climate change issue is a socially generated problem requiring social solutions.

8.3 Research Journey

All journeys are confusing and the travellers rarely know where they have been until they've got there. All journeys, too, carry internal personal knowledge and an external experience which, retold, add to social knowledge and accumulative wisdom. My internal personal knowledge is one where I wish to be an ethical consumer providing for self and broader family. My external knowledge relates to my broader engagement with environmental issues as social issues. My social knowledge and accumulative wisdom about carbon footprinting and labelling is that, while it can make a contribution, it is not the solution to global warming. This is largely because climate change is a social problem, created by market reliance on cheap food and energy with consequent externalities of pollution, rather than a problem that can be solved by individual choice.

My research journey began in many ways as an Environmental Scientist at Greenwich University. I transferred to a more people focused programme for the final two years of my final undergraduate education. In so doing, I was introduced to but did not consolidate a viewpoint that I now consider the political economy of the environment. The theoretical lens of the political economy argues among other things, that natural disasters are not natural but only happen to poor people in poor places. This viewpoint sought to explain the global process of soil erosion by the outmigration of people from rural areas, leaving insufficient labour to tend the land. My research journey essentially moved towards seeking understanding of the loss of food entitlements as a major cause for famine. In short, the political economy of the environment had people producing nature, including food.

I carried these separate understandings to a job as a Demonstrator in the Newcastle Business School, where alongside my teaching fellowship, I was encouraged to do a PhD. I had parallel research experiences in conducting life cycle analyses to ascertain carbon equivalent loadings of animal feed

(pig and poultry) production. The LCA attempts of animal feed production were separately undertaken for the UK's largest producer of pig and poultry animal feeds, Agricultural British Nutrition, known as ABN-Agri. The survey was partial in that, not all information was available to the Researchers and essentially relied upon calculating the energy 'hotspots' in pig and poultry animal feed production.

A decision was made to undertake a consumer survey questionnaire to understand how purchasers responded to environmental labelling, particularly the emerging LCA based carbon footprint label for food products. With my research training from environmental management, I then began to develop a consumer survey of response to food labelling for carbon footprint minimisation. Over several months, I conducted a preliminary pilot questionnaire at a Co-operative grocery supermarket in Amble, Northumberland, having chosen this site because it had a wide range of clientele by class, age and gender. Following this pilot, I then completed 428 researcher-led consumer surveys around the UK on the reaction to environmental change and carbon footprint labelling. Preliminary results of UK shoppers' perceptions were published in the journal, *Food Policy* in December 2011 (Gadema and Oglethorpe, 2011). In retrospect, this survey confirmed what many other surveys of green issues record, namely that people say they are willing to address the issue but on the bottom line, price and quality dictate consumer choice.

A parallel qualitative survey of the supply chain disturbingly showed that supermarkets constrained choice, not simply for consumers but also for producers, manufacturers and distributors. My experience of the food supply chain industry is that the retailer is King.

What was missing in my first attempt to describe the whole food chain reaction to the challenge of climate change was any reference to theory. Following discussion with my supervisors and other colleagues, I was driven back to the beginning to consider theoretical claims to economic behavioural change under market conditions. Not surprisingly, I found a literature which was full of exceptions, where nobody told the 'whole story' of the journey. Again, with external advice, I moved to theoretical considerations in parallel contexts, particularly that of public health. From all of these literatures, I came to the conclusion that market economics did not seriously address the causes of social problems which, dialectically, in many cases was the market itself. Quite simply, cheap food demands cheap production practices.

I might have made the journey more quickly if I had approached the issue from the perspective of the political economy in the first place. However, the journey in one sense had a goal, namely, to press for increasing uptake of carbon footprinting and labelling to address the climate change problem. Here, my disappointment with theoretical interpretations came home to roost. The policy frame encouraged by Government, implemented by some suppliers through carbon footprinting and sanctioned through the Carbon Trust, came to be seen for what it was, namely a charade to brush the environmental problem away from public oversight.

The journey experienced to date, is that the empirical data could not answer all of the research questions. Looking back on my research journey, it could have been done more efficiently. The emphasis should have been, from the literature review, finding gaps in explanations of consumer change prompted by environmental concerns, especially that of climate change. From these gaps, using different theoretical lenses, I would have identified a series of key propositions that could be turned into research questions. I would have undertaken pilot research to further develop both the propositions and the research questions. I would have also identified a sample, probably contrasting conventional supermarket buying habits against those of a dedicated environmental-vegetarian-vegan population. I would also have spent considerably more time on the qualitative of the supply chain, eliciting opportunity as well as constraint to understand the limits of behavioural change.

The development of a survey instrument specific to consumers, incorporating scales of behavioural response would give a more robust approach than the researcher-led questionnaire. Such a survey instrument would allow more advanced multi-variate data analysis to explore relationships between key constructs in the data. However, as I have come to the end of this part of my research journey, is that what I would really wish to do?

I have found that the journey so far has taken me to a better understanding of the political economy of food under market conditions. I think the direction of a future journey will be to explore in depth, the ethical considerations behind food in an environmental context under capitalism. This implies a greater use of theory than normally operationalised in the generic model of Newcastle Business School but it would also give a moral and, therefore, satisfying purpose to my future research inquiry as well as contribute towards Newcastle Business School's concerted drive towards responsible business and sustainable development.

Where to next on this journey? For me, the logical place to start is with the political economy of food, and with the implications of it, for oligopolistic practice. More important than the starting point, is to share that journey with others of likeminded experiences in and beyond Northumbria University. I look forward to a journey that sees me as an academic advocate of good food practice that develops social environmental goals rather than least cost production pricing.

There is a long way to go, not least to explore the role of food provision to cities, where the majority of the World's population now lives. One conclusion, albeit small, is that supermarkets can be part of the solution to ensure food security but they are not the answer to secure food security for a sustainable future.

8.4 Limitations and Future Research

The qualitative phase of this research study relied on in-depth semi-structured interviews with key informants from six different UK food supply chain relevant businesses as data. This limits the overall 'representativeness' of the sample given the inherently heterogeneous nature of the UK food sector and its relative food supply chain businesses that offer multiple food product types, operate at different stages of supply chains and are characterised by their different supply chain levels of complexity, reach, scale and length.

While the literature was drawn upon together with the inductive method of deducing rich interpretations derived from in-depth interviews, this inherently constrains the research study's scope in terms of the extent to which it is possible to include examination of a broader range, scale and size of food supply chain businesses. However, given this study's continuous and iterative consultation of academic literature, together with the richness of the interview data, these data were used to provide rationale and support for the generation of findings and conclusions. Validation via further empirical investigation using a research design premised on quantitative approaches, possibly with a closed survey questionnaire could complement these findings further.

Sampling procedures also represent a number of limitations to this study's contributions. For the quantitative inquiry in this thesis, a convenience sampling approach was used to gain access to and capture as many responses as possible from a broad range of UK food consumers. However, any re-iterations in the dissemination of this survey questionnaire and collection of primary data in this manner will inevitably differ in repeat surveys. For the qualitative stage of this research, purposive sampling was undertaken. However, it is recognised that purposive sampling cannot by definition be generalised to larger populations. The entire population of UK food supply chain businesses involved in the supply of food to the UK market did not have an equal probability of being selected as research participants for key informant interviews. The sample instead comprises a number of carefully chosen key informants within six different businesses known by the author of this thesis to be involved in sustainability and/or environmental reporting/compliance/rule setting and so forth at the strategic upper management level or above.

The overall nature of this PhD research project is exploratory. Although, the six businesses within the sample are diverse and the results analytically generalisable, extending reach to include a larger number of businesses' outcomes would provide more evidence to further explicate and test casual linkages within and across both phases of this study. Hence, inclusion of a larger sample size including for instance, more UK food supply chain businesses and possibly other key stakeholder businesses from (for example) a cross section of NGOs either through additional key informant interviews or quantitative surveys should be investigated. Another potential area for future research that sits outside of the scope of this research study could extend to the examination of the effects of ongoing national and international harmonisation to standardise carbon footprint standards.

Literature is continuously being published and thus adds to the base of existent knowledge for the purposes of the research in this thesis. However, this PhD study was undertaken at a single point in

time utilising articles from grey literature and peer reviewed journal articles then available. The continuous growth in this broad but rich research area is indicative of the developing phenomenon of carbon footprinting and green supply chain management and shows considerable future research potential.

Additionally, the dynamic nature of carbon footprint and carbon labelling standard setting at the policy and market level means that the quantitative survey administered to food consumers in 2009 could be repeated to explore the emergent response to carbon footprints over time at different temporal phases (such as every five years). Although, as mentioned previously, due to the heterogeneity of UK food consumers as well as the convenience sampling approach to capture respondents, it is impossible to survey the same set of consumers every time the survey is conducted.

As such, further insights can be solicited from the UK demand side of food chains that are time relevant. Consequent adoption of the questionnaire design and methodological approach over different timescales may also potentially arise, the cataloguing of which could provide a continual growth in the richness of inquiry and a clear trajectory of evidence relating to critically evaluating the evolving response to carbon footprinting and labelling and wider sustainability issues at the demand side of UK food chains.

A multi-national research project is needed to further assess empirically the total 'carbon' costs of conventional versus organic agri-food chains. Indeed, further research is needed to holistically compare and contrast such issues in agricultural production and trace these to the point of consumption for different food supply chain systems.

There is wide scope for innovative research that could combine collaborative, interdisciplinary and novel approaches to study the wider social, economic and environmental impacts of conventional versus 'green' food production systems. Further, by framing such research within a supply chain context, a continuation of the 'mixed' methodological approach employed within this thesis could be extended to include a number of case studies centred on specific food product supply chains. Future research should attempt to capture internationally acknowledged experts giving different perspectives on chosen issues (e.g. business, academic and NGO). In parallel, a supporting database of both primary data, collected directly from detailed case studies and secondary data with a collection of key academic and non-academic literature could be developed.

Building on the knowledge garnered from this research, future research on carbon footprinting and carbon label adoption in food chains could be expanded upon via case-study research. This could provide a rich repository of primary source data that could focus on specific issues outside the scope of this PhD research project. As such, future research could extend to an assessment of:

- carbon fluxes in production, packaging and distribution networks (e.g. carbon footprints and food miles);

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- carrying capacities of agricultural systems, conventional intensive versus alternative sustainable;
 - primary (source) and secondary (consumer) waste;
 - energy consumption throughout the lifecycle;
 - water reliance and 'virtual water';
 - environmental impacts and climate change; and
 - visible and virtual economic costs.

8.5 Conclusion

This study's results illustrate that the architecture of delivery is important in delivering a policy imperative such as PAS 2050, designed to reduce adverse carbon impact outcomes. As such, should the decarbonisation of food systems remain principally centred upon carbon footprinting and labelling policy initiatives, it is inferred from the findings of this study that there are a number of key factors that need to be considered for the successful fruition of such policy goals. These are listed below:

- At present, carbon footprint labels for food alone are not sufficient even if simplified (in terms of the information presented) to drive significant and meaningful levels of decarbonisation across the food system.
- Carbon footprint standards such as PAS 2050 will need to be refined to individual sectors and would benefit from the promulgation of sector-specific and further, product-specific approaches to ensure improvements in consistency and comparability.
- To facilitate reproducible results at the methodological level, the clarification of technical difficulties amongst and across food supply chain actors is needed.
- Carbon footprint label design should integrate existent knowledge gathered from earlier labelling studies, be transparent and comprehensible to enable consumers to make simple product comparisons within 'same' product categories.
- A reasoned and logical widespread targeted carbon labelling policy that includes a strong social learning campaign with respect to environmental impact and carbon footprints specifically is recommended.
- PAS 2050 carbon footprint uptake is disparate amongst UK food supply chain businesses largely due to the voluntary premise of the standard.

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- Switching from a voluntary premised policy approach to mandatory compliance with PAS 2050 carbon footprinting in the UK food sector is more likely to encourage uptake amongst its food supply chain businesses.

As both the interviews and the literature indicate (Dendler, 2014; Freidberg, 2014; Upham et al., 2011 and Tzilivakis et al., 2012), it is very difficult to establish a scientific regime for the measurement of carbon content, particularly of carbon equivalent content. Despite standardisation of method to measure carbon equivalents through a standard such as PAS 2050, such efforts are open to conflicting and contradictory accounting approaches given the genericised nature of the guidelines and method contained within the standard itself. Carbon labelling therefore, can only 'fudge' the environmental transparency of any individual product. Carbon labelling has no claim on scientific transparency but rather, is an opaque form of 'feel good' advertising.

Cohen and Vandenberg (2012) and Vandenberg et al. (2011) highlight that major gaps exist as to the state of play and knowledge of how consumers comprehend and respond to carbon footprint labels. They also suggest that few studies investigate the use and usefulness of such labels in 'natural' environments where individuals are often side-tracked, under time constraints or exposed to different options than laboratory studies. Such empirical testing is suggested to improve the chances of success of such carbon footprint policy regimes. However, as Chkanikova and Lehner (2015); Freidberg (2015); Edwards-Jones et al. (2009); and Mutersbaugh (2005) caution, the nature of such nationally and internationally applicable environmental standards, not least, the support by global institutions such as the WBCSD, WRI and ISO for their increasing 'harmonisation' and standardisation in process and practice terms within a voluntary, 'self-regulatory' context, frequently mean that such efforts can lead to unethical and disproportionate power imbalances within and across food chains. As Mutersbaugh (2005) p.2038 put: "*globalized standards and affiliated transnational institutions have become both a bone of contention in international trade disputes and a focus of corporate and environmental or social-justice movement attention*".

Following Hopwood, Mellor and O'Brien (2005) and more recently, Geels et al. (2015), the drive to sustainability in light of this research inquiry, demonstrates that any attempt to locate carbon footprinting and labelling within the wider context of sustainability essentially culminates in the preserving of the status quo rather than seeking reform or actual transformation for a sustainable future. While the carbon lobby itself, especially the Carbon Trust would wish to make a claim for reform, the inability to operationalise LCA behind ISO 14000/1 or the GHG Protocol, means that at best, it sits on the edge between status quo and reform. The voluntary PAS 2050 carbon standard forms a fall-back position which again, does not really move much beyond the status quo. Consequently, carbon labelling itself requires a more robust, refined, egalitarian and reliable scientific evidence base to move towards reform. The transformations that have occurred in the food industry that are reformist are largely outside of the food industry control. For instance, the generation of bulk electricity from renewables has significantly reduced the carbon footprint of food processing (Economist, 2017). There are parallels to this analysis

which also highlight international differences between major developed country food regimes in the US and Europe (Mutersbaugh, 2005).

It is useful that the findings of this PhD inquiry are largely corroborated by Rayner (2014) in his second edition of *'A Greedy Man in a Hungry World'*. From pages 64 to 67, Rayner addresses in a popular rant, the issue of food labelling, arguing for a new kind of labelling. The food industry he argues should be no different from the White Goods industry but with food, it will require significant international cooperation and the creation of cross-industry bodies. All this takes some patience but as he notes "*it has been done before*". New measures will come in and others will be abandoned. This will not baffle shoppers because shoppers are smart. What Rayner argues for are two ratings. One of the ratings would indicate food stuffs in relation to sustainability, from, he suggests, light shades of green for the highly sustainable to deep shades of red for the non-sustainable for the whole food basket. His second rating would indicate where products stood in relation to other products within the same category so that producers would have an incentive to produce a carbon footprint as much as possible towards carbon neutrality. He suggests, with humour, it might be called the *'Rayner Scale'*. Despite this tongue in cheek remark, Rayner urges that the food industry and policy makers ought to move quickly and just *'get on with it'* no matter *'what they call it'* given the prevalent knowledge and increasing familiarity of the practice of life cycle based carbon footprinting.

What this raises goes beyond the food industry. It is perhaps reflected in the tensions between conventional economics, business school economic practice and broader political economy theory (Taylor, 2016). The emphasis in conventional and business economics is on the individual. As Taylor (2016) succinctly points out, the focus is placed upon the individual even though social science is meant to be about 'social' reality because the agenda, particularly driven by business schools, is an agenda to support corporate activity. He argues that there is no social inquiry any longer in social science, and still less in business studies. The issue of the 'social' brings one to the issue of social contracts. The 12 propositions in this study all hinted at a bias towards a preference of individual contract theory, placing the onus on individuals in a market place for behavioural change. But both the climate change issue and the food industry issue are inherently social. Resolving social problems politically requires social contract (Taylor, 2016; Mutersbaugh, 2005 and Deegan, 2002).

For a variety of reasons, carbon footprinting and labelling are not social contracts as put forward by Chkanikova and Lehner (2015), Mayes and Thompson (2014) and Mutersbaugh (2005). However, even if there were social contracts, they would be limited by the nature of intellectual inquiry. In this sense and in a broader context of social science, the carbon debate reinforces the idea that reliance on science to address environmental problems produces as put forward famously by Wilbur Zelinsky in 1975, a *'Demigod's dilemma'* (that 'science' has become the dominant 'religion' of late twentieth century social science domains). Indeed, 42 years on, and well into the twenty first century, there seems to have been little progress beyond the Demigod's dilemma (Zelinsky, 1975) in the context of food policy making for environmental and social good.

Echoing this dilemma, in an article published in the Observer (30/07/2017), Jay Rayner¹⁴ offers a manifesto to 'keep the country fed' (Guardian, 2017a). From a global perspective, he argues that the UK is increasingly not self-sufficient in food with middle class demand throughout Asia changing access to the global larder. Within the UK, self-sufficiency can only be addressed if prices increase even though this will impact severely on those with lower incomes. It is stated that the existing subsidy structure is flawed with farmers paid for activity, not outcome. One significant outcome to be addressed is that of environmental protection. Within the environmental protection argument, Rayner argues that carbon footprinting even though it is a blunt tool, has much to recommend it, not least because the expertise behind carbon footprinting is now widespread. It is suggested that only by addressing the issue of carbon footprinting will the sustainability of the food industry be addressed. This thesis contributes substantially to this debate by providing a detailed analytic from both the demand and supply perspective of responses to the current carbon footprinting and labelling regimes. As such, it contributes to the building of a national food policy in a globalising world.

As suggested by Shewmake et al. (2015); Garnett, (2013); Cristopher (2013); Baddeley et al. (2012); Guenther et al. (2012); Vergez (2012); Upham et al. (2011); Steenblik and Moise (2010); Finkbeiner (2009); McKinnon (2010); and Saunders et al. (2009) amongst others, there is a need to learn from existing carbon footprint attempts as they evolve. This is especially pertinent given the gravitas associated with the PAS 2050 carbon footprint standard which is also referred to and used as an exemplar of 'best practice' by leading global institutions also involved in developing and disseminating carbon footprint-centric initiatives often embedded within broader food policy frameworks (Baddeley et al., 2012).

With reference to carbon footprinting and labelling, there is scope to explore the issues from a theoretical perspective of political economy in the food industry. Political economy allows a search light to be thrown at the problem rather than weaving the tale of the reluctant uptake by producers and consumers of carbon footprinting and labelling respectively (Freidberg, 2015). Carbon footprinting itself requires a situational analysis within the broader field of environmental sustainability within the food industry, where there seems to be a trade-off between carbon minimisation and the minimisation of other environmental impacts associated with the requirements for production such as water for instance. The power of supermarkets in dictating production patterns needs consistent and constant research effort, not least because oligopolies can 'make or break' good environmental practice (Glover et al., 2014; Burch et al., 2013; Manning et al., 2013; Richards et al., 2013). In a globalising food market, attention must be paid to the proportionate income that is devoted to the food basket, especially

¹⁴ This article was essentially the email that Rayner sent to the Secretary of State for DEFRA, Michael Gove (appointed 11th June, 2017), after he refused to sit on a roundtable for (innovative thinkers) convened by DEFRA on 25th July 2017 on food policy.

for those at the lower end of the income chain (Burch et al., 2013; Lang and Barling, 2013 and Richards et al., 2013).

This research contributes towards the emergent field of carbon management as well as the more mature disciplines of food policy, operations management, environmental management, food supply chain management and marketing management. It does so by clearly demonstrating there is still far to go in voluntary food standards and labelling to change human behaviour to produce socially and environmentally beneficial outcomes. The usefulness of carbon footprinting and labelling is apparent even if it continues to be contested scientifically. In this sense, the use of carbon footprinting and labelling continues to be limited, not least because those commanding the food chain, namely the supermarket retailers, have not been forced by market conditions or regulations to change behaviour towards a broader, more socially inclusive environmentally friendly regime.

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References

- Aaron, J. I. Mela, D. J. and Evans, R. E. (1994) ***The influences of attitudes, beliefs and label information on perceptions of reduced-fat spread***, *Appetite*, Vol. 22, Issue 1, pp. 25–37
- Abbasi, M. and Nilsson (2012) ***Themes and challenges in making supply chains environmentally sustainable***, *Supply Chain Management: An International Journal*, Vol. 17, Issue 5, pp.517-53
- Aertsens, J. Verbeke, W. van Mondelaers, K. and Huylenbroeck, G. (2009) ***Personal determinants of organic food consumption: a review***, *British Food Journal*, Vol. 111, pp.1140– 1167
- Agrawala, S., (1998), ***Context and Early Origins of the Intergovernmental Panel on Climate Change***, *Climate Change*, Vol. 39, pp. 621–642
- Agyeman, J. Bullard, R.D. Evans, B. (2003) ***Just Sustainabilities: Development in an Unequal World***, MIT Press, Cambridge, MA
- Ajzen, I. (1991) ***The theory of planned behaviour***, *Organizational Behavior and the Human Decision Process*, Vol. 50, pp. 179-211
- Albuquerque, P. Bronnenberg, B.J. and Corbett, C.J. (2007) ***A Spatiotemporal Analysis of the Global Diffusion of ISO9000 and ISO14000 Certification***, *Management Science*, Vol. 53 Issue 3, pp. 451–468
- Aldanondo-Ochoa, A.M. and Almansa-Saez, C. (2009) ***The private provision of public environment: consumer preferences for organic production systems***, *Land Use Policy*, Vol. 26, pp.669–682
- Alexander, H. Walker, H. and Naim, M (2014) ***Decision theory in sustainable supply chain management: a literature review***, *Supply Chain Management: An International Journal*, Vol. 19 Issue 5/6 pp. 504 - 522
- Alton Mackey, M. and Metz, M. (2009) ***Ease of reading of mandatory information on Canadian food product labels***, *International Journal of Consumer Studies*, Vol. 33, pp. 369–381
- Amagoh, F. (2008) ***Perspectives on Organizational Change: Systems and Complexity Theories***, *The Innovation Journal: The Public Sector Innovation Journal*, Vol. 13, No. 3, Article 3, pp.1-14
- Andrews, J. C., Burton, S. and Kees, J. (2011) ***Is simpler always better? Consumer evaluations of front-of-package nutrition symbols***, *Journal of Public Policy and Marketing*, Vol. 30, Issue 2, pp. 175–190
- Anselmsson, J. and Johansson, U. (2007) ***Corporate social responsibility and the positioning of grocery brands***, *International Journal of Retail & Distribution Management*, Vol. 35, No. 10, pp. 835-856
- Arimura, T.H. Darnall, N. And Katayama, H. (2011) ***Is ISO 14001 a gateway to more advanced voluntary action? The case of green supply chain management***, *Journal of Environmental Economics and Management*, Vol. 61, pp. 170-182
- Arimura, T.H. Hibiki, A. and Katayama, H. (2008) ***Is a voluntary approach an effective environmental policy instrument? A case for environmental management systems*** *Journal of Environmental Economics and Management*, Vol. 55 pp. 281–295
- Ayres, R.U. (2008) ***Sustainability economics: Where do we stand?*** *Ecological Economics*, Vol. 67, pp. 281-310
- Baddeley, S. Cheng, P. and Wolfe, R. (2012) ***Trade Policy Implications of Carbon Labels on Food***, *The Etsy Centre Journal of International Law and Trade Policy*, Vol. 13, No. 1, pp. 59-93
- Bai, C. and Sarkis, J. (2010) ***Green supplier development: analytical evaluation using rough set theory***, *Journal of Cleaner Production*, Vol. 18, Issue 12, pp. 1200–1210
- Baines, J. (2014) ***Food Price Inflation as Redistribution: Towards a New Analysis of Corporate Power in the World Food System***, *New Political Economy*, Vol. 19, Issue 1, pp. 79-112
- Balcombe, K. Fraser, I. and Di Falco, S. (2010) ***Traffic lights and food choice: a choice experiment examining the relationship between nutritional food labels and price***, *Food Policy*, Vol. 35, pp. 211-220
- Bansal, P. and Roth, K. (2000) ***Why Companies Go Green: A Model of Ecological Responsiveness***, *Academy of Management Journal*, Vol. 43, No. 4, pp. 717-736
- Barling, D. (2007) ***Food Supply Chain Governance and Public Health Externalities: Upstream Policy Interventions and the UK State***, *Journal of Agricultural and Environmental Ethics*, Vol. 20, Issue 3, pp. 285-300

-
- Barling, D. and Lang, T. (2003) ***A Reluctant Food Policy? The First Five Years of Food Policy under Labour***, The Political Quarterly Publishing Co. Ltd, Blackwell Publishing, Oxford, pp. 8-18
- Barreiro-Hurlé, J. Gracia, A. and de-Magistris, T. (2010) ***Does nutrition information on food products lead to healthier food choices?*** Food Policy, Vol. 35, pp. 221–229
- Barrett, C.B. Barbier, E.B. Reardon, T. (2001) ***Agroindustrialization, globalization, and international development: the environmental implications***, Environment and Development Economics, Vol. 6, pp. 419–433
- Barrett, J. Birch, R. Baiocchi, G. Minx, J. and Wiedmann, T. (2006) ***Environmental Impacts of UK Consumption – Exploring Links to Wealth, Inequality and Lifestyle***, IABSE Henderson Colloquium, Cambridge, 10-12 July 2006, Factor 10 Engineering for Sustainable Cities, pp. 1-6, [online] Available at: http://www.istructe.org/IABSE/Files/Henderson06/Paper_01.pdf
- Benbrook, C., Carman, C., Clark, E., Daley, C., Fulwider, W., Hansen, M., Leifert, C., Martens, K., Paine, L., Petkewitz, L., Jodarski, G., Thicke, F., Velez, J., and Wegner, G. (2010) ***A Dairy Farm's Footprint: Evaluating the Impacts of Conventional and Organic Farming Systems***, Critical Issue Report. Washington, DC: The Organic Center
- Berger, P.L. (1963) ***Invitation to Sociology, A Humanistic Perspective***, New York Anchor Books, Doubleday & Company Inc. S.1-24
- Bernués, A., Olaizola, A. and Corcoran, K. (2003) ***Labelling information demanded by European consumers and relationships with purchasing motives, quality and safety of meat***, Meat Science, Vol. 65, pp. 1095–1106
- Berry, T. Crossley, D. and Jewell, J. (2008) ***Check-out Carbon: The Role of Carbon Labelling in Delivering a Low-carbon Shopping Basket*** (London) Pp.1-24 [online] Available at: <http://www.forumforthefuture.org/sites/default/files/project/downloads/check-out-carbon-final300608.pdf>
- Beske, P. Land, A. and Seuring, S. (2014) ***Sustainable supply chain management practices and dynamic capabilities in the food industry: A critical analysis of the literature***, International Journal of Production Economics, Vol. 152, pp. 131-143
- Bhaskar, R. (1979) ***The Possibility of naturalism: a philosophical critique of the human sciences***, Brighton: Harvester
- Bjorner, T.B. Hansen, L.G. and Russell, C.S. (2002) ***Environmental Labeling and Consumers' Choice: An Empirical Analysis of the effect of the Nordic Swan*** (Preliminary Version) [online] <http://www.vanderbilt.edu/Econ/wparchive/workpaper/vu02-w03.pdf>
- Bleda, M. and Valente, M. (2009) ***Graded Eco-Labels: a demand-oriented approach to reduce pollution***, 21 pages [online] <http://www.business.mmu.ac.uk/emaee/papers/17BledaValente.pdf>
- Blundel, R.K. and Hingley, M.K. (1999) ***Exploring growth in vertical inter-firm relationships: Small-medium firms supplying multiple food retailers***, Journal of Small Business and Enterprise Development, Vol. 8, No. 3, pp. 245-265
- Bockel, L. Touchemoulin, O. Jönsson, M. and Cortés, R.S. (2011) ***Carbon footprinting across the food value chain: a new profitable low carbon initiative? A review of the main benefits for businesses, public bodies and issues for developing countries***, Food and Agriculture Organization of the United Nations (FAO) [online] Available at: www.fao.org/easypol
- Bocken, N.M.P. Short, S.W. Rana, P. and Evans, S. (2014) ***A literature and practice review to develop sustainable business model archetypes*** Journal of Cleaner Production, Vol. 65, pp. 42-56
- Braathen, N.A. OECD, Environment Directorate, Paris, France, (2003) ***Voluntary Approaches for Environmental Policy, Effectiveness, Efficiency and Usage in Policy Mixes***, 137 pages [online] Available at <http://www.foundationpartnership.org/pdf/oecd.PDF>
- Brandt 21 (2010) ***The Brandt Equation: 21st Century Blueprint for the New Global Economy*** [online] Available at: http://www.brandt21forum.info/About_BrandtCommission.htm
- Brecard, D., Hlaimi, B. Lucas, S. Perraudeau, Y. and Salladare, F. (2009) ***Determinants of demand for green products: an application to eco-label demand for fish in Europe***, Ecological Economics, Vol. 69, pp. 115–125

-
- Brenton, P. Edwards-Jones, G. Jensen, M.F. and the World Bank (2009) **Carbon Labelling and Low Income Country Exports: A Review of the Development Issues**, Development Policy Review, Vol. 27 (3), pp.243-267 [online] Available at: <http://onlinelibrary.wiley.com/doi/10.1111/j.1467-7679.2009.00445.x/pdf>
- Brownawell, A. M. and Falk, M. C. (2010) **Cholesterol: Where science and public health policy intersect**, Nutrition Review, Vol. 68, Issue 6, pp. 355–364
- Brownell K, Warner K. (2009) **The perils of ignoring history: big tobacco played dirty and millions died. How similar is big food?** Milbank Quarterly, Vol. 87, Issue 1, pp. 259–94
- Bryden, A. Petticrew, M. Mays, N. Eastmure, E. and Knai, C. (2013) **Voluntary agreements between government and business—A scoping review of the literature with specific reference to the Public Health Responsibility Deal**, Vol. 121, Issue 6, pp. 575-726
- BSI, British Standards Institution (2008) **PAS 2050:2008—Specification for the assessment of the life cycle greenhouse gas emissions of goods and services**, London
- Bulkeley, H. and Owens, S. (2009) **Converging agendas? Energy and climate change policies in the UK**, Environment and Planning C: Government and Policy, Vol. 27, Issue 1, pp. 90-109
- Burch, D. Dixon, J. and Lawrence, G. (2013) **Introduction to symposium on the changing role of supermarkets in global supply chains: from seedling to supermarket: agri-food supply chains in transition**, Agriculture and Human Values, Vol. 30, Issue 2, pp. 215-224
- Busch, L. (2000) **The moral economy of grades and standards**, Journal of Rural Studies, Vol.16, pp. 273-283
- Buse, K. Mays, N. and Walt, G. (2012) **Making Health Policy**, 2nd ed. Maidenhead, Open University Press
- Butler, K. M. L. (2010) **Making smart choices: Health claims, regulation, and food packaging** [online] Available at: <http://etd.library.pitt.edu/ETD/available/etd-04122010-130208/unrestricted/>
- Cao, G. and McHugh, M. (2005) **A systemic view of change management and its conceptual underpinnings**, Systemic Practice and Action Research, Vol. 18, Issue 5, pp.475-490
- Capps, O. (1992) **Consumer response to changes in food labelling: discussion**, American Journal of Agricultural Economics, Vol. 74, pp. 1215–1217
- Caraher, M. (2004) **Retailer Dominance and the Impact on Farmers: From Growing to Sustenance**, National Potato Conference Proceedings 2004 [online] Available at: <http://www.teagasc.ie/publications/2004/20040226/nationalpotatoconferenceproceedings2004.pdf>
- Carbon Brief (2017) **Analysis: Dramatic shift in UK government outlook for gas and clean energy** [online] Available at: <https://www.carbonbrief.org/analysis-dramatic-shift-uk-government-outlook-gas-clean-energy>
- Carbon Trust (2007) **Carbon Footprint Measurement Methodology**, Version 1.1, The Carbon Trust, London, UK [online] Available at: <http://www.carbontrust.co.uk>
- Carbon Trust (2008) [online] Available at: <http://www.carbontrust.co.uk/default.ct>
- Carbon Trust (2009) **How Carbon Labels Work** [online] Available at: <http://www.carbon-label.com/individuals/why.html>
- Carbon Trust (2012) [online] Available at: <http://www.carbontrust.com/>
- Carbon Trust (2013) **Carbon Trust Certification becomes the world's first organisation to achieve accreditation to certify against the new version of the standard for product carbon footprinting; PAS 2050**, [online] Available: <http://www.carbontrust.com/about-us/press/2012/08/carbon-trust-certification-becomes-the-worlds-first-organisation-to-achieve-accreditation-to-certify-against-the-new-version-of-the-standard-for-product-carbon-footprinting-pas-2050>
- Carbon Trust (2013a) **Carbon Footprint Labels from the Carbon Trust** [online] Available at: <http://www.carbontrust.com/client-services/footprinting/footprint-certification/carbon-footprint-label>
- Carlsson-Kanyama, A. and Gonzalez, A. (2009) **Potential contributions of food consumption patterns to climate change**, American Journal of Clinical Nutrition, Vol. 89, Issue 5, pp.1704S–1709S

-
- Caro, F. Corbett, C.J. Tarkan, T. and Zuidwijk, R. (2013) **Double Counting in Supply Chain Carbon Footprinting**, *Manufacturing & Service Operations Management*, Vol. 15, Issue 4, pp. 545-558
- Carter, C.R. and Easton, P.L. (2011) **Sustainable supply chain management: evolution and future directions**, *International Journal of Physical Distribution & Logistics Management*, Vol. 41, No. 1, pp. 46-62
- Carter, C.R. and Rogers, D.S. (2008) **A framework of sustainable supply chain management: moving toward new theory**, *International Journal of Physical Distribution & Logistics Management*, Vol. 38, No. 5, pp. 360-387
- Carter, C.R. Kale, R. and Grimm, C.M. (2000) **Environmental purchasing and firm performance: an empirical investigation**, *Transportation Research Part E: Logistics and Transportation Review*, Vol. 36, No. 3, pp. 219–228
- Carvalho, F.P. (2006) **Agriculture, Pesticides, Food Security and Food Safety**, *Environmental Science and Policy*, Vol. 9, pp. 685-692
- Cashore, B. Auld, G. Bernstein, S. and McDermott, C. (2007) **Can Non-state Governance ‘Ratchet Up’ Global Environmental Standards? Lessons from the Forest Sector**, Vol. 16, Issue 2, pp. 158-172
- Caviglia-Harris, Chambers, D. and Kahn, J.R. (2009) **Taking the “U” out of Kuznets A comprehensive analysis of the EKC and environmental degradation**, *Ecological Economics*, Vol. 68, pp. 1149-1159
- Ceci-Renaud, N. and Khamsing, W. T. (2012) **Consumers faced with environmental labelling**, *Collection of the Economy, Evaluation and Integration of Sustainable Development Service (SEEIDD) in the Department of the Commissioner-general for Sustainable Development (CGDD)* [online] Available at: http://www.developpement-durable.gouv.fr/IMG/pdf/ED74_-_EV.pdf
- Chakravarthy, B. (1997) **A new strategy framework for coping with turbulence**, *Sloane Management Review*, Vol. 38, Issue 2, pp.126-127
- Chambers, S.A., Lobb, A.E. & Mortimer, D.T. (2006) **Attitudes and behaviour towards functional foods: focus groups**, Work package No. 2, Report No. 3, University of Reading, UK
- Chandon, P. and Wansink, B. (2007) **The biasing health halos of fast-food restaurant health claims: Lower calorie estimates and higher side-dish consumption intentions**, *Journal of Consumer Research*, Vol. 34, Issue 3, pp. 301–314
- Chapple, W. Morrison, C.J. Harris, P. and Harris, R. (2005) **Manufacturing and Corporate Environmental Responsibility: Cost Implications of Voluntary Waste Minimisation**, No. 17-2004 ICCSR Research Paper Series - ISSN 1479-5124 and *Structural Change and Economic Dynamics*, Vol. 16, pp. 347-373
- Chatterton, T. (2011) **An Introduction to Thinking about ‘Energy Behaviour’: a multi-model approach**, London: DECC [online] Available at: <http://www.decc.gov.uk/assets/decc/11/about-us/economics-social-research/3887-intro-thinking-energy-behaviours-pdf>
- Chernev, A. (2011) **The Dieter’s paradox**, *Journal of Consumer Psychology*, Vol. 21, Issue 2, pp. 178–183
- Chkanikova, O. and Lehner, M. (2015) **Private eco-brands and green market development: towards new forms of sustainability governance in the food retailing**, *Journal of Cleaner Production*, Vol. 107, pp. 74-84
- Chkanikova, O. and Mont, O. (2012) **Corporate supply chain responsibility: drivers and barriers for sustainable food retailing**, *Corporate Social Responsibility and Environmental Management*, DOI: 10.1002/csr.1316
- Christopher, M. (2013) **Logistics and Supply Chain Management**, ePub eBook Financial Times Series, 4th edition, Financial Times, Pearson, 288 pages
- Cini, M. (2007) **European Union Politics**, Oxford University Press, Second Edition, ISBN 0199281955, 9780199281954, 496 pages
- Clapp, J. and Dauvergne, P. (2011) **Paths to a green world: The political economy of the global environment**, 2nd Edition. Cambridge, MA: MIT Press
- Coe, N.M. Dicken, P. and Hess, M. (2008) **Global production networks: realizing the Potential**, *Journal of Economic Geography*, Vol. 8, Issue 3, pp. 271–295

- Cohen, D. and Farley, T. A. (2008) ***Eating as an automatic behaviour***, Preventing Chronic Disease, Vol. 5, Issue 1, pp. 1-7
- Cohen, M.A. and Vandenberg, M.P. (2012) ***The potential role of carbon labelling in a green economy***, Energy Economics, Vol. 34, Supplement 1. pp. 53-63
- Cohen, N. (2012) ***Planning for Urban Agriculture; Problem Recognition, Policy Formation and Politics in Sustainable Food Planning***, edited by A. M. Viljoen and J. S. C. Wiskerke, pp. 103 – 114
- Coley, D. Howard, M. and Winter, M. (2009) ***Local food, food miles and carbon emissions: A comparison of farm shop and mass distribution***, Food Policy, Vol. 34, pp. 150-155
- COM, Commission of the European Communities (2000) **Communication from the Commission on the Precautionary Principle** [online] Available at: http://ec.europa.eu/dgs/health_consumer/library/pub/pub07_en.pdf
- Conway, G. (1997) ***The Doubly Green Revolution: Food for all in the 21st century***. London: Penguin Books
- COP 15 (2009) ***United Nations Climate Change Conference, December 7-18, 2009*** [online] Available at: <http://en.cop15.dk/frontpage>
- Corbett, C.J. and Kirsch, D.A. (2001) ***International Diffusion of ISO 14000 Certification***, Production and Operations Management, Vol. 10, No.3 pp. 327–342
- Corbett, C.J. and Klassen, R.D. (2006) ***Extending the Horizons: Environmental Excellence as Key to Improving Operations***, Manufacturing & Service Operations Management, Vol. 8, No.1, pp. 5–22, ISSN: 1523-4614
- Court, T. de la (1990) ***Beyond Brundtland Green Development in the 1990s***, Zed Books Ltd., London
- Cowan, C. (1998) ***Irish and European consumer views on food safety***, Journal of Food Safety, Vol. 18, pp. 275–295
- Creese, J. and Marks, N. (2009) ***Future Farming 'How Will Climate Change Impact Market Requirements for Victoria's Agrifood Exports?'*** ISBN 978-1-74217-454-9
- Cruz, J.M. and Matsypura, D. (2009) ***Supply chain networks with corporate social responsibility through integrated environmental decision-making***, International Journal of Production Research, Volume 47, Issue 3, pp. 621-648 Kovács, G. (2004) ***Framing a demand network for sustainability***, Progress in Industrial Ecology: an International Journal, 1 (4) pp. 397-410
- D'Souza, C. (2004) ***Ecolabel programmes: a stakeholder (consumer) perspective***, Corporate Communications: An International Journal, Vol. 9 Issue: 3, pp. 179-188
- Daly, J. Kellehear, A. and Gliksman, M. (1997) ***The public health researcher: A methodological approach***, Melbourne, Australia, Oxford University Press
- Daniels, P.W. (2004) ***Urban challenges: the formal and informal economies in mega-cities***, Cities, Vol. 21, Issue 6, pp. 501-511
- Darnton, A. (2004) ***The Impact of Sustainable Development on Public Behaviour***, 23 pages [online] Available at: <http://collection.europarchive.org/tna/20080530153425/http://www.sustainable-development.gov.uk/publications/pdf/desk-research1.pdf>
- Dauvergne and Lister (2012) ***Big Brand Sustainability: Governance prospects and environmental limits***, Global Environmental Change, Vol. 22, Issue 1, pp. 36-45
- Davies, W.P. (2003) ***An historical perspective from the Green Revolution to the gene revolution***, Nutrition reviews, Vol. 61, No. 6 Pt 2, pp. S124-34
- de Almeida, M.D.V. Graca, P. Lappalainen, R. Giachetti, I. Kafatos, A. de Winter, A.M.R. and Kearney, J.M. (1997) ***Sources used and trusted by nationally representative adults in the European Union for information on healthy eating***, European Journal of Clinical Nutrition, Vol. 51, pp. S16–S22
- De Pelsmacker P. Driesen, L. and Rayp, G. (2005) ***Do consumers care about ethics? Willingness to pay for fair-trade coffee***, Journal of Consumer Affairs, Vol. 39, pp. 363–385
- Decker, S.C. and Reuveny, R. (2005) ***Endogenous Technological Progress and the Malthusian Trap: Could Simon and Boserup Have Saved Easter Island?*** Human Ecology, Vol. 33, No. 1, pp. 119-140

-
- Deegan, C. (2002) *Introduction: The legitimising effect of social and environmental disclosures – a theoretical foundation*, Accounting, Auditing and Accountability Journal, Vol. 15, Issue 3, pp.282-311
- DEFRA (2006a) *Food Industry Sustainability Strategy*, HMSO, London Dept. for Transport, (2006) *Transport Statistics for Great Britain*, Chapter 3, Table 3.4 [online] Available at: <http://www.dft.gov.uk/pgr/statistics/datatablespublications/energyenvironment/tsgbchapter3energyandtheenvi1863>
- DEFRA (2006b) *Promoting Pro-Environmental Behaviour: Existing Evidence to Inform Better Policy Making*, Chapter 2: Policy Instruments [online] Available at: <http://www.defra.gov.uk/defrasearch/index.jsp?query=fiscal+instrument&search.x=0&search.y=0&search=search>
- DEFRA (2007a) *New statistics on life satisfaction shed light on wellbeing*, [online], Available at: <http://www.defra.gov.uk/news/2007/070727b.htm>
- DEFRA (2007b) *A shopper's guide to green labels* [online] Available at: <http://www.defra.gov.uk/environment/business/pdf/shoppers-guide.pdf>
- DEFRA (2008) *A framework for pro-environmental behaviours* [online] Available at: <http://www.defra.gov.uk/publications/files/pb13574-behaviours-report-080110.pdf>
- DEFRA (2008a) *Climate Change Act 2008 - key provisions/milestones* [online] Available at: <http://www.defra.gov.uk/environment/climate/legislation/index.htm>
- DEFRA (2008b) *Pitching Green – green labels and credentials: a guide to the options* [online] Available at: [http://ecolabel.defra.gov.uk/pdfs/Pitching%20Green Oct%202008.pdf](http://ecolabel.defra.gov.uk/pdfs/Pitching%20Green%20Oct%202008.pdf)
- DEFRA (2008c) *Types of Labels* [online] Available at: <http://www.defra.gov.uk/environment/business/marketing/glc/types.htm>
- DEFRA (2010) *Effective approaches to environmental labelling of food products* [online] Available at: <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=1&ProjectID=17104>
- DEFRA (2011) *Consumer understanding of green terms: A report to the Department for Environment, Food and Rural Affairs*, Brook Lyndhurst & Icaro Consulting, for Defra, London. Pages 1-88
- DEFRA (2012) *DEFRA Food Pocket Book - Total Factor Productivity* [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/183303/foodpocketbook-datasources-09apr2013.pdf
- DEFRA (2012a) *Sustainable Development in Government, The impact of product footprinting* [online] Available at: <http://sd.defra.gov.uk/2012/01/the-impact-of-product-footprinting/>
- Dendler, L. (2014) *Sustainability Meta Labelling: an effective measure to facilitate more sustainable consumption and production?*, Journal of Cleaner Production, Vol. 63, pp. 74-83
- Dolan, P. Hallsworth, M., Halpern, D., King, D. and Vlaev, I. (2012) *Influencing behaviour: The mindspace way*, Journal of Economic Psychology, Vol. 33, Issue 1, pp. 264-277
- Dow, S. C. (1990) *Post-Keynesianism as political economy: a methodological discussion*, Review of Political Economy, Vol. 2, No. 3, pp.345-58
- Dowler, E. Caraher, M. and Lincoln, P. (2007) *Inequalities in food and nutrition: challenging 'lifestyles'*, From Acheson to Choosing Health, The Policy Press, Bristol
- Downward, P.M. and Mearman, A. (2007) *Retroduction as mixed-methods triangulation in economic research: reorienting economics into social sciences*, Cambridge Journal of Economics, Vol. 31, pp. 77-99
- Drazin, R. and Van de Ven, A.H. (1985) *Alternative forms of fit in contingency theory*, Administrative Science Quarterly, Vol. 30, pp. 514-539
- Drewnowski, A. Moskowitz, H. Reisner, M. and Krieger, B. (2010) *Testing consumer perception of nutrient content claims using conjoint analysis. Public Health Nutrition*, Vol. 13, Issue 5, pp. 688-694
- Drichoutis, A. C. Lazaridis, P. and Nayga, R. M. (2006) *Consumers' use of nutritional labels: A review of research studies and issues*, Academy of Marketing Science Review 10(9) [Online] Available at <http://www.amsreview.org/articles/drichoutis09-2006.pdf>

-
- Dutra de Barcellos, M. Krystallis, A. de Melo Saab, S.M. Kügler, J.O. and Grunert, K.G. (2011) **Investigating the gap between citizens' sustainability attitudes and food purchasing behaviour: empirical evidence from Brazilian pork consumers**, *International Journal of Consumer Studies*, Vol. 35, pp. 391–402
- EAC (2007) **New Inquiry**, Environmental Labelling, 2007 [online] Available at: <http://www.parliament.uk/business/committees/committees-archive/environmental-audit-committee/eac-260707/>
- EC (2012) **Future Brief: Green Behaviour**, Science for Environment Policy, European Commission, pp.1-11 [online] Available at: <http://ec.europa.eu/environment/integration/research/newsalert/pdf/FB4.pdf>
- EC (2013) **European Commission welcomes the 7th Environment Action Programme becoming law, European Commission - MEMO/13/1020 20/11/2013** [online] Available at: <http://ec.europa.eu/environment/newprg/7eap.htm>
- EC Europa (2000) **Commission of the European Communities Brussels, Communication From The Commission on the precautionary principle**, [online], Available at: ec.europa.eu/dgs/health_consumer/library/pub/pub07_en.pdf
- Economist (2017) **electricity systems** [online] Available at: <http://www.economist.com/news/leaders/21717371-thats-no-reason-governments-stop-supporting-them-wind-and-solar-power-are-disrupting>
- Edwards-Jones, G. Canals, L.M. Hounsome, N. Truninger, M. Koerber, G. Hounsome, B. Cross, P. York, E.H. Hospido, A. Plassmann, K. Harris, I.M. Edwards, R.T. Day, G.A.S. Tomos, A.D. Cowell, S.J. and Jones, D.L. (2008) **Testing the assertion that 'local food is best': the challenges of an evidence-based approach**, *Trends in Food Science & Technology*, Vol. 19, pp. 265-274
- Edwards-Jones, G. Plassmann, K. York, E.H. Hounsome, B. Jones, D.L. Canals, M.A. (2009) **Vulnerability of exporting nations to the development of a carbon label in the United Kingdom**, *Environmental Science and Policy*, Vol. 12, Issue 4, pp. 479–490
- Edwards, J. B., McKinnon, A.C. Cullinane, S.L. (2010) **Comparative analysis of the carbon footprints of conventional and online retailing A "last mile" perspective**, *International Journal of Physical Distribution & Logistics Management*, Vol. 40, No. 1/2, pp. 103-123
- EEA (2005) **The European Environment Agency in coordination with Global Footprint Network presents: The National Ecological Footprint and Biocapacity Accounts**, 2005 Edition [online] Available at: <http://www.eea.europa.eu/highlights/Ann1132753060>
- EEA (2006) **The State of Action to Protect the Environment in Europe** [online] Available at: <http://reports.eea.europa.eu/92-827-4083-8/en/page004.html>
- EFSA (2009) **The community summary report on food-borne outbreaks in the European Union in 2007**, *The EFSA Journal*, 271. [online] Available at: <http://www.efsa.europa.eu/en/efsajournal/doc/271r.pdf>
- EIPRO (2006) **Analysis of the life-cycle environmental impacts related to the final consumption of the EU-25**, 13 pages [online] http://ec.europa.eu/environment/ipp/pdf/eipro_report.pdf
- Ekins and Dresner (2004) **Green Taxes and Charges: Reducing their impact on low income households**, York: Joseph Rowntree Foundation [online] Available at: <http://www.jrf.org.uk/knowledge/findings/housing/074.asp>
- Ekins, P. (1999) **European environmental taxes and charges: recent experience, issues and trends**, *Ecological Economics*, Vol. 31, pp. 39-62
- Elkington, J. (1998) **Cannibals with Forks: The Triple Bottom Line of the 21st Century**, New Society, Stoney Creek, CT
- Engels, S.V. Hansmann, R. and Scholz, R.W. (2010) **Toward a Sustainability Label for Food Products: An Analysis of Experts' and Consumers' Acceptance**, *Ecology of Food and Nutrition*, 49:1, pp. 30-60
- Environment Times (2009) **Kingsmill is first bread to put its carbon footprint on a label on the daily loaf** [online] Available at: http://www.environmenttimes.co.uk/news_detail.aspx?news_id=986

-
- EPLCA (2008) **CARBON FOOTPRINT - what it is and how to measure it** [online] Available at: http://lca.jrc.ec.europa.eu/Carbon_footprint.pdf
- Epstein, L., Dearing, K., Roba, L., and Finkelstein, E. (2010) **The influence of taxes and subsidies on energy purchased in an experimental purchasing study**, *Psychological Science*, Vol. 21, Issue 3, pp. 406–414
- Epstein, R. A. (1982) **The Social Consequences of Common Law Rules**, *Harvard Law Review*, Vol. 95, No. 8, pp. 1717-1751
- Ericksen, P.J. (2008) **Conceptualizing food systems for global environmental change research**, *Global Environmental Change*, Vol. 18, pp. 234-245
- Espinoza-Orias, N. Stichnothe, H. and Azapagic, A. (2011) **The carbon footprint of bread**, *The International Journal of Life Cycle Assessment*, Vol.16, pp.351-365
- European Commission (EC) (2012) **The Common Agricultural Policy: A Partnership Between Europe and Farmers**, Luxembourg: European Union
- European Commission–Standing Committee on Agricultural Research (EC–SCAR) (2011) **Sustainable Food Consumption and Production in a Resource-Constrained World**, Brussels: European Commission
- European Environment Agency (EEA) (2005) **Household Consumption and the Environment**, EEA Report No 11/2005. Copenhagen: EEA
- European Environmental Agency (EEA) (2008) **Time for Action— Towards Sustainable Consumption and Production in Europe**, EEA Technical Report No 1/2008. Copenhagen: EEA
- European Parliament and the Council of the European Union (2002) '**Decision No 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 Laying Down the Sixth Community Environment Action Programme**', *Official Journal of the European Communities* L242(45): pp. 1-15
- Eurostat (2012) **Food Supply Chain—Price Indices** [online] Available at: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_epgais&lang=en/
- Fabbrizzi, S. Maggino, F. Marinelli, N. Menghini, S. Ricci, C. and Sacchelli, S. (2016) **Sustainability and Food: A Text Analysis of the Scientific Literature**, *Agriculture and Agricultural Science Procedia*, Vol. 8, pp. 670-679
- Fairtrade Labelling Organization International (FLO). (2006) **Building Trust**, Annual Report 2005–6. Bonn: FLO
- FAO (2012) **World Agriculture: towards 2030/2050**, Interim Report [online] Available at: http://www.fao.org/fileadmin/user_upload/esag/docs/Interim_report_AT2050web.pdf
- FAO (2016) **What is Codex Alimentarius?** [online] Available at: <http://www.fao.org/fao-who-codexalimentarius/en/>
- Fearne, A. Hornibrook, S. and Dedman, S. (2001) **The management of perceived risk in the food supply chain: a comparative study of retailer-led beef quality assurance schemes in Germany and Italy**, *International Food and Agribusiness Management Review*, Vol. 4, pp. 19-36
- Feindt, P.H. and Flynn, A. (2009) **Policy stretching and institutional layering: British food policy between security, safety, quality, health and climate change**, *British Politics*, Vol. 4, No. 3, pp. 386-414
- Fereday, J. and Muir-Cochrane, E. (2006) **Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development**. *International Journal of Qualitative Methods*, Vol. 5, Issue 1, pp.1-11
- Ferguson, M.E. Toktay, L.B. (2006) **The effect of competition on recovery strategies**, *Production & Operations Management*, Vol. 15, Issue 3, pp. 351–368
- Feunekes, G. Gortemaker, I. Willems, A. Lion, R. and Kommer, M. (2008) **Front-of-pack nutrition labelling: Testing effectiveness of different nutrition labelling formats front-of-pack in four European countries**, *Appetite*, Vol. 50, Issue 1, pp. 57–70
- Fifoot, C. H. S. (1950) **History and Sources of the Common Law: Tort and Contract**, S. E. Thorne, *The Yale Law Journal*, Vol. 59, No. 6, pp. 1197-1200

-
- Financial Times (2017) *Balance of power tilts from fossil fuels to renewable energy* [online] Available at: <https://www.ft.com/content/8c28d1c2-2400-11e6-9d4d-c11776a5124d>
- Finkbeiner M. (2009) *Carbon footprinting – opportunities and threats*, The International Journal of Life Cycle Assessment, Vol.14, pp. 91-94
- Fischer, A., Frewer, L. and Nauta, M. (2006) *Toward improving food safety in the domestic environment: a multi-item Rasch scale for the measurement of the safety efficacy of domestic food-handling practices*, Risk Analysis, Vol. 26, pp. 1323–1338
- Foley, J.A. Ramankutty, N. Brauman, K.A. Cassidy, E.S. Gerber, J.S. Johnston, M. Mueller, N.D. O’Connell, C. Ray, D.K. West, P.C. Balzer, C. Bennett, E.M. Carpenter, S.R. Hill, J. Monfreda, C. Polasky, S. Rockström, Sheehan, J. Siebert, S. Tilman, D. And Zaks, D.P.M. (2011) *Solutions for a cultivated planet*, Nature, Vol. 478, pp. 337-342
- Follett, J.R. (2009) *Choosing a Food Future: Differentiating Among Alternative Food Options*, Journal of Agricultural and Environmental Ethics, Vol. 22, Issue 1, pp. 31-51
- Folmer, H. Jeppesen, T. (2003) *Environmental policy in the European Union: community competence vs member state competence*, Tijdschrift voor economische en sociale geografie, Vol. 94, Issue 4, pp. 510–515
- Food Ethics Council (2011) *‘Omni-label’ for food is pie in the sky – for now* [online] Available at: <http://www.ethicalperformance.com/news/article/6721>
- Food Standards Agency (FSA) (2009) *Comprehension and use of UK nutrition signpost labelling schemes* [online] Available at: <http://www.food.gov.uk/multimedia/pdfs/pmpreport.pdf>
- Foresight (2011) *Foresight Project on Global Food and Farming Futures Synthesis Report C12: Meeting the challenges of a low-emissions world*, pp.1-30 [online] Available at: <http://www.bis.gov.uk/assets/foresight/docs/food-and-farming/synthesis/11-632-c12-meeting-challenges-of-low-emissions-world.pdf>
- Forum for the Future (2008) *Check-out Carbon: the role of Carbon Labelling in Delivering a Low-carbon Shopping Basket*, pp. 1-21 [online] Available at: http://www.forumforthefuture.org/files/Check-out%20carbon%20FINAL_30068.pdf
- Foucault, M. (1979) *Discipline and Punish* (Vintage, New York)
- Fournier, V. (2008) *Escaping from the economy: the politics of degrowth and motivation*, International Journal of Sociology and Social Policy, Vol. 28, No. 11/12, pp. 528-545
- Fox and Vorley (2004) *Stakeholder accountability in the UK supermarket sector, Final report of the ‘Race to the Top’ project*, International Institute for Environment and Development (IIED) pp.4-37
- Fraj-Andrés, E. Martínez-Salinas, E. and Matute-Vallejo, J. (2009) *A Multidimensional Approach to the Influence of Environmental Marketing and Orientation on the Firm’s Organizational Performance*, Journal of Business Ethics, Vol. 88, No. 2, pp. 263-286
- Frame, B. Gordon, R. Mortimer, C. (2010) *Hatched: the capacity for sustainable development*, Landcare Research ebook [online] Available at: <http://search.landcareresearch.co.nz/s/search.html?gscope=1=40&mode=results&query=atched%3A+the+capacity+for+sustainable+development&collection=landcare-research-nz-meta>
- Freidberg (2015) *From behind the curtain: talking about values in LCA*, The International Journal of Life Cycle Assessment, ISSN: 0948-3349 (print version) ISSN: 1614-7502 (electronic version), Journal no. 11367, 5 pages
- Freidberg, S. (2003) *Culture, conventions and colonial constructs of rurality in south north horticultural trades*, Journal of Rural Studies, Vol. 19, Issue 1, pp. 97-109
- Freidberg, S. (2003b) *Cleaning up down south: supermarkets, ethical trade and African horticulture*, Social and Cultural Geography, Vol. 4, Issue 1, pp. 27-43
- Freidberg, S. (2014) *Footprint technopolitics*, Geoforum, Vol. 55, pp. 178-189
- Fresco, L.O. (2009) *Challenges for food system adaptation today and tomorrow*, Environmental Science and Policy, Vol. 12, Issue 4, pp. 378–385

-
- Fruitnet (2009) **UK Shoppers Keen on Green Labelling** [online] Available at: <http://www.fruitnet.com/content.aspx?cid=5312&ttid=6&sid=5302>
- FSA (2006) **Food labelling requirements: qualitative research**, Final Report, August 2006. [online] Available at: <http://www.food.gov.uk/multimedia/pdfs/flrqr.pdf>
- FSA (2008) **Don't make your mealtime a horror story**, Press Release Ref: R1374. [online] Available at: <http://tna.europarchive.org/20111116080332/> and <http://www.food.gov.uk/news/pressreleases/2008/jun/germwatch>
- FSA (2012) **EC General Food Law Regulation 178/2002 : Guidance Notes on the Food Safety Act 1990 (Amendment) Regulations 2004 and the General Food Regulations 2004** [online] Available at: <http://www.food.gov.uk/multimedia/pdfs/generalfoodsafetyguide2.pdf>
- FSANZ (2003) **Food labelling issues: quantitative research with consumers, Evaluation report series No 4. Food Standards Australia New Zealand** [online] Available at: <http://www.foodstandards.gov.au/scienceandeducation/publications/evaluationreportseries/foodlabellingissuesquantitativeresearchconsumer sjune2003/>
- FSANZ (2008) **Consumer attitudes survey 2007: a benchmark survey of consumers' attitudes to food issues**, Food Standards Australia New Zealand [online] Available at: <http://www.foodstandards.gov.au/scienceandeducation/publications/consumerattitudes/>
- Fuchs, D. Di Giulio, A. Glaab, K. Lorek, S. Maniates, M. Princen, T. and Røpke, I. (2016) **Power: the missing element in sustainable consumption and absolute reductions research and action**, Journal of Cleaner Production, Vol. 132, pp. 298-307
- Fuchs, D. Kalfagianni, A. and Havings, T. (2011) **Actors in private food governance: the legitimacy of retail standards and multistakeholder initiatives with civil society participation**, Agricultural Human Values, Vol. 28, pp. 353-367
- Gadema, Z. and Oglethorpe, D. (2011) **The use and usefulness of carbon labelling food: A policy perspective from a survey of UK supermarket shoppers**, Food Policy, Vol. 36, Issue 6, pp.815-822
- Galizzi, M.M. (2012) **Label, Nudge or Tax? A Review of Health Policies for Risky Behaviours**, Journal of Public Health Research, Vol. 1, Issue 1, pp. 14–21
- Garnaut, R. Howes, S. Jotzo, F. and Sheehan, P. (2008) **Emissions in the Platinum Age: the implications of rapid development for climate-change mitigation**, Oxford Review of Economic Policy, Vol. 24, No. 2, pp.377–401
- Garnett, T. (2009) **Livestock-related greenhouse gas emissions: impacts and options for policy makers**, Environmental Science and Policy, Vol. 12, pp. 491-503
- Garnett, T. (2013) **Three perspectives on sustainable food security: efficiency, demand restraint, food system transformation. What role for LCA?** Journal of Cleaner Production, Article in Press, pp. 1-9
- Garnett, T. Mathewson, S. Angelides, P. and Borthwick, F. (2015) **Policies and actions to shift eating patterns: What works? A review of the evidence of the effectiveness of interventions aimed at shifting diets in more sustainable and healthy directions**, Food Climate and Research Network (FCRN) [online] Available at: http://fcrn.org.uk/sites/default/files/fcrn_chatham_house_0.pdf
- Gaschler, R. Mata, J. Störmer, V. Kühnel, A. and Bilalic, M. (2010) **Change detection for new food labels**, Food Quality and Preference, Vol. 21, Issue 1, pp.140–147
- Geels, F. McMeekin, A. Mylan, J. and Southerton, D. (2015) **A critical appraisal of Sustainable Consumption and Production research: The reformist, revolutionary and reconfiguration positions**, Global Environmental Change, Vol. 34, pp. 1-12
- Gellynck, X. Verbeke, W. and Vermeire, B. (2006) **Pathways to increase consumer trust in meat as a safe and wholesome food**, Meat Science, Vol. 74, Issue 1, pp. 161–171
- Geyskens, K., Pandelaere, M., Dewitte, S. and Warlop, L. (2007) **The backdoor to overconsumption: The effect of associating "low-fat" food with health references**, Journal of Public Policy & Marketing, Vol. 26, Issue 1, pp. 118–125

-
- GFK Social Research (2009) **Public attitudes to food**, Report prepared for the Food Standards Agency, UK. [online] Available at: <http://www.food.gov.uk/multimedia/pdfs/publicattitudestofood.pdf>
- Gibney, M. (2012) **Something to Chew on: Challenging Controversies in Food and Health**, Dublin, University College Dublin Press
- Giddens, A. (1984) **The constitution of society**, US: University of California Press
- Giddens, A. (2009) **The politics of climate change**. Oxford, UK: Polity
- Gilmore, A.B. and Savell E, Collin J. (2011) **Public health, corporations and the New Responsibility Deal: promoting partnerships with vectors of disease?** Journal of Public Health, Vol. 33, Issue 1, pp.2–4
- Gilson, L. and Raphaely, N. (2007) **The terrain of health policy analysis in low and middle income countries: a review of the literature 1994–2005**, Paper presented to a Workshop on Health Policy Analysis, London
- Ginsberg, J.M. and Bloom, P.N. (2004) **Choosing the Right Green Marketing Strategy**, MIT Sloan Management Review, Vol. 46, No.1, pp. 79-84 [online] <http://202.183.190.133/multim/2811.pdf>
- Glaser, B. and Strauss, A. (1967) **The Discovery of Grounded Theory: Strategies for Qualitative Research**, Aldine, Chicago, CA
- Glasson, J. Therivel, R. and Chadwick, (2005) **Introduction to environmental impact assessment**. Third ed., London, Routledge
- Golan, E., Kuchler, F. and Mitchell, L. (2000) **Economics of food labelling**, Economic Research Service, US Department of Agriculture, No. 793. [online] Available at: <http://www.ers.usda.gov/publications/aer793/aer793.pdf>
- Gómez-Limón, J.A. and Sanchez-Fernandez, G. (2010) **Empirical evaluation of agricultural sustainability using composite indicators**, Ecological Economics, Vol. 69, Issue 5, pp.1062–1075
- González-Benito, J. and González-Benito, O. (2006) **The role of stakeholder pressure and managerial values in the implementation of environmental logistics practices**, International Journal of Production Research, Vol. 44, Issue 7, pp. 1353-1373
- Gonzalez-Roa, M.C. and Calatrava-Requena, J. (2008) **Food labelling use and differentiated consumers behaviour: a survey analysis in Spanish food market**, 12th Congress of the European Association of Agricultural Economists (EAAE) [online] Available at: <http://ageconsearch.umn.edu/bitstream/43541/2/097.pdf>
- Goodall, A.H. (2008) **Why Have the Leading Journals in Management (and Other Social Sciences) Failed to Respond to Climate Change?** Journal of Management Inquiry, Vol. 17, Issue 4, pp. 408-420
- Gore, A. (2006) **An inconvenient truth: The planetary emergency of global warming and what we can do about it**. Emmaus, PA: Rodale Books
- Gortmaker, S.L. Swinburn, B.A. Levy, D. Carter, R. Mabry, P.L. Finegood, D.T. and Moodie, M.L. (2011) **Changing the future of obesity: Science, policy, and action**, The Lancet, Vol. 378, Issue 9793, pp. 838-847
- Gov.UK (2013) **Policy: Supporting international action on climate change** [online] Available at: <https://www.gov.uk/government/policies/taking-international-action-to-mitigate-climate-change>
- Graveter, F. Forzano, L.A.B. (2008) **Research Methods for the Behavioural Sciences**, Cengage Learning EMA, International Editions 3e. Gardners Books, UK
- Green Labels Purchase (2006) **making a greener procurement with energy labels** [online] <http://www.greenlabelspurchase.net/v-swan.html>
- Gresov, C. and Drazin, R. (1997) **Equifinality: Functional equivalence in organizational design**, Academy of Management Review, Vol. 22, Issue 2, pp. 403-428
- Grimes, C., Riddell, L. and Nowson, C. (2009) **Consumer knowledge and attitudes to salt intake and labelled salt information**, Appetite, Vol. 53, Issue 2, pp. 189–194

-
- Grocer (2012) '**Frustrated**' **Tesco ditches eco-labels**, January 28 2012 [online] Available at: <http://www.thegrocer.co.uk/companies/supermarkets/tesco/frustrated-tesco-ditches-eco-labels/225502.article>
- Grocer (2012a) **Tesco's not taking a step back from carbon reduction**, February 4 2012 [online] Available at: <http://www.thegrocer.co.uk/opinion/letters/tescos-not-taking-a-step-back-from-carbon-reduction/225760.article>
- Grocer (2012b) **Green Retailer of the Year: Tesco initiatives having a 'transformative effect'** 16th June 2012 [online] Available at: <http://www.thegrocer.co.uk/companies/supermarkets/tesco/tesco-initiatives-having-a-transformative-effect/230059.article>
- Grunert, K. (2002) **Current issues in the understanding of consumer food choice**, Trends in Food Science & Technology, Vol. 13, Issue 8, pp. 275–285
- Grunert, K. (2005) **Food quality and safety: consumer perception and demand**, European Review of Agricultural Economics, Vol. 32, Issue 3, pp. 369–391
- Grunert, K. G. and Wills, J. M. (2007) **A review of European research on consumer response to nutrition information on food labels**, Journal of Public Health, Vol. 15, Issue 5, pp.385–399
- Grunert, K. G., Wills, J. M. and Fernandez-Celemin, L. (2010b) **Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK**, Appetite, Vol. 55, Issue 2, pp.177–189
- Grunert, K.G. Bolton, L.E. and Monique M. R. (2012) **Processing and Acting on Nutrition Labeling on Food**, In Transformative Consumer Research for Personal and Collective Well-Being, London: Routledge
- Grunert, K.G. Fernandez-Celemin, L. Wills, J.M. Storcksdieck Genannt Bonsmann, S. and Nureeva, L. (2010a) **Use and understanding of nutrition information on food labels in six European countries**, Journal of Public Health, Vol. 18, Issue 3, pp. 261–277
- Grunert, K.G. Hieke, S. and Wills, J. (2014) **Sustainability labels on food products: Consumer motivation, understanding and use**, Food Policy, Vol. 44, pp. 177–189
- Grunert, K.G. Wills, J.M. and Fernández-Celemín, L. (2010) **Nutrition knowledge, use and understanding of nutrition information on food labels among consumers in the UK**, Appetite, Vol. 55, Issue 2, pp. 177-189
- Guardian (2008) **Government urged to introduce 'omni-standards' for food, Expert calls for a comprehensive labelling system integrating all available information of the environmental, health and social impact of food** [online] Available at: <https://www.theguardian.com/environment/2008/sep/09/food.ethicalliving>
- Guardian (2017) **UK breaks solar energy record on sunny March weekend** [online] Available at: <https://www.theguardian.com/environment/2017/mar/28/uk-solar-energy-march-electricity>
- Guardian (2017a) **Saving Britain's food supply: a manifesto to keep food on the table** [online] Available at: <https://www.theguardian.com/global-development/2017/jul/29/saving-britains-food-supply-manifesto-jay-rayner>
- Guenther, M. Saunders, C. and Tait, P.R. (2012) **Carbon labelling and consumer attitudes**, Carbon Management, Vol. 3, Issue 5, pp. 445-455
- Guthrie, J. Mancino, L. and Jordan Lin, C.T. (2015) **Nudging Consumers toward Better Food Choices: Policy Approaches to Changing Food Consumption Behaviors**, Psychology & Marketing, Vol. 32, Issue 5, pp. 501–11
- Haigh, N. (1999) **Manual of European Environmental Policy: EC and Britain**, Elsevier: London
- Halewood, P. (2011) **Trade Liberalization and Obstacles to Food Security: Toward a Sustainable Food Sovereignty**, Inter-American Law Review, Vol. 43, No. 1, pp. 115-136
- Hall, C. and Ossess, F. (2013) **A review to inform understanding of the use of food safety messages on food labels**, International Journal of Consumer Studies, Vol. 37, Issue 4, pp. 422–432
- Halldórsson, A. and Kovács, G. (2010) **The sustainable agenda and energy efficiency, Logistics solutions and supply chains in times of climate change**, International Journal of Physical Distribution & Logistics Management, Vol. 40, Issue 1-2, pp. 5-13

-
- Halldórsson, Á. Kotzab, H. and Skjøtt-Larsen, T. (2009) **Supply chain management on the crossroad to sustainability: a blessing or a curse?** Logistics Research, Vol. 1, Issue 2, pp.83–94
- Halliday, J. (2011) **Not enough science for green omni-label for food**, Defra, [online] Available at: <http://www.foodnavigator.com/Market-Trends/Not-enough-science-for-green-omni-label-for-food-Defra>
- Hansen, P.G. and Jespersen, A.M. (2013) **Nudge and the Manipulation of Choice: A Framework for the Responsible Use of the Nudge Approach to Behaviour Change in Public Policy**, European Journal of Risk Regulation, Vol. 4, Issue 1, pp. 3-28
- Haq, G. Bailey, P.D. Chadwick, M.J., Forrester, J. Kuylenstiernal, J. Leach, G. Villagrasa, D. Fergusson, M. Skinner, I. and Oberthur, S. (2001) **Determining the costs to industry of environmental regulation**, European Environment, Vol. 11, Issue 3, pp 125-139
- Hartikainen, H. Roininen, T. Juha-Matti Katajajuuri, and Pulkkinen, H. (2014) **Finnish consumer perceptions of carbon footprints and carbon labelling of food products**, Journal of Cleaner Production, Vol. 73, pp. 285-293
- Hartlieb, S. and Jones, B. (2009) **Humanising Business Through Ethical Labelling: Progress and Paradoxes in the UK**, Journal of Business Ethics, Vol. 88, pp. 583-600
- Hartmann, P. and Apaolaza Ibanez, V. (2006) **Green value added**, Marketing Intelligence and Planning, Vol. 24, Issue 7, pp. 673-680
- Hassini, E., Surti, C. and Searcy, C. (2012) **A literature review and a case study of sustainable supply chains with a focus on metrics**, International Journal of Production Economics, Vol. 140 Issue 1, pp. 69-82
- Haufler, V. (2003) **New Forms of Governance: Certification Regimes as Social Regulations of the Global Market**, in E. Meidinger, C. Elliott and G. Oesten (eds.), Social and Political Dimensions of Forest Certification (Forstbuch, Remagen-Oberwinter, Germany), pp. 237–247
- Hawkes, C. and Buse, K. (2011) **Public health sector and food industry interaction: It's time to clarify the term 'partnership' and be honest about underlying interests**, European Journal of Public Health, Vol. 21, Issue 4, pp. 400-401
- Hawkes, C. Friel, S. Lobstein, T. and Lang, T. (2012) **Linking Agricultural Policies with Obesity and Non-communicable Diseases: A New Perspective for a Globalising World**, Food Policy, Vol. 7, Issue 3, pp. 343–353
- Hawley, K.L. Roberto, C.A. Bragg, Liu, P.J. Schwartz, M.B. and Kelly, D.B. (2013) **The Science On Front-Of-Package Food Labels**, Public Health Nutrition, Vol. 16, pp. 430–39
- Hervani, A.A. Helms, M.M. and Sarkis, J. (2005) **Performance measurement for green supply chain management**, Benchmarking: an International Journal, Vol. 12, Issue 4, pp. 330–353
- Heslop, L.A. (2006) **If we label it, will they care? The effect of GM-ingredient labelling on consumer responses**, Journal of Consumer Policy, Vol. 29, pp. 203–228
- Heyes, A. (2009) **Is environmental regulation bad for competition? A survey**, Journal of Regulatory Economics, Vol. 36, pp. 1-28
- Higginson, C. S. Rayner, M. J. Draper, S. and Kirk, T. R. (2002b) **The nutrition label – which information is looked at?** Nutrition Food Science, Vol. 32, Issue 3, pp. 92–99
- Higginson, C.S. Rayner, M.J. Draper, S. and Kirk, T. R. (2002a) **How do consumers use nutrition label information?** Nutrition Food Science, Vol. 32, Issue 4/5, pp. 145–152
- Hinrichs, C. (2003) **The practice and politics of food system localization**, Journal of Rural Studies, Vol. 19, Issue 1, pp. 33–45
- Hobbes, T. 1651 (1994) **The leviathan**, Indianapolis, IN: Hackett Publishing Co.
- Hoefkens, C. Verbeke, W. and Van Camp, J. (2011) **European consumers' perceived importance of qualifying and disqualifying nutrients in food choices**, Food Quality and Preference, Vol. 22, Issue 6, pp. 550–558
- Hogan, L. and Thorpe, S. (2009) **Issues in food miles and carbon labelling**, [online] Available at: http://adl.brs.gov.au/data/warehouse/pe_abarebrs99001677/foodmiles.pdf

-
- Hollos, D. Blome, C. and Foerstl, K. (2012) ***Does sustainable supplier co-operation affect performance? Examining implications for the triple bottom line***, International Journal of Production Research, Vol. 50, Issue 11, pp. 2968-2986
- Hopwood, B. Mellor, M. and O'Brien, G. (2005) ***Sustainable Development: Mapping Different Approaches***, Sustainable Development, Vol. 13, Issue 1, pp. 38-52
- Horne, R.E. (2009) ***Limits to labels: the role of eco-labels in the assessment of product sustainability and routes to sustainable consumption***, International Journal of Consumer Studies, Vol. 33, Issue 2, pp. 175–182
- Hornibrook, S. May, C. and Fearne, A. (2015) ***Sustainable Development and the Consumer: Exploring the Role of Carbon Labelling in Retail Supply Chains***, Business Strategy and the Environment, Vol. 24, Issue 4, pp. 266-276
- House of Commons (2009) ***Fourth Report of Session 2009-10. Securing Food Supplies up to 2050: the Challenges Faced by the UK***, Vol. 1. The Stationery Office Limited, London
- Howlett, M. and M. Ramesh, (1995) ***Studying Public Policy: Policy Cycles and Policy Subsystems***, Toronto: Oxford University Press
- Hughner, R. S. McDonagh, P. Prothero, A. Shultz, C.J. II Stanton, J. (2007) ***Who are organic food consumers? a compilation and review of why people purchase organic food***, Journal of Consumer Behaviour, Vol. 6, Issue 2-3, pp. 94–110
- Hulme, M. (2009) ***Why we disagree about climate change: Understanding controversy, inaction and opportunity***, Cambridge, UK: Cambridge University Press
- IEMA (2011) ***Revised PAS 2050 more accessible***, The Environmentalist, Institute of Environmental Management and Assessment [online] Available at: <http://www.environmentalisonline.com>
- IISD, László, P. Hardi, P. and Bartelmus, P. (2005) ***Sustainable Development Indicators, Proposals for a Way Forward*** [online], Available at: <http://www.iisd.org/publications/pub.aspx?pno=769>
- Ilbery, B. and Maye, D. (2005a) ***Food supply chains and sustainability: evidence from specialist food producers in the Scottish/English borders***, Land Use Policy, Vol. 22, Issue 4, pp. 331–334
- Ilbery, B. Morris, C. Buller, H. Maye, D. and Kneafsey, M. (2005b) ***Product, Process and Place***, European Urban and Regional Studies, Vol. 12, Issue 2, pp. 116-132
- Ingwersen, W.W. (2012) ***Life cycle assessment of fresh pineapple from Costa Rica***, Journal of Cleaner Production, Vol. 35, pp.152-163
- International Organization for Standardization (ISO) (2012) ***Carbon Footprint of Products: Requirements and Guidelines for Quantification and Communication***, Draft International Standard ISO/DIS 14067. Geneva: ISO
- IPCC (2007) ***Climate Change 2007: Working Group II: Impacts, Adaption and Vulnerability***, IPCC Fourth Assessment Report, Working Group II, chap. 5 [online] Available at: http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch5s5-es.html
- Ipsos Mori (2010) ***Qualitative research to explore peoples' use of food labelling information***, Report prepared for UK's Food Standards Agency [online] Available at: <http://www.food.gov.uk/multimedia/pdfs/qualilabelres.pdf>
- Ison, S. Peake, S. and Wall, S. (2002) ***Environmental Issues and Policies***, First Ed., Pearson Education Limited, Essex
- Jack, L. (2007) ***Accounting, post-productivism and corporate power in UK food and agriculture***, Critical Perspectives on Accounting, Vol. 18, pp. 905–931
- Jackson, P. Ward, N. and Russell, P. (2006) ***Mobilising the commodity chain concept in the politics of food and farming***, Journal of Rural Studies, Vol. 22, Issue 2, pp. 129-141
- Jackson, T. (2005) ***Motivating Sustainable Consumption: a review of evidence on consumer behaviour and behavioural change***, London: Sustainable Development Research Network. [online] Available at: http://hiveideas.com/attachments/044_motivatingfinal_000.pdf
- Jacobs, M. (2013) ***Green growth***, The Handbook of Global Climate and Environment Policy, Wiley-Blackwell, Chichester, UK, pp. 163-177

-
- James, S. and Friel, S. (2015) ***An integrated approach to identifying and characterising resilient urban food systems to promote population health in a changing climate***, Public Health Nutrition, Vol. 18, Issue 13, (Sustainability and Public Health Nutrition), pp. 2498-2508
- Janssen, M. and Hamm, U. (2012) ***Product labelling in the market for organic food: consumer preferences and willingness-to-pay for different organic certification logos***, Food Quality and Preference, Vol. 25, pp. 9–22
- Jarratt, D.G. (1996) ***A comparison of two alternative interview techniques used within an integrated research design: a case study in outshopping using semi-structured and non-directed interviewing techniques***, Marketing Intelligence and Planning, Vol. 14, Issue 6, pp. 6-15
- Jefferson, T. (2007) ***Two studies of women's retirement incomes in Australia: assessing some outcomes of pluralism in economic research***, Cambridge Journal of Economics, Vol. 31: pp. 363–378
- Jensen, J.K. (2012) ***Product carbon footprint developments and gaps***, International Journal of Physical Distribution & Logistics Management, Vol. 42, Issue 4, pp. 338-354
- Jevsnik, M., Hlebec, V. & Raspor, P. (2008) ***Consumers' awareness of food safety from shopping to eating***, Food Control, Vol. 19, Issue 8, pp. 737–745
- Johnson, A., Donkin, A., Morgan, A., Lilley, J., Neale, R., Page, R. and Silburn, R. (1998) ***Food safety knowledge and practice among elderly people living at home***, Journal of Epidemiology and Community Health, Vol. 52, Issue 11, pp. 745–748
- Johnston, R.J. Gregory, D. Pratt, G. and Watts, M. (2000) ***The Dictionary of Human Geography***, 4th Edition, Blackwell Publishing, Oxford, ISBN: 0-631-20561-6
- Jones, P. Comfort, D. and Hillier, D. (2004) ***A case study of local food and its routes to market in the UK***, British Food Journal, Vol. 106, Issue 4, pp.328-335
- Jones, P. Hillier, D. and Comfort, D. (2011) ***Shopping for tomorrow: promoting sustainable consumption within food stores***, British Food Journal, Vol. 113, Issue 7, pp.935-948
- Kahneman, D. (2011) ***Thinking, Fast and Slow***, Farrar, Straus and Giroux, New York, NY
- Kaiser, J. and Enserink, M. (2000) ***Environmental toxicology. Treaty takes a POP at the dirty dozen***, Science, New York, Vol. 290, No. 5499, pp. 2053
- Kalafatis, S. Pollard, M. East, R. and Tsogas M.H. (1999) ***Green marketing and Ajzen's theory of planned behaviour: a cross-market examination***, Journal of Consumer Marketing, Vol. 16, Issue 5, pp. 441-460
- Kassolis, M.G. (2007), ***The diffusion of environmental management in Greece through rationalist approaches: driver or product of globalisation?*** Journal of Cleaner Production, Vol. 15, Issue 8, pp. 1886-1893
- Kasterine, A. and Vanzetti, D. (2010) ***The Effectiveness, Efficiency and Equity of Market-based and Voluntary Measures to Mitigate Greenhouse Gas emissions from the Agri-food Sector***, Trade and Environment Review, United Nations Conference on Trade and Development (UNCTAD), Geneva, pp. 1-37
- Kearney, A.T. and WRI (2008) ***RATTLING SUPPLY CHAINS: The Effect of Environmental Trends on Input Costs for the Fast-Moving Consumer Goods Industry***, WRI, 42 pages [online] Available at: http://pdf.wri.org/rattling_supply_chains.pdf
- Kemp-Benedict, E. Barron, J. Vetter, S. Yengoh, T.G. Fielding, M. (2013) ***Sustainability Implications of Closing the Yield Gap***, Discussion brief, SIANI [online] Available at: http://www.siani.se/sites/clients.codepositive.com/files/document/discussion_brief_sustainability_implications_of_closing_the_yield_gap.pdf
- Kerr, J. and Foster, L. (2011) ***Sustainable consumption – UK Government activity***, Nutrition Bulletin, Vol. 36, pp. 422-425
- Khush, G.S. (1999) ***Green revolution: preparing for the 21st century***, Genome / National Research Council Canada = Genome / Conseil national de recherches Canada, Vol. 42, No. 4, pp. 646-655
- Kimura, A. Mukawa, N. Yamamoto, M. Masuda, T. Yuasa, M. Goto, S. Oka, T. and Wada, Y. (2012) ***The influence of reputational concerns on purchase intention of fair-trade foods among young Japanese adults***, Food Quality and Preference, Vol. 26, Issue 2, pp. 204–210

-
- Kimura, A. Wadaa, Y. Kamada, A. Masuda, T. Okamoto, M. Goto, S. Tsuzuki, D. Cai, D. Oka, T. and Ippeita, D. (2010) ***Interactive effects of carbon footprint information and its accessibility on value and subjective qualities of food products***, *Appetite*, Vol. 55, Issue 2, pp. 271–278
- Kingdon, J. W. (2010) ***Agendas, Alternatives, and Public Policies***, Update Edition, with an Epilogue on Health Care, 2nd ed. London, Pearson, 304 pages
- Kirwan, J. and Maye, D. (2013) ***Food security framings within the UK and the integration of local food systems***, *Journal of Rural Studies*, Vol. 29, pp. 91-100
- Kissinger, G. (2012) ***Corporate social responsibility and supply agreements in the private sector: Decreasing land and climate pressures***, CCAFS Working Paper 14. Copenhagen, Denmark: CCAFS, pp. 1-92 Available at: http://192.156.137.192/bitstream/handle/10568/21072/ccafs-wp-14-csr_ag-web.pdf?sequence=6
- Kleef, E.V. and Dagevos, H. (2015) ***The Growing Role of Front-of-Pack Nutrition Profile Labeling: A Consumer Perspective on Key Issues and Controversies***, *Critical Reviews in Food Science and Nutrition*, Vol. 55, pp. 291–303
- Klobeckner, J. (2012) ***The power of eco-labels: Communicating climate change using carbon footprint labels consistent with international trade regimes under the WTO***, *Climate Law*, Vol. 3, Number 3-4, pp. 209-230
- Kollmuss, A. and Agyeman, J. (2002) ***Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behaviour?*** *Environmental Education Research*, Vol. 8, Issue 3, pp. 239-260
- Kotha, S. and Nair, A. (1995) ***Strategy and environment as determinants of performance: evidence from the Japanese machine tool industry***, *Strategic Management Journal*, Vol. 16, Issue 7, pp.497-518
- Kottila, M.R. Maijala, A. and Rönni (2005) ***The organic food supply chain in relation to information management and the interaction between actors***, International Scientific Conference on Organic Agriculture, ISO FAR, [online] <http://orgprints.org/4402/> pp. 1-4
- Kraak V, Harrigan P, Lawrence M, Harrison P, Jackson M, and Swinburn B. (2012) ***Balancing the benefits and risks of public–private partnerships to address the global double burden of malnutrition***, *Public Health Nutrition*, Vol. 15, Issue 3, pp. 503–517
- Krishnendu, S. Shankar, R. Yadav, S.S.and Thakur, L.S. (2012) ***Supplier selection using fuzzy AHP and fuzzy multi-objective linear programming for developing low carbon supply chain***, *Expert Systems with Applications*, Vol. 39, Issue 9, pp.8182-8192
- Landcare Research (2012) ***New Product Environmental Issues and Retailer Action***, Landcare Research Report
- Lang T. (2003) ***Food industrialisation and food power: implications for food governance***, *Development Policy Review*, Vol. 21, pp. 555–568
- Lang, T. (2008) ***Call for new ‘universal’ food labelling***, The Independent [online] Available at:<http://www.independent.co.uk/life-style/food-and-drink/news/call-for-new-universal-food-labelling-923480.html>
- Lang, T. (2008) ***Where Will All the Food Come From?***, Debate at the British Association Festival of Science, Liverpool [online] Available at: <http://www.scouseveg.co.uk/2008/09/page/2/>
- Lang, T. (2009) in: ***Sustainable development in a changing climate***, fifth report of session 2008-09, Vol. 2 Oral and written evidence by Great Britain. Parliament. House of Commons, 204 pages
- Lang, T. and Barling, D. (2012) ***Food security and food sustainability: reformulating the debate***, *The Geographical Journal*, Vol. 178, Issue 4, pp. 313-326
- Lang, T. and Barling, D. (2013) ***Nutrition and sustainability: an emerging food policy discourse***, *Proceedings of the Nutrition Society*, Vol. 72, Issue 1, pp. 1-12
- Lang, T. and Heasman, M. (2004) ***Food Wars: The Battle for Mouths, Minds and Markets***, London: Earthscan
- Lang, T. and Heasman, M. (2015) ***Food wars: The global battle for mouths, minds and markets***, Routledge

-
- Lang, T. and Schoen, V. (2016) **Food, the UK and the EU: Brexit or Bremain?**, Food Research Collaboration [online] Available at: <http://openaccess.city.ac.uk/14896/1/FRC%20Brexit%2007%2003%2016.pdf>
- Lang, T. Barling, D. and Caraher, M. (2009) **Food Policy: Integrating Health, Environment and Society**, Oxford: Oxford University Press
- Lang, T. Rayner, G. Rayner, M. Barling, D. and Millstone, E. (2005) **Discussion Paper Policy Councils on Food, Nutrition and Physical Activity: the UK as a case study**, Public Health Nutrition, Vol. 8, Issue 1, pp. 11-19
- Leary, N. Adejuwon, J. Barros, V. Burton, I. Kulkarni, J. Lasco, R. (2009) **Climate Change and Adaptation**, Political Science, Earthscan, 384 pages
- Lee, S-Y (2012) **Corporate carbon strategies in responding to climate change**, Business Strategy and the Environment, Vol. 21, pp. 33-48
- Leggett, W. (2014) **The Politics of Behaviour Change: Nudge, Neoliberalism and the State**, Policy & Politics, Law and Policy, Vol.42, No. 1, pp. 3–19.
- Lenzen, M. Murray, J. Sack, F. and Wiedmann, T. (2007a) **Shared producer and consumer responsibility - Theory and practice**, Ecological Economics, Vol. 61, Issue 1, pp. 27-42
- Lenzen, M. Wiedmann, T. Foran, B. Dey, C. Widmer-Cooper, A. Williams, M. and Ohlemüller (2007) **Forecasting the Ecological Footprint of Nations: a blueprint for a dynamic approach** [online] Available at: <http://www.isa.org.usyd.edu.au/publications/DEF.pdf>
- Levenstein, H. (2012) **Fear of Food: A History of Why We Worry about What We Eat**, Chicago: University of Chicago Press
- Levy, D. (2008) **Political Contestation in Global Production Networks**, The Academy of Management Review, Vol. 33, No. 4, pp. 943-963
- Lindell, M. and Karagozoglu, N. (2001) **Corporate Environmental Behaviour – A Comparison Between Nordic and US Firms**, Business Strategy and the Environment, Vol. 10, pp. 38-52
- Linton, J.D. Klassen, R. and Jayaraman, V. (2007) **Sustainable supply chains: an introduction**, Journal of Operations Management, Vol. 25, Issue 6, pp. 1075-1082
- Liobikienė, G. and Dagiliūtė, R. (2016) **The relationship between economic and carbon footprint changes in EU: The achievements of the EU sustainable consumption and production policy implementation**, Environmental Science and Policy, Vol. 61, pp. 204-211
- Liu, T. Wang, Q. and Su, B. (2016) **A review of carbon labelling: Standards, implementation, and impact**, Renewable and Sustainable Energy Reviews, Vol. 53, pp. 68-79
- Lobstein, T. (2009) **Defining and labelling ‘healthy’ and ‘unhealthy’ food**, Public Health Nutrition, Vol. 12, Issue 3, pp. 331-340
- Lockie, S. (2009) **Responsibility and agency within alternative food networks: assembling the “citizen consumer”** Agriculture and Human Values, Vol. 26, pp.193–201
- Lowrey, T.M. Otnes, C.C. and McGrath, M.A. (2005) **Shopping with consumers: reflections and innovations**, Qualitative Market Research: An International Journal, Vol. 8, Issue 2, pp. 176-188
- Lucas, L. and Clark, P. (2012) **Tesco steps back on carbon footprint labelling**, Financial Times, January 31, 2012 [online] Available at: <http://www.ft.com/cms/s/0/96fd9478-4b71-11e1-a325-00144feabdc0.html#axzz2kLRTxZvB>
- Ludwig, D.S. and Nestle, M. (2008) **Can the food industry play a constructive role in the obesity epidemic?** Journal of the American Medical Association, Vol. 300(15), pp. 1808–11
- Luke, T.W. (2008) **The politics of true convenience or inconvenient truth: struggles over how to sustain capitalism, democracy, and ecology in the 21st century**, Environment and Planning A, Vol. 40, Issue 8, pp. 1811-1824
- Lunn, J. Howie, M. Hughes, C. Fenwick, L. Read, A. Richardson, Casson, R. and O’Kennedy, E. (2011) **The food industry perspective: a collection of case studies**, Nutrition Bulletin, Vol. 36, pp.468-476

-
- MacCracken, M.C. (2009) *The Increasing Pace of Climate Change*, Strategic Planning for Energy and the Environment, Vol. 28, Issue 3, pp. 8-25
- MacMaoláin, C. (2003) *Using the precautionary principle to protect human health: Pfizer v Council*, European Law Review, Vol. 28, Issue 5, pp. 723-734
- Maibach, E. Myers, T. and Leiserowitz, A. (2014) *Climate scientists need to set the record straight: There is a scientific consensus that human-caused climate change is happening*, Earth's Future, Vol. 2, Issue 5, pp.295–298
- Majone, G. (2002) *The Precautionary Principle and its Policy Implications*, Journal of Common Market Studies, Vol. 40, No. 1, pp. 89-109
- Manning, L. and Baines, R.N. (2004) *Globalisation: a study of the poultry meat supply chain*, British Food Journal, Vol. 106, Issues 10-11, pp. 819-836
- Manning, L. Baines, R.N. and Chadd, S.A. (2006) *Ethical modelling of the food supply chain*, British Food Journal, Vol. 108, Issue 5, pp. 358-370
- Manson, S.M. (2001) *Simplifying complexity: a review of complexity theory*, Geoforum, Vol. 32, pp. 406-414
- Marcu, A. (2013) *Taking stock after the Warsaw COP*, Centre for European Policy Studies, pp. 1-6 [online] Available at: http://aei.pitt.edu/46165/1/ACM_After_Warsaw.pdf
- Marimon, F. del Mar Alonso-Almeida, M. del Pilar Rodriguez, M. and Cortez Alejandro, K.A. (2012) *The worldwide diffusion of the global reporting initiative: what is the point?* Journal of Cleaner Production, Vol. 33, pp. 132-144
- Marsden, S. and De Mulder, J. (2005) *Strategic Environmental Assessment and Sustainability in Europe – How Bright is the Future?* Review of European Community & International Environmental Law, Vol. 14, Issue 1, pp. 50-62
- Marsden, T. (2013) *From post-productionism to reflexive governance: Contested transitions in securing more sustainable food futures*, Journal of Rural Studies, Vol. 29, pp. 123-134
- Marsden, T. and Wrigley, N. (1995) *Regulation, retailing, and consumption*, Environment and Planning A, Vol. 27, pp. 1899-1912
- Martin-Tapia, I. Aragon-Correa, J.A. and Senise-Barrio, M.E. (2008) *Being green and export intensity of SMEs: The moderating influence of perceived uncertainty*, Ecological Economics, Vol. 68, pp. 56-67
- Martindale, W. (2010) *Delivering Food Security with Supply Chain Led Innovations: Understanding supply chains, providing food security, delivering choice*, Aspects of Applied Biology, Vol. 102, pp. 1-9
- Maxwell, D. Owen, P. McAndrew. L, Muehmel, K. and Neubauer, A. (2011) *Addressing the Rebound Effect*, A report for the European Commission DG Environment, [online] Available at: http://ec.europa.eu/environment/eussd/pdf/rebound_effect_report.pdf
- Maxwell, J.A. (2012) *What Is Realism, and Why Should Qualitative Researchers Care? A Realist Approach to Qualitative Research*, PART I, A REALIST STANCE FOR QUALITATIVE RESEARCH, Sage Books, London, pp. 3-49
- Maxwell, J.A. and Mittapalli, K. (2010) *Realism as a stance for mixed methods research*, pp. 145-167 in A. Tashakkori and C. Teddlie (Eds.), SAGE Handbook of Mixed Methods in Social and Behavioral Research, 2nd ed. Sage Publications
- Maxwell, S. and Slater, R. (2003) *Food Policy Old and New*, Development Policy Review, Vol. 21, Issue 5-6, pp. 531-533
- Mayes, C. (2014) *Governing through choice: Food labels and the confluence of food industry and public health to create healthy consumers*, Social Theory and Health, Vol. 12, Issue 4, pp. 376–395
- Mayes, C. and Thompson, D.B. (2014) *Is nutritional advocacy morally indigestible? A critical analysis of the scientific and ethical implications of healthy food choice discourse in liberal societies*, Public Health Ethics, Vol. 7, Issue 2, pp.158–169
- McCarthy, M. Brennan, M., Kelly, A.L. Ritson, C. de Boer, M. and Thompson, N. (2007) *Who is at risk and what do they know? Segmenting a population on their food safety knowledge*, Food Quality and Preference, Vol. 18, pp. 205–217

-
- McCarthy, T. and Golcic, S. (2002) **Implementing collaborative forecasting to improve supply chain performance**, International Journal of Physical Distribution and Logistics, Vol. 32, Issue 6, pp.431-454
- McGee, A. Muchoney, D. Skrøvseth, P.E. (2013) **UNFCCC COP18 makes progress towards 2015 global climate deal**, Carbon Management, Vol. 4, Issue 1, pp. 13-15
- McKinnon, A.C. (2010) **Product-level carbon auditing of supply chains: Environmental imperative or wasteful distraction?** International Journal of Physical Distribution & Logistics Management, Vol. 40, Issue 1/2, pp.42 – 60
- McWilliams, A. and Siegel, D. (2001) **Corporate Social Responsibility: a Theory of the Firm Perspective**, Academy of Management Review, Vol. 26. No. 1, pp. 117-127
- Melnyk, S.A. Sroufe, R. and Calantone, R. (2003) **Assessing the impact of environmental management systems on corporate and environmental performance**, Journal of Operations Management, Vol. 21, pp. 329-351
- METI (2013) **Visualization of the Carbon Footprint** [online] Available at: http://www.meti.go.jp/english/policy/energy_environment/cfp/
- Michie, S. van Stralen, M.M. and West, R. (2011) **The behaviour change wheel: A new method for characterising and designing behaviour change interventions**, Implementation Science, 6:42, pp. 1-11 [online] Available at: <https://implementationscience.biomedcentral.com/track/pdf/10.1186/1748-5908-6-42?site=implementationscience.biomedcentral.com>
- Min, H. and Galle, W.P. (1997) **Green purchasing strategies: trends and implications**, The Journal of Supply Chain Management, Vol. 33, Issue 2, pp. 10-17
- Mindell JS, Reynolds L, Cohen DL, and McKee M. (2008) **All in this together: the corporate capture of public health**, British Medical Journal, Vol. 345, pp. 80-82
- Mollenkopf, D. Stolze, H. Tate, W.L. and Ueltschy, M. (2010) **Green, lean, and global supply chains**, International Journal of Physical Distribution & Logistics Management, Vol. 40, Issue 1-2, pp. 14-41
- Mont, O. Heiskanen, E. Power, K. and Helka, K. (2013) **Improving Nordic policymaking by dispelling myths on sustainable consumption**, Nordic Council of Ministers Secretariat [online] Available at: <http://www.diva-portal.org/smash/get/diva2:702825/FULLTEXT01.pdf>
- Mueller, M., dos Santos, V.G. and Seuring, S.J. (2009) **The Contribution of Environmental and Social Standards Towards Ensuring Legitimacy in Supply Chain Governance**, Journal of Business Ethics, Vol. 89, Issue 4, pp. 509-523
- Mutersbaugh, T. (2005) **Fighting standards with standards: harmonization, rents, and social accountability in certified agrofood networks**, Environment and Planning A, Vol.37, pp. 2033 -2051
- Napolitano, F. Pacelli, C. Girolami, A. and Braghieri, A. (2008) **Effect of information about animal welfare on consumer willingness to pay for yogurt**, Journal of Dairy Science, Vol. 91, Issue 3, pp. 910–917
- Nartova, O. (2009) **Carbon Labelling- Moral, Economic and Legal Implications in a World Trade Environment**, NCC Trade Regulation, Swiss National Centre of Competence Research, Working Paper No 2009/5, February, pp. 1-26
- NASDAQ OMX (2011) **Carbon Products** [online] Available at: http://www.nasdaqomx.com/digitalAssets/78/78868_carbonmarket.pdf
- Nash, H.A. (2009) **The European Commission's sustainable consumption and production and sustainable industrial policy action plan**, Journal of Cleaner Production, Vol. 17, pp. 496–498
- Nereng, G. Semini, M. Romsdal, A. Brekke, A. (2009) **Can Innovations in the Supply Chain Lead to Reduction of GHG Emissions from Food Products? A Framework**, 22 pages [online] Available at: <http://gin.confex.com/gin/2009/webprogram/Paper2373.html>
- Nestle, M. and Ludwig, D. (2010) **Front-of-Package Food Labels: Public Health or Propaganda?** Journal of the American Medical Association, Vol. 303, Issue 8, pp. 771–772
- Newell, P. and Mackenzie, R. (2000) **The 2000 Cartagena protocol on biosafety: legal and political dimensions**, Global Environmental Change, Vol. 10, pp 313-317. The Institute of Development Studies, University of Sussex

-
- Nordberg, D. (2010) **Review essay: Disagreeing about the climate**, *Business & Society*, Vol. 49, pp. 549-557
- Nørgaard, M. and Brunsø, K. (2009) **Families' use of nutritional information on food labels**, *Food Quality and Preference*, Vol. 20, pp. 597–606
- O'Riordan (2001) **Globalism, Localism and Identity: Fresh Perspectives on the Transition to Sustainability**, Earthscan, London
- O'Rourke, D. (2003) **Outsourcing Regulation: Analyzing Nongovernmental Systems of Labor Standards and Monitoring**, *Policy Studies Journal*, Vol. 31, pp. 1-29
- OCTA (Observatorio de Consumo y de la Distribución Alimentaria) (2006) **Etiquetado De Los Productos** [Product Labelling]. Ministerio de Agricultura, Pesca y Alimentación, Madrid
- OECD (2013) **The 0.7% ODA/GNI target - a history** [online] Available at: <http://www.oecd.org/dac/stats/the07odagnitarget-ahistory.htm>
- Office for National Statistics (ONS) (2011) **Mid-2010 Population Estimates** [online] Available at: <http://www.statistics.gov.uk/STATBASE/Product.asp?vlnk=601>
- Okereke, C. Wittneben, B. and Bowen, F. (2012) **Climate Change: Challenging Business, Transforming Politics**, *Business & Society*, Vol.51(1) pp.7-30
- OPTEM (2005) **European consumers' attitudes regarding product labelling – qualitative study in 28 European Countries**, Report prepared for the European Commission. [online] Available at: http://ec.europa.eu/consumers/topics/labelling_report_en.pdf
- Osbaldiston, R. and Schott, J.P. (2012) **Environmental Sustainability and Behavioral Science: Meta-Analysis of Proenvironmental Behavior Experiments**, *Environment and Behavior*, Vol. 44 (2) pp. 247-299
- Panjwani, C. and Caraher, M. (2014) **The Public Health Responsibility Deal: Brokering a deal for public health, but on whose terms?** *Health Policy*, Vol. 114, Issues 2-3, pp. 163–173
- Patton, M. (1990) **Qualitative Evaluation and Research Methods**, Sage, Newbury Park, CA.
- Peattie, K. (2010) **Green Consumption: Behavior and Norms**, *Annual Review of Environment and Resources*, Vol. 35: pp. 195-228
- Peattie, K. and Peattie, S. (2009) **Social marketing: a pathway to sustainability**, *Journal of Business Research*, Vol. 62 Issue 2, pp. 260-268
- Peck, J. and Tickell, A. (2002) **Neoliberalizing space**, *Antipode*, Vol. 34, pp. 380-404
- Pelozo, J. and Shang, J. (2011) **How can corporate social responsibility activities create value for stakeholders?** A systematic review, *Journal of the Academy of Marketing Science*, Vol. 39, Issue 1, pp.117–135
- Pepper, D. Lawlor, L. Webster, F. and Revill, G. (2002) **Environmentalism, Critical Concepts**, Routledge, Vol. 3, pp 44-46
- Perezgrovas, G.V. Celis, C.F. (2002) **La crisis del cafe: causas, consecuencias y estrategias de respuesta** [*The coffee crisis: causes, consequences, and strategies*], Conferencia Electronica del Grupo Chorlav], La Crisis del Café [online] Available at: <http://www.GrupoChorlavi.org/cafe>
- Peter, J. P. and Olson, J. C. (1994) **Understanding Consumer Behaviour**, McGraw- Hill, Irwin, Boston, MA
- Pieniak, Z. Verbeke, W. Scholderer, J. Brunsø, K. and Olsen, S.O. (2007) **European consumers' use of and trust in information sources about fish**, *Food Quality and Preference*, Vol.18, pp. 1050–1063
- Pintér, L. Hardi, P. Martinuzzi, A. Hall, J. (2012) Bellagio **STAMP: Principles for sustainability assessment and measurement**, *Ecological Indicators*, Vol. 17, pp.20-28
- Pirog, R.T. Van Pelt, K. Enshayan and Cook, E. (2001) **Food, Fuel, and Freeways: An Iowa Perspective on How Far Food Travels, Fuel Usage, and Greenhouse Gas Emissions**, Leopold Center for Sustainable Agriculture: Ames, IA, [online] Available at: http://www.leopold.iastate.edu/pubs/staff/ppp/food_mil.pdf

-
- Plassmann, K. Norton, A. Attarzadeh, N. Jensen, M.P. Brenton, P., Edwards-Jones, G. (2010) **Methodological complexities of product carbon footprinting: a sensitivity analysis of key variables in a developing country context**, Environmental Science & Policy, Vol. 13, pp. 393-404
- Polanyi, K. (2001) **The Great Transformation: The Political and Economic Origins of Our Time**, second paperback edition (Beacon Press, Boston, MA), originally published 1944 (Farrar and Rinehart, New York)
- Porter, M.E. and Kramer, M.R. (2006) **The Link Between Competitive Advantage and Corporate Social Responsibility**, Strategy & Society, Harvard Business Review, HBR Spotlight, 16 pages [online] <http://web.efzg.hr/dok/OIM/momazic/etika%20i%20drustvena%20odgovornost/Strategy%20and%20Society.pdf>
- Porter, M.E. and Van der Linde C. (1995) **Green and Competitive: Ending the Stalemate**, Harvard Business Review, September-October: pp. 120-134
- Potoski, M. and Prakash, A. (2005) **Covenants with weak swords: ISO14001 and Facilities' environmental performance**, Journal of Policy Analysis and Management, Vol. 24, pp. 745–769
- Potoski, M. and Prakash, A. (2013) **Do voluntary programs reduce pollution? Examining ISO 14001's effectiveness across countries**, Policy Studies Journal, Vol. 41, pp. 273-294
- Potts, T. and Haward, M. (2007) **International Trade, Eco-labelling, Sustainable Fisheries – Recent Issues, Concepts and Practices**, Environment, Development and Sustainability, Vol. 9, pp. 91–106
- Pouncy, R.P.C. (2011) **Food, Globalism and Theory: Marxian and Institutionalist Insights into the Global Food System**, Inter-American Law Review, Vol. 43, No. 1, pp.89-114
- PPRC (2009) What is PAS 2050? **How is it being used? Is it usable by governments to facilitate change?** [online] Available at: <http://pprc.org/research/climatechange/rr-pas2050.pdf>
- Pre-Sustainability (2013) **Product Carbon Footprint standards: which standard to choose?** [online] Available at: <http://www.pre-sustainability.com/product-carbon-footprint-standards-which-standard-to-choose>
- Prendergrast, J. Foley, B. Menne, V. and Isacc, A.K. (2008) **Creatures of Habit? The Art of Behavioural Change**, 110 pages [online] Available at: https://socialpolicy.crawford.anu.edu.au/sparc/pdf/2010/SMF_Creatures_of_Habit.pdf
- Punch, K.F. (1998) **Introduction to Social Science Research: Quantitative and Qualitative Approaches**, Sage Publications, London
- Putnam, H. (1999) **The threefold cord: Mind, body, and world**, New York: Columbia University Press
- Raghunathan, R. Naylor, R. W. and Hoyer, W. D. (2006) **The unhealthy = tasty intuition and its effects on taste inferences, enjoyment and choice of food products**, Journal of Marketing, Vol. 70, No. 4, pp. 170–184
- Ranilovic, J. and Baric, I. C. (2011) **Differences between younger and older populations in nutrition label reading habits**, British Food Journal, Vol. 113, Issue 1, pp. 109–121
- Raspor, P. (2008) **Total food chain safety: how good practices can contribute?** Trends in Food Science & Technology, Vol. 19, pp. 405–412
- Rayner, G. and Lang, T. (2012) **Leaders, Movements and Ideas to Shift the Boundaries Between the Normal and the Desirable**, HEALTH OF PEOPLE, PLACES AND PLANET, ECOLOGICAL PUBLIC HEALTH, Part 7, Chapter 38, ANU Press, pp. 617-641
- Rayner, J. (2014) **A Greedy Man in a Hungry World**, Williams Collins Paperback, Second Edition, London, 289 pages
- Rayner, M. Boaz, A. and Higginson, C. (2009) **Consumer Use of Health-Related Endorsements On Food Labels in the United Kingdom and Australia**, Journal of nutrition education, Vol. 33, Issue 1, pp. 24-30
- Redmond, E. and Griffith, C. (2004) **Consumer perceptions of food safety risk, control and responsibility**, Appetite, Vol. 43, pp. 309–313
- Redmond, E. and Griffith, C. (2005) **Factors influencing the efficacy of consumer food safety communication**, British Food Journal, Vol. 107, Issue 7, pp. 484–499
- Rees, E.W. (2009) **More Sustainable Cities**, Scientific American, Vol. 19, No. 1, p.18

-
- Reisch, L. Ulrike, E. and Lorek, S. (2013) ***Sustainable food consumption: an overview of contemporary issues and policies***, Sustainability Science, Practice, & Policy, Vol. 9, Issue 2, pp. 1-19
- Reisch, L.A. Cohen, M.J. Thøgersen, and J.B. Tukker, A. (2016) ***Frontiers in Sustainable Consumption Research***, Gaia, Vol. 25, No. 4, pp. 234-240
- Reitsma, F. (2003) ***A response to simplifying complexity***, Geoforum, Vol. 34, Issue 4, pp. 13-16
- Rettie, R. Burchell, K. and Barnham, C. (2014) ***Social normalisation: Using marketing to make green normal***, Journal of Consumer Behaviour, Vol. 13, Issue 1, pp. 9-17
- Rex, E. and Baumann, H. (2007) ***Beyond ecolabels: what green marketing can learn from conventional marketing***, Journal of Cleaner Production, Vol. 15, pp. 567-576
- Rice, P. and Ezzy, D. (1999) ***Qualitative research methods: A health focus***, Melbourne, Australia, Oxford University Press
- Richards, C. Bjørkhaug, H. Lawrence, G. and Hickman, E. (2013) ***Retailer-driven agricultural restructuring—Australia, the UK and Norway in comparison***, Agriculture and Human Values, Vol. 30, pp. 235-245
- Rigby, E. Harvey, F. and Crooks, E. (2007) ***Tesco to 'carbon label' its products***, Financial Times, 19 January [online] Available at: <http://www.ft.com/cms/s/0/966e2910-a765-11db-83e4-0000779e2340.html#axzz2kLRTxZvB>
- Riordan, N. Cowan, C. and McCarthy, M. (2002) ***Safety of Irish beef – concerns, awareness and knowledge of Irish consumers***, Journal of Food Safety, Vol. 22, pp. 1–15
- Robertson, J. Ruhnke, F. and Meimeth, M. (2011) ***Conclusion: Is there a reason to hope for sustainable development as an integrative paradigm?*** In M. Meimeth & J. Robertson (Eds.), Sustainable Development: an Integrative Paradigm? A Transatlantic View on Politics, Economy and Society, pp. 171–175. Baden-Baden: Nomos
- Roe, B. Levy, A. S. and Derby, B. M. (1999) ***The impact of health claims on consumer search and product evaluation outcomes: Results from FDA experimental data***, Journal of Public Policy & Marketing, Vol. 18, No. 1, pp. 89–105
- Rohr, A. Luddecke, K. Drusch, S., Muller, M.J. and Alvensleben, R.V. (2005) ***Food quality and safety – consumer perception and public health concern***, Food Control, Vol. 16, pp. 649–655
- Rojey, A. (2009) ***Energy and Climate: How to Achieve a Successful Energy Transition***, John Wiley and Sons, Illustrated Edition, 153 pages
- Röös, E. and Tjärnemo, H. (2011) ***Challenges of carbon labelling of food products: a consumer research perspective***, British Food Journal, Vol. 113, pp. 982–996
- Rosset, P. (2006) ***Food is Different: Why we must get the WTO out of agriculture***, Zed Books Ltd., 192 pages
- Roth, A. V. Tsay, A. A. Pullman, M. E. and Gray, J. V. (2008), ***Unraveling the Food Supply Chain: Strategic Insights from China and the 2007 Recalls***, Journal of Supply Chain Management, Vol. 44, pp. 22–39
- Rothwell, A. Ridoutt, B. Page, G. and Bellotti, W. (2016) ***Environmental performance of local food: trade-offs and implications for climate resilience in a developed city***, Journal of Cleaner Production, Vol. 114, pp. 420-430
- Rousu, M.C. and Corrigan, J.R. (2008) ***Estimating the Value Consumers Derive from Product Labeling***, Journal of Agricultural and Food Industrial Organization, 2008, Article 3, 28 pages
- Roy, P. Nei, D. Orikasa, T. Qingyi Xu, Okadome, H. Nakamura, N. Shiina, T. (2008) ***A review of life cycle assessment (LCA) on some food products***, Journal of Food Engineering, Vol. 90, pp. 1-10
- Salaün, Y. and Flores, K. (2001) ***Information quality: meeting the needs of the Consumer***, International Journal of Information Management, Vol. 21, pp. 21–37
- Salzmann, O. Ionescu-Somers, A. and Steger, U. (2005) ***The Business Case for Corporate Sustainability: Literature Review and Research Options***, European Management Journal, Vol. 23, Issue 1, pp. 27–36

-
- Sammarco, M. Ripabelli, G. and Grasso, G.M. (1997) **Consumer attitude and awareness towards food related hygienic hazards**, Journal of Food Safety, Vol. 17, pp. 215–221
- Saunders, C. Allison, G. Wreford, A. and Emanuelsson, M. (2005) **Food Markets: Trade Risks and Trends**, ARGOS Research Report: Number 05/04, 64 pages
- Saunders, C. Barber, A. Sorenson, L.C. (2009) **Food Miles, Carbon Footprinting and their potential impact on trade**, [online] Available at: <http://ageconsearch.umn.edu/bitstream/48051/2/AARESSaunder09.pdf>
- Schor, D. Maniscalco, S. Tuttle, M. M. Alligood, S. and Kapsak, W. R. (2010) **Nutrition facts you can't miss: The evolution of front-of-pack labeling: Providing consumers with tools to help select foods and beverages to encourage more healthful diets**, Nutrition Today, Vol. 45(1), pp. 22–32
- Schuchard, R. Berry, T. Skinner, C. Stewart, E. and Ure, S. (2008) **Eco-promising: communicating the environmental credentials of your products and services**, 20 pages [online] <http://www.forumforthefuture.org.uk/projects/eco-promising>
- Schultz, I. and Stieß, I. (2008) **Linking sustainable consumption to everyday life: a socio-ecological approach to consumption research**, in A. Tukker, M. Charter, & C. Vezzoli (Eds.), System Innovation for Sustainability 1: Perspectives on Radical Changes to Sustainable Consumption and Production. pp. 288–300. Sheffield: Greenleaf
- Schurman, R. and Munro, W. (2009) **Targeting Capital: A Cultural Economy Approach to Understanding the Efficacy of Two Anti-Genetic Engineering Movements**, American Journal of Sociology, Vol. 115, No. 1, pp. 155-202
- Schwartz, S.H. Melech, G. Lehmann, A. Burgess, S. Harris, M. and Owens, V. (2001) **Extending the cross cultural validity of the theory of basic human values with a different method of measurement**, Journal of Cross-Cultural Psychology, Vol. 32, pp. 519–542
- Scrinis, G. (2013) **Nutritionism: The science and politics of dietary advice**. New York: Columbia University Press
- Scrinis, G. and Parker, C. (2016) **Front-of-Pack Food Labeling and the Politics of Nutritional Nudges**, Law & Policy, Vol. 38, No. 3, pp. 234-239
- Senge, P. (2010) **The Sustainable Supply Chain**, Harvard Business Review, October 2010, pp. 70-72
- Seuring, S. (2011) **Supply chain management for sustainable products – insights from research applying mixed methodologies**, Business Strategy and the Environment, Vol. 20, Issue 7, pp. 471-484
- Seuring, S. and Müller, M. (2008) **From a literature review to a conceptual framework for sustainable supply chain management**, Journal of Cleaner Production, Vol. 16, Issue 15, pp. 1699-1710
- Seuring, S.A. (2008) **Assessing the rigor of case study research in supply chain management**, Supply Chain Management: An International Journal, Vol. 13, Issue 2, pp. 128-137
- Seyfang, G. (2007), **Growing sustainable consumption communities – The case of local organic food networks**, International Journal of Sociology and Social Policy, Vol. 27, Issue 3-4, pp. 120-134
- Sharf, M. Sela R. Zentner, G. Shoob, H. Shai, I. and Stein-Zamir, C. (2012) **Figuring out food labels. Young adults' understanding of nutritional information presented on food labels is inadequate**, Appetite, Vol. 58, pp. 531–534
- Sharfman, M. Shaft, T. Anex, R. (2009) **The road to cooperative supply-chain environmental management: trust and uncertainty among proactive firms**, Business Strategy and the Environment, Issue 18, Issue 1, pp. 1–13
- Sharma, L. Teret, S. Brownell, K. (2010) **The food industry and self-regulation: standards to promote success and to avoid public health failures**, American Journal of Public Health, Vol. 100, No. 2, pp. 240–6
- Sheu, J. (2008) **Green supply chain management, reverse logistics, and nuclear power generation**, Transportation Research Part E, Vol. 44, Issue 1, pp. 19-46
- Shewmake, S. Abigail, O. Lanka, T. Vandenberg, M. (2015) **Predicting consumer demand responses to carbon labels**, Ecological Economics, Vol. 119, pp. 168–180

-
- Shih, Fu-Jin (1998) **Triangulation in nursing research: issues of conceptual clarity and purpose**, Journal of Advanced Nursing, Vol. 28, pp. 633-641
- Sinden, G. (2009) **The contribution of PAS 2050 to the evolution of international greenhouse gas emission standards**, International Journal of Life Cycle Assessment, Vol. 14, pp. 195-203
- Sirieix, L. Delanchy, M. Remaud, H. Zepeda, L. and Gurviez, P. (2012) **Consumers' perceptions of individual and combined sustainable food labels: a UK pilot investigation** International Journal of Consumer Studies, Vol. 37, pp. 143-151
- Smedman, A. Lindmark-Månsson, H. Drewnowski, A. and Edman, M. (2010) **Nutrient density of beverages in relation to climate impact**, Food & Nutrition Research, Vol. 54, pp. 51-70.
- Smeds, S. (2012) **Financial penalties on foods: the fat tax in Denmark**, Nutrition Bulletin, Vol. 37, Issue 2, pp. 142-147
- Smith, M.P. (2009) **Explaining Divergent Health and Environmental Regulation in the United States and the European Union**, European Union Studies Association, EUSA Review (Summer), pp. 9-13 [online] http://www.eustudies.org/files/eusa_review/summer2009final.pdf
- Sneddon, C. Howard, R.B. Norgaard, R.B. (2006) **Sustainable development in a post-Brundtland world**, Ecological Economics, Vol. 57, pp. 253- 268
- Sorensen, H. (2009) **Inside the mind of the shopper: the science of retailing**, NJ, USA: Pearson Prentice Hall
- Spence, L.J. and Rinaldi, L. (2014) **Governmentality in accounting and accountability: A case study of embedding sustainability in a supply chain**, Accounting, Organizations and Society, Vol. 39, Issue 6, pp. 433-452
- Srivastava, S.K. (2007) **Green supply-chain management: A state-of-the-art literature review**, International Journal of Management Reviews, pp. 53-80
- Steenblik, R. and Moise, E. (2010) **Counting the Carbon Emissions from Agricultural Products: Technical Complexities and Trade Implications**, International Food & Agriculture Trade Policy Council. [online] Available at: http://agritrade.org/events/documents/Steenlik_Moise_Counting_Carbon.pdf
- Steenhuis, I. H. M. Kroeze, W. Vyth, E. L. Valk, S. Verbauwen, R. and Seidell, J. C. (2010) **The effects of using a nutrition logo on consumption and product evaluation of a sweet pastry**, Appetite, Vol. 55, Issue 3, pp. 707-709
- Steg, L. and Vlek, C. (2009) **Encouraging pro-environmental behaviour: An integrative review and research agenda**, Journal of Environmental Psychology, Vol. 29, Issue 3, pp. 309-317
- Stern (2017) **Ten years after the Stern Review on the economics of climate change: looking back, looking forward**, Insights Public Lectures January - May 2017 [online] Available at: <http://www.ncl.ac.uk/media/wwwnclacuk/universityevents/files/Insights%20Public%20Lectures%20January%20-%20May%202017.pdf>
- Stern, N. (2006) **Stern Review: The Economics of Climate Change**, Cambridge, Cambridge University Press. (2008) 'The Economics of Climate Change', American Economic Review, Vol. 98, No. 2, pp. 1-37
- Stewart, D.W. (2009) **The role of method: some parting thoughts from a departing editor**, Journal of the Academy of Marketing Science, Vol. 37, No. 4, p.381
- Story, M. Kaphingst, K. Robinson-O'Brien, R. and Glanz, K. (2008) **Creating healthy food and eating environments: Policy and environmental approaches**, Annual Review of Public Health, Vol. 29, pp. 253-272
- Sundarakani, B. de Souza, R. Goh, M. Wagner, S.M. and Manikandan, S. (2010) **Modeling carbon footprints across the supply chain**, International Journal of Production Economics, Vol. 128, Issue 1, pp.43-50
- Sunstein, C. (2011) **Empirically informed regulation**, The University of Chicago Law Review, Vol. 78(4), pp. 1349-1429
- Sunstein, C. and Reisch, L. (2013) **Automatically green**, Harvard Environmental Law Review
- Sustainable Development Commission (SDC) (2005) **Sustainability Implications of the Little Red Tractor Scheme**, London: SDC. Sustainable Development Commission (SDC)

-
- Sustainable Development Commission (SDC) (2009) **Setting the Table: Advice to Government on Priority Elements of Sustainable Diets**, London: SDC
- Svanen (2009) **Regulations for Nordic Ecolabelling** [online] http://www.svanen.nu/pdf/Regelverk_eng.pdf
- Swinburn B, Sacks G, Hall K, McPherson K, Finegood D, Moodie M, (2011) **The global obesity pandemic: shaped by global drivers and local environments**, *Lancet*, Vol. 378, Issue 9793, pp. 804–814
- Szanyi, J. M. (2010) **Brain food: Bringing psychological insights to bear on modern nutrition labeling efforts**, *Food Drug Law Journal*, Vol. 65, Issue 1, pp. 159–184
- Taber, D. Chriqui, J. Powell, L. and Chaloupk, F. (2012) **Banning all sugar-sweetened beverages in middle-schools: reduction of in-school access and purchasing but not overall consumption**, *Archive*
- Tannenbaum, F. (1938) **Crime and Community**, Columbia University Press, London and New York
- Tashakkori, A. and Teddlie, C. (1998) **Mixed Methodology. Combining Qualitative and Quantitative Approaches**, Sage, Thousand Oaks
- Taylor, P. (2016) **Corporate Social Science and the Loss of Curiosity**, The Social Science Research Council [online] Available at: <http://items.ssrc.org/corporate-social-science-and-the-loss-of-curiosity/>
- Taylor, P. O'Brien, G. and O'Keefe, P. (2016) **Eleven Antitheses on Cities and States: Challenging the Mindscape of Chronology and Chorography in Anthropogenic Climate Change**, *An International Journal for Critical Geographies*, Vol.15, Issue 2, pp. 393-417
- Taylor, R.C. (2002) **Restoring Economic Health to Contract Poultry Production**, Agricultural Resource Policy Forum, Auburn University College of Agriculture, Auburn
- TEEC (The European Evaluation Consortium) (2003) **Evaluation of the food labelling legislation (Final Report)**, Brussels: The European Commission, Directorate-General for Health and Consumer Protection (DG SANCO). [online] Available at: http://ec.europa.eu/food/food/labellingnutrition/foodlabelling/effl_conclu.pdf
- Temple, N.J. and Fraser, J. (2014) **Food labels: A critical assessment**, *Nutrition*, 30, pp.257-260
- Terlack, A. and King, A.A. (2006) **The Effect of Certification with the ISO 9000 Quality Management Standard: A Signaling Approach**, *Journal of Economic Behavior & Organization*, Vol. 60, Issue 4, pp. 579–602
- Terpstra, M.J. Steenbeckers, L.P.A. de Maertaelere, N.C.M. and Nijhuis, S. (2005) **Food storage and disposal: consumer practices and knowledge**, *British Food Journal*, Vol. 107, pp. 526–533
- Terrapass (2007) **Chips aren't for (carbon) free: carbon labeling hits the shelves in the UK** [online] Available at: <http://www.terrapass.com/images/blogposts/walkers.jpg>
- Thaler, R. and Sunstein, C. (2008) **Nudge: Improving Decisions about Health, Wealth, and Happiness**, New Haven, CT: Yale University Press
- Thankappan, S. and Flynn, A. (2007) **Looking up, looking down: Responsibilities for Climate Change in the UK Food Supply Chains**, Working Paper Series No. 41, 32 pages
- The Oxford Compact English Dictionary (1996) Oxford University Press, Oxford
- Thøgersen, J. (2010) **Country difference in sustainable consumption: the case of organic food**, *Journal of Macromarketing*, Vol. 30 (2), pp. 171–185
- Thomas, G. (2011) **How to Do Your Case Study: A Guide for Students and Researchers**, London: Sage
- Thrane, M., and Schmidt, J., (2008) **Life Cycle Assessment (LCA)** [online] <http://www.plan.aau.dk/~thrane/Publications/7-REM-Chapter-4A-tool.pdf>
- Tiesl, M. F. Peavey, S. Newman, F. Buono, F. Hermann, M. (2002) **Consumer reactions to environmental labels for forest products: A preliminary look**, *Forest Products Journal*, Vol. 52, Issue 1, pp. 44-50
- TNS (2004) **Consumer attitudes to food standards**, Wave 4, Northern Ireland Report. Report prepared for the Food Standards Agency and COI communications. [online] Available at: <http://www.food.gov.uk/multimedia/pdfs/cas2003ni.pdf>
- TNS (2008) **Consumer attitudes to food standards**, Wave 8. Report prepared for the Food Standards Agency and COI communications. [online] Available at:

http://www.foodbase.org.uk/admintools/reportdocuments/441-1-777_cas2007ukreport.pdf

Tukker, A. Bausch-Goldbohm, S. Verheijden, M. de Koning, A. Kleijn, R. Wolf, O. and Perez Dominguez, I. (2009) **Environmental Impacts of Diet Changes in the EU**, Seville: Institute for Prospective Technological Studies

Turner, K., Lenzen, M., Wiedmann, T. and Barrett, J. (2007), **Examining the global environmental impact of regional consumption activities – Part 1: A technical note on combining input-output and ecological footprint analysis**, Ecological Economics, Vol. 62, pp. 37-44

Tzivilakis, J. Green, A. Warner, D. McGeevor, K. Lewis, K. (2012) A framework for practical and **effective eco-labelling of food products**, Sustainability Accounting, Management and Policy Journal, Vol. 3, Issue 1, pp.50-73

UN (1992) **Rio Declaration on Environment and Development**, Report of the United Nations Conference on Environment and Development, [online], Available at: <http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm>

UNDESA (2004) **Documents** [online], Available at: <http://www.un.org/esa/sustdev/documents/agenda21/index.htm>

UNFCCC (2013) **United Nations Framework Convention on Climate Change, Article 2: Objective** [online] Available at: http://unfccc.int/essential_background/convention/background/items/1353.php

UNFCCC, (2004) **United Nations Framework Convention on Climate Change, The First Ten Years** [online] Available at: http://unfccc.int/resource/docs/publications/first_ten_years_en.pdf

United Nations Population Fund (2008) **State of World Population 2008**, United Nations Population Fund, New York, NY.

Unruh, G. and Ettenson, R. (2010) **Growing Green – Three smart paths to developing sustainable products**, Harvard Business Review, [June 2010], pp. 94-100

Upham, P. and Bleda, M. (2009) **Carbon Labelling: Public Perceptions of the Debate. Summary report**. (Manchester) pp. 1-36 [online], Available at: <http://sciv2.iqmedialink.co.uk/uploads/carbonlabellingpublicperceptionsofthedebate.pdf>

Upham, P. Dendler, L. Bleda, M. (2011) **Carbon labelling of grocery products: public perceptions and potential emissions reductions**, Journal of Cleaner Production, Vol. 19, pp.348-355

Urien, B. and Kilbourne, W. (2011) **Generativity and self-enhancement values in eco-friendly behavioral intentions and environmentally responsible consumption behaviour**, Psychology and Marketing, Vol. 28, Issue 1, pp.69-90

Van Kleef, E. and Dagevos, H. (2015) **The Growing Role of Front-of-Pack Nutrition Profile Labeling: A Consumer Perspective on Key Issues and Controversies**, Critical Reviews in Food Science, Vol. 55, Issue 3, pp. 291-303

Vanclay, J.K. Shortiss, J. Aulsebrook, S. Gillespie, A.M. Howell, B.C. Johanni, R. Maher, M.J. Mitchell, K.M. Stewart, M.D. and Yates, J. (2011) **Customer Response to Carbon Labelling of Groceries**, Journal of Consumer Policy, Vol. 34, pp. 153-160

Vandenbergh, M.P. Dietz, T. and Stern, P.C. (2011) **Time to try carbon labelling**, Nature Climate Change, Vol.1, pp.4-6

Vasileiou, K. and Morris, J. (2006) **The sustainability of the supply chain for fresh potatoes in Britain**, Supply Chain Management: An International Journal, Vol. 11, Issue 4, pp. 317-327

Verbeke, W. and Ward, R. (2006) **Consumer interest in information cues denoting quality, traceability and origin: an application of ordered probit models to beef labels**, Food Quality and Preference, Vol. 17, pp. 453– 467

Verbeke, W. Frewer, L. Scholderer, J. and De Brabander, H. (2007) **Why consumers behave as they do with respect to food safety and risk information**, Analytica Chimica Acta, Vol. 586, pp. 2–7

Vergez, A. (2012) **Display of the environmental footprint of products: French developments in the food sector** [online] Available at: <http://www.developpement-durable.gouv.fr/IMG/pdf/ED64EN.pdf>

-
- Vittersø and Tangeland (2015) ***The role of consumers in transitions towards sustainable food consumption. The case of organic food in Norway***, Journal of Cleaner Production, Vol. 92, pp. 91–99
- Vogler, J. (2013) ***Changing conceptions of climate and energy security in Europe***, Environmental Politics, Vol. 22, Issue 4, pp. 627–645
- Vyth, E. L. Hendriksen, M. A. H. Roodenburg, A. J. C. Steenhuis, I. H. M. Van Raaij, J. M. A. Verhagen, H. and Seidell, J. C. (2011a) ***Consuming a diet complying with front-of-pack label criteria may reduce cholesterol levels: A modeling study***, European Journal of Clinical Nutrition, Vol. 66, pp. 510–516
- Vyth, E. L. Steenhuis, I. H. M. Heymans, M. W. Roodenburg, A. J. C. Brug, J. and Seidell, J. C. (2011b) ***Influence of placement of a nutrition logo on cafeteria menu items on lunchtime food choices at Dutch work sites***, Journal of the Dietetic Association, Vol. 111, Issue 1, pp. 131–136
- Vyth, E. L. Steenhuis, I. H. M. Roodenburg, A. J. C. Brug, J. and Seidell, J. C. (2010a) ***Front-of-pack nutrition label stimulates healthier product development: A quantitative analysis***, International Journal of Behaviour Nutrition and Physical Activity, Activ. 7., 7:65
- Vyth, E. L. Steenhuis, I. H. M. Vlot, J. A. Wulp, A. Hogenes, M. G. Looije, D. H. Brug, J. and Seidell, J. C. (2010b) ***Actual use of a front-of-pack nutrition logo in the supermarket: Consumers motives in food choice***, Public Health Nutrition, Vol. 13, Issue 11, pp. 1882–1889
- Wackernagel, M. Monfreda, C. Moran, D. Wermer, P. Goldfinger, S. Deumling, D. and Murray, M. (2005) ***National Footprint and Biocapacity Accounts 2005: The underlying calculation method***
- Wackernagel, M. Schulz, N. Deumling, D. Callejas Linares, A. Jenkins, M. Kapos, V. Monfreda, C. Loh, J. Myers, N. Norgaard, R. Randers, J. (2002) ***Tracking the ecological overshoot of the human economy***, Proceedings of the National Academy of Sciences, Vol. 99, Issue 14, pp. 9266–9271
- Wackernagel, Mathis and Rees, William (1996) ***Our Ecological Footprint: Reducing Human Impact on the Earth***, New Society Publishers, 160 pages
- Walker, H. and Jones, N. (2012) ***Sustainable supply chain management across the UK private sector***, Supply Chain Management: an International Journal, Vol. 17, Issue 1, pp. 15–28
- Walker, H. Di Sisto, L. and McBain, D. (2008) ***Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors***, Journal of Purchasing and Supply Chain Management, Vol. 14, pp. 69–85
- Wallgren, C. and Hojer, M. (2009) ***Eating energy—Identifying possibilities for reduced energy use in the future food supply system***, Energy Policy, Vol. 37, Issue 12, pp. 5803–5813
- Walt, G. and L. Gilson, (1994.) ***Reforming the Health Sector in Developing Countries: The Central Role of Policy Analysis***, Health Policy and Planning Vol. 9, Issue 4, pp. 353–370
- Walton, S.V. Handfield, R.B. Melnyk, S.T. (1998) ***The green supply chain: Integrating suppliers into environmental management process***, International Journal of Purchasing and Materials Management, pp. 2–11
- Wansink, B. (2005) ***Marketing Nutrition. Soy, Functional Foods, Biotechnology and Obesity***, University of Illinois Press, Urbana, IL
- Wansink, B. and Chandon, P. (2006) ***Can “low-fat” nutrition labels lead to obesity?*** Journal of Market Research, Vol. 43(4), pp. 605–617
- Wansink, B. and Van Ittersum, K. (2007) ***Portion size me: Downsizing our consumption norms***, Journal of the American Dietetic Association, Vol. 107, Issue 7, pp. 1103–1106
- WBCSD (2009) ***Greenhouse Gas Protocol Publishes New Guidelines***, [online] Available at: <http://www.wbcsd.org/plugins/DocSearch/>
- WCED (1987) ***Our Common Future***, World Commission on Environment and Development. Oxford: Oxford University Press
- Weber, C. and Scott H.M. (2008) ***Food-Miles and the Relative Climate Impacts of Food Choices in the United States***, Journal of Environmental Science and Technology, Vol. 42, Issue 10, pp. 3508–3513
- Weidema, Bo P. Thrane, M. Christensen, P. Schmidt, J. and Løkke, S. (2008) ***Carbon Footprint A Catalyst for Life Cycle Assessment?*** Journal of Industrial Ecology, Vol. 12, Issue 1, pp. 3–6

-
- White, H. (2000) **“Buyer-supplier relationships in the UK fresh produce industry”**, British Food Journal, Vol. 98, Issue 6, pp. 9-15
- White, P. Sharp, V. Darnton, A. Downing, P. Inman, A. Strange, K. Garnett, T. (2009) **Food Synthesis Review: A Report to the Department for Environment, Food and Rural Affairs**, Defra, London [online] Available at: http://www.resourcesnotwaste.org/upload/documents/reports/FoodBehavioursSynthesisReview_25.pdf
- White, R. (2007) **Carbon governance from a systems perspective: an investigation of food production and consumption in the UK**, Environmental Change Institute Oxford University Centre for the Environment, ECEEE 2007 SUMMER STUDY • SAVING ENERGY – JUST DO IT! pp. 103-110 [online] <http://www.eci.ox.ac.uk/research/energy/downloads/eceee07/white.pdf>
- Wiedmann, T. and Minx, J. (2007) **A Definition of ‘Carbon Footprint’**, ISA UK Research & Consulting [online], Available at: http://www.isa-research.co.uk/docs/ISA-UK_Report_07-01_carbon_footprint.pdf
- Wiedmann, T. and Minx, J. (2008) **A Definition of ‘Carbon Footprint’**, in C.C. Pertsova, Ecological Economics Research Trends: Chapter 1, pp. 1-11, Nova Science Publishers, Hauppauge NY, USA
- Wiedmann, T. Barrett, J. and Lenzen, M. (2007) **Companies on the Scale: Comparing and Benchmarking the Footprints of Businesses**, International Ecological Footprint Conference, Cardiff, pp. 1-20, [online], Available at: http://www.isa-research.co.uk/docs/Wiedmann_et_al_2007_Cardiff_Companies_EF.pdf
- Wijkman, A. and Rockström, J. (2012) **Bankrupting Nature: Denying Our Planetary Boundaries**, Business & Economics, Routledge, Earthscan, 206 pages
- Williams, M. Demkine, V. and Fowler, D. (2012) **Simultaneously mitigating near-term climate change and improving human health and food security**, Science, Vol. 335, Issue 6065, pp.183–189
- Williams, P. and Colyer, C. (2009) **Nutrition profiling and labelling of healthy or functional meals**, Journal of Foodservice, Vol. 20, Issue 5, pp. 230–240
- Williams, P. Duncan, R. De Agnoli, K. Hull, A. Owers, A. and Wang, T. (2010) **Front of pack daily intake labelling on Australian pack- aged foods: Introduction and use 2007–2009**, Food Australia, Vol. 62, Issue 12, pp. 583– 588
- Wilson, T. D. Houston, C. E. Etling, K. M. and Brekke, N. (1996) **A new look at anchoring effects: Basic anchoring and its antecedents**, Journal of Experimental Psychology: General, Vol 125(4), pp. 387-402
- Wognum P.M. Bremmers, J. Trienekens, J.H. van der Vorst, J.G.J.A. Bloemhof, J.F. (2011) **Systems for sustainability and transparency of food supply chains — Current status and challenges**. Advanced Engineering Informatics, Vol. 1, No. 25, pp. 65-75
- World Health Organization (2004) **Global Strategy on Diet, Physical Activity and Health**, Geneva, Switzerland, WHO
- World Health Organization (2008) **2008–2013 Action Plan for the Global Strategy for the Prevention and Control of Non-communicable Diseases**, Geneva, Switzerland, WHO
- Wu, Z. and Pagell, M. (2011) **Balancing priorities: Decision-making in sustainable supply chain management**, Journal of Operations Management, Vol. 29, pp. 577-590
- Yakovleva, N. and Flynn, A. (2009) **Organic production: the adoption of a niche strategy by the mainstream food system**, International Journal of Innovation and Sustainable Development, Vol. 4, Issue 1, pp. 43-60
- Yeatman, H (2008) **Window of opportunity: positioning food and nutrition policy within a sustainability agenda**, Australian and New Zealand Journal of Public Health, Vol. 32, pp. 107–109
- Yeung, R.M.W. and Morris, J. (2001) **Food safety risk. Consumer perception and purchase behaviour**, British Food Journal, Vol. 103, pp. 170-186
- Yin, R. K. (2008) **Case Study Research: Design and Methods**, London: Sage
- Yin, R.K. (1994) **Case study research: design and methods**, 2nd ed. Thousand Oaks, CA: Sage Publications
- Yin, R.K. (2004) **The case study anthology**, Thousand Oaks, CA: Sage Publications

-
- Yin, R.K. (2013) **Case Study Research: Design and Methods**, SAGE Publications, Social Science, 312 pages
- Young, A. and Kielkiewicz-Young (2001) **Sustainable supply network management**, Corporate Environmental Strategy, Vol. 8, Issue 3, pp. 260–268
- Zander, K. and Hamm, U. (2010) **Consumer preferences for additional ethical attributes of organic food**, Food Quality and Preference, Vol. 21, pp. 495–503
- Zelinsky, W. (1975) **The Demigod's Dilemma**, Annals of the Association of American Geographers, Vol. 65, Issue 2, pp. 123-142
- Zsidisin, G.A. and Siferd, S.P. (2001) **Environmental purchasing: a framework for theory development**, European Journal of Purchasing & Supply Management, Vol. 7, Issue 1, pp. 61–73

Appendix 1

Labelling Legislation: the UK

EU legislation has for the last 30 years or so driven UK legislation, which is dominated by Regulations over Directives. Some of the most fundamental parts of food labelling legislation are EU Regulations. For instance, Regulation 1169/2011 provides a general framework and governs food constituents such as ingredients lists and allergens, Regulation 1924/2006 controls the use of health and nutrition claims. There are also specific EU Regulations, which deal with certain categories of food such as organic or fresh meat. UK legislation in addition to EU law also exists, for instance the Food Safety Act, 1990. This requires that food packaging must not be misleading. However, the UK food labelling regime is largely informed by UK and EU case law. For instance, the Raspberry Vanilla case (C – 195/14) informs how “misleading” is interpreted for the purposes of pictures on packaging.

The trend in recent years has been for the EU to legislate via Regulations rather than Directives for food labelling in an effort to ensure consistency across EU Member States. Regulation and Directives have distinctive differences. Directives are not enforceable and serve to simply instruct Member States to create legislation. Regulations on the other hand, are directly effective in all Member States including the UK (at the moment). While there is no need for a Member State to legislate, for the purposes of food labelling, the UK has adopted many of the food labelling regulations directly into UK law in the form of Statutory Instruments. The most salient of which are the Nutrition and Health Claims Regulations 2007/2080 and the Food Information Regulations 2014/1855. The effect of transposing most of the Regulations into Statutory Instruments is that there will be little immediate impact on food labelling regardless which model the UK chooses to adopt. While it is possible that the underlying Regulations will fall away and no longer be binding in the UK, the Statutory Instruments will continue and will be binding in the normal way. What will change is that the UK Parliament will (re)gain the ability to modify these Statutory Instruments. For instance, in light of the substantial consumer support for anti-obesity measures such as those proposed in the Sugar in Food and Drinks (Targets, Labelling and Advertising) Bill, which would force manufacturers to display sugar content in teaspoons on packaging. However, if the UK Parliament (re)gains the right to amend these labelling requirements, the Bill may be revisited and other anti-obesity measures considered.

Appendix 2



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This questionnaire is designed to gauge consumer perceptions of 'greenness' and 'green' issues when food shopping. As such, this questionnaire will contribute towards an in depth research study on the carbon footprinting of food being undertaken by Zaina Gadema, a PhD student and researcher at the Newcastle Business School at Northumbria University. The specific research study is looking at the uptake of a particular carbon footprint standard and to what extent it will help reduce adverse climate change impacts in the context of food production, processing, distribution, retail and consumption. Your anonymity is assured; hence the request for names is not made. Should you have any queries, or would like further information about the research or are willing to participate further, please do not hesitate to contact Zaina Gadema on: 07957 615 255 or by email at: zaina.gadema@northumbria.ac.uk.

Perceptions in Food Purchasing Questionnaire: Consumers

Please answer all of the questions below and tick boxes that apply:

Date:

Time of day:

Postcode of home address:

Gender	Male	Female	Other			
Age	up to 20	From 21 to 30	From 31 to 40	From 41 to 55	From 56 to 65	over 65
Do you mainly shop for food at a supermarket?	Yes	No	Other			
If yes, which supermarket do you use most?	Asda	Tesco	Sainsburys	Morrisons	Waitrose	Other (please state)
How often do you shop for food at a supermarket?	Every day	1-3	3-6	once a week	bi-weekly	once a month
Do you try to do your main food shopping at local shops?	Yes	No	Sometimes	Depends on price	Depends on convenience	Depends on quality
Do you buy from farmers' markets and or farm shops?	Yes	No	Sometimes			
If you buy from farmers' markets and/or farm shops what is the distance you are prepared to travel?	Up to 1 mile	Up to 5 miles	Up to 15 miles	Up to 25 miles	Up to 35 miles	+ 35 miles
I shop at a supermarket because it is most convenient	Agree	Strongly agree	Neutral	Slightly agree	Strongly disagree	
Do you think climate change is important when buying food?	Very important	Important	Neutral	Less important	Not important	
How important is it to know the amount of carbon in food?	Very important	Important	Neutral	Less important	Not important	

What is most important when buying a product?

Please rate: high, low, medium, neutral or don't know (high being of the highest importance)

Number of calories
Nutrition

Carbon	
Special offers	
Sustainable sources	
Price	
Fair Trade	
Place of origin/local or regional sourcing	
Free range	
Organic	
Food Miles	
Quality/Taste	
Attractive branding	
Biodegradable/recyclable packaging	

Have your priorities changed in purchasing food over the last ten years?

Yes	No

If your priorities have changed, how have they? Where the option exists for less/more, please choose one option if applicable to your priorities

Buy less/more organic	Buy less/more fair trade	Buy less/more free range	Want more locally sourced food	Buy less/more processed	Buy products that display familiar brand names	Buy products that display carbon footprints

What has influenced the difference in purchasing from ten years ago?

School/Education	Media/popular press	Advertising	Health	Concern for the Environment	Friends/Family	Other

How important is the quality of food?

Very important	Important	Neutral	Less important	Not very important

Would a carbon footprint level displayed on a product against one that didn't, indicate better quality?

Yes	No	Not sure

Can you compare carbon footprint measurements of products?

Yes	No

Understanding and comparing carbon footprints of products is confusing.

Strongly Agree	Agree	Neutral	Slightly disagree	Strongly disagree

Are there other issues you think are more important than the amount of carbon in a product?

Yes	No	Not sure

What other issues do you think are important?

Fair trade	Reduce chemical additives/ colourings and flavourings	Clearer labelling	Local food sourcing	Biodiversity/ conservation	Sustainable sources	Reduce carbon	Other

Do you specifically look for organic and/or free range products?

Please delete as appropriate

Free Range	Conventional
Yes/No	Yes/No

Do you think that buying organic and/or free range products is better for the environment?

Yes	No

How important is it for food companies to measure the carbon footprint of their products?

Very important	Important	Neutral	Less important	Not important

Is it important to have carbon labels on food?

Very important	Important	Don't know	Less important	Not important

Would you like to see carbon labels on food products?

Yes	No

Do you think carbon labels would make it easier to compare environmental standards?

Yes	No	Don't know

Would you choose to buy a product that has a carbon footprint label over one that didn't?

Yes	No	Yes, but depends on cost

Do you know your own personal carbon footprint?

Yes	No

Appendix 3
Interview Protocol: Framework of Questions

Interview questions for the business:

1. How many full time equivalent employees work within the company?
2. What is the annual sales revenue per year?
3. Who is responsible for environmental management and sustainability issues within your organisation?
4. How would you describe the overall approach of your company towards sustainability, environmental standards and green supply chain management?
5. Do you think consumers influence the carbon footprinting, sustainability and environmental agendas?
6. Where along the supply chain do you think the most pressure is coming from to carbon footprint and 'green' products/systems?
7. Do you think the pressure is driven from externalities such as government policy and regulation or more from within the organisation or from others within the supply chain?
8. Does your organisation have green supply chain management practices? If so, what are they and what is the organisation's overall objective?
9. Does your organisation publish environmental performance standards and make them available to the public? If so, how?

General

1. Do you have an environmental management programme/system/LCA in place?
2. If so, to what extent has the programme/system/LCA been successful?
3. How is success/failure measured?
4. Have you heard of PAS 2050? If not, go to question 7.
5. If so, have you used the specification? If not, go to question 7.
6. To what extent has your organisation used the specification, i.e. for the purposes of carbon footprint labelling verification and communication? How long have you been working on the PAS 2050 method?
7. Do you think PAS 2050 might be something you would consider?
8. With respect to question 7, why?

Drivers and Barriers

1. What are the principal benefits of using PAS 2050 to carbon footprint products? Has PAS 2050 speeded up the transition to labelling products for marketing purposes, communication and verification?
2. What are the main reasons/drivers for using PAS 2050 in your organisation?
3. What were the barriers or conflicts you encountered in firstly coming to the decision to use PAS 2050 and then in the process of using it?
4. What are your views on carbon footprinting?
5. What do you think the main drivers for carbon footprinting using PAS 2050 are?
6. What do you think the barriers for carbon footprinting using PAS 2050 are?
7. Are there any other environmental programmes, objectives or standards in place?

Appendix 4

Newcastle Business School Informed Consent Form for research participants

Title of Study	<i>Assessing the extent to which PAS 2050 stimulates proactive carbon footprinting in UK food supply chains to mitigate climate change impacts.</i>
Person(s) conducting the research	Zaina Gadema
Programme of study	PhD
Address of the researcher for correspondence	Seashell Cottage 3 Gordon Street Amble Morpeth, Northumberland NE65 0AT
Telephone	07957 615 255 or 01665 710 977
E-mail	zainagg@aol.com and zaina.gadema@northumbria.ac.uk
Description of the broad nature of the research	A mixed methods approach to evaluating the adoption of PAS 2050 (a carbon footprinting standard) in food supply chains.
Description of the involvement expected of participants including the broad nature of questions to be answered or events to be observed or activities to be undertaken, and the expected time commitment	The purpose of this study is to evaluate PAS 2050 effectiveness and map the diffusion of uptake/adoption rates across food supply chains. The research intends to identify the main drivers and barriers for PAS 2050 uptake and gain insights into whether PAS 2050 (which is now part of a growing suite of voluntary environmental standards) is effecting meaningful change in the context of carbon reduction and the wider sustainability agenda; by together, identifying key determinants that influence its uptake and mapping out emergent diffusion of PAS 2050 adoption. Consequently, an evaluation of PAS 2050 diffusion and uptake across whole food supply chains, using a methodological framework of internationally recognized OECD evaluation criteria to gauge PAS 2050's relevance, impact, effectiveness, efficiency, and sustainability will be undertaken. Evaluation takes place at the programme level to inform policy. It is necessary to evaluate policy at the programme level because; ultimately it is this

	<p>level which forms the foundation for the design and development of legislature by policy-makers.</p> <p>The research will be carried out in three parts as and as per the methods employed by Walton et al. (1998): (i) an initial customer survey questionnaire will be administered; (ii) semi-structured face to face interviews will be conducted with key people identified in organisations across food selected supply chains who are involved in sustainability/environmental reporting to explore in more detail, the extent of PAS 2050 influence on their businesses; and (iii) an iterative desk-top literature review.</p>
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Information obtained in this study, including this consent form, will be kept strictly confidential (i.e. will not be passed to others) and anonymous (i.e. individuals and organisations will not be identified *unless this is expressly excluded in the details given above*).

Data obtained through this research may be reproduced and published in a variety of forms and for a variety of audiences related to the broad nature of the research detailed above. It will not be used for purposes other than those outlined above without your permission.

Participation is entirely voluntary and participants may withdraw at any time.

By signing this consent form, you are indicating that you fully understand the above information and agree to participate in this study on the basis of the above information.

Participant's signature

Date

Student's signature

Date

Please keep one copy of this form for your own records



Newcastle Business School

RESEARCH ORGANISATION INFORMED CONSENT FORM

Newcastle Business School
University of Northumbria

Completion of this form is required whenever research is being undertaken by NBS staff or students within any organisation. This applies to research that is carried out on the premises, or is about an organisation, or members of that organisation or its customers, as specifically targeted as subjects of research.

The researcher must supply an explanation to inform the organisation of the purpose of the study, who is carrying out the study, and who will eventually have access to the results. In particular issues of anonymity and avenues of dissemination and publications of the findings should be brought to the organisations' attention.

Researcher's Name: Zaina Gadema

Student ID No. (if applicable):04923160

Researcher's Statement:

The purpose of this study is to evaluate PAS 2050 uptake/adoption in UK food supply chains. The research intends to identify the main drivers and barriers for PAS 2050 uptake and gain insights into whether PAS 2050 (which is now part of a growing suite of voluntary environmental standards) is effecting meaningful change in the context of carbon reduction and the wider sustainability agenda; by together, identifying key determinants that influence PAS 2050 adoption and non-adoption. Consequently, an evaluation of PAS 2050 diffusion and uptake across whole food supply chains, using a methodological framework of internationally recognized OECD evaluation criteria to gauge PAS 2050's relevance, impact, effectiveness, efficiency, and sustainability will be undertaken.

The research will be carried out in three parts as and as per the methods employed by Walton et al. (1998): (i) an initial customer survey questionnaire will be administered; (ii) key stakeholders in the development of PAS 2050 will be identified and invited to participate in semi-structured face-to-face interviews; and (iii) semi-structured face to face interviews will be conducted with key people identified in organisations across selected food supply chains who are involved in sustainability/environmental reporting to explore in more detail, the extent of PAS 2050 influence on their businesses.

Any organisation manager or representative who is empowered to give consent may do so here:

Name: _____

Position/Title: _____

Organisation Name: _____

Location: _____

Anonymity must be offered to the organisation if it does not wish to be identified in the research report. Confidentiality is more complex and cannot extend to the

markers of student work or the reviewers of staff work, but can apply to the published outcomes. If confidentiality is required, what form applies?

- No confidentiality required
- Masking of organisation name in research report
- No publication of the research results without specific organisational consent
- Other by agreement as specified by addendum

Signature: _____ Date: _____

This form can be signed via email if the accompanying email is attached with the signer's personal email address included. The form cannot be completed by phone, rather should be handled via post.

Appendix 5

Article in the Journal, Food Policy:

Gadema, Z. and Oglethorpe, D. (2011) *The use and usefulness of carbon labelling food: A policy perspective from a survey of UK supermarket shoppers*, Food Policy, Vol.36, pp.815-822

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