PLAYING FOR HIGH STEAKS: MARKET STRUCTURE AND PURCHASER-LED SUSTAINABILITY INITIATIVES IN THE UK BEEF SECTOR

Chris Foster* & Sally Gee**

*The Sustainable Consumption Institute, The University of Manchester, UK.

** Manchester Institute of Innovation Research & The Sustainable Consumption Institute, The University of Manchester, UK. C*orresponding author:* sally.gee@manchester.ac.uk;

ABSTRACT

Large purchasers, or "focal organisations", exert considerable control over their value chains, particularly in the food sector. This paper draws on original qualitative research about the UK beef sector to explore how large purchasers are organising supply-chain eco-innovation. Livestock farming affects environmental sustainability in a number of ways and various initiatives aim to address these challenges. Through a 'fine-grained' analysis, focused on the organisational diversity of supply-chains within a single product group, we analyse how supply-chain structure conditions eco-innovative activity initiated by large purchasers. The paper extends the theory on buyer-driven commodity chains by considering how eco-innovation is influenced by the commercial importance of a product, as well as factors beyond the immediate supply-chain, such as government policy and consumer expectations. The paper concludes that although major retailers use their purchasing power to exert control over provision, they do not necessarily play a role in the governance of supply-chain eco-innovation.

Keywords: eco-innovation; supply chain; UK beef sector; major retailers; purchasing power.

INTRODUCTION

Many supply chains in the food sector can accurately be described as buyer-driven commodity chains (Gereffi et al, 2005) where major buyers (food retailers) determine what is supplied and how it is produced (Huber, 2008). Large retailers and foodservice companies are considered the most powerful actors in food chains by virtue of their purchasing "muscle" (Lang & Heasman, 2004). The UK beef sector is no exception and major purchasers, described here as 'focal organisations', exert considerable control over the provision of beef and beef products. Arguably, these focal organisations are well-positioned to drive eco-innovation; they are dynamic businesses with track records of innovation (e.g. Cox et al 2002a) and most have committed to using their influence to improve their supply chains' environmental performance.

In this paper we differentiate between focal organisations purchasing one product group (beef), finding differences in the structure of their supply chains. This fine-grained analysis of variety in buyer-driven commodity chains in the beef sector facilitates an examination of the factors informing supply chain structure, and the implications of this variety for eco-innovation. We hypothesise that supply chain structures affect the nature of sustainability initiatives employed by retailers as well as the organisation of eco-innovation. To test this hypothesis we describe and categorise the types of eco-innovations emerging in the UK beef sector. We extend Gereffi and colleagues' (2005) concept of value chains by differentiating between several buyer-driven commodity chains within one product group. This distinction enables us to consider how chain structure shapes supply-chain eco-innovation, and to understand the influence of factors such as a product's commercial importance, consumer expectations and government policy.

The UK beef sector is an interesting empirical area for this type of analysis. Firstly, there is considerable social and political pressure to address environmental issues in the beef sector. Agriculture is responsible for the largest proportion of environmental impacts in the life cycles of many food products (Tukker *et al* 2005) and this is particularly true for livestock products; livestock rearing accounts for over 57% of agricultural emissions in the UK (Audsley et al, 2009). Significantly reducing the environmental burden of food production is critical to achieving a more sustainable society (e.g. Government Office for Science, 2011). Secondly, sector characteristics meet the analytical requirements. Over 80% of meat sold directly to consumers passes through food retailers, the commercial importance of beef to individual retailers varies, while the production base is highly fragmented and notoriously conservative (Gray, 2000). There is also a high degree of regulation (e.g. European Commission 2012; European Council 1991) which, together with the reported price sensitivity of most consumers, informs production and provisioning practices. The paper explores how these structural factors shape the supply-chain sustainability initiatives of major purchasers.

The paper is laid out as follows: in the next section, we discuss the theoretical basis from which eco-innovation in the UK beef sector can be viewed. The review explores the role of major purchasers in food supply chains, discusses the potential for major purchasers to stimulate innovation in farming or farm input production ("upstream"), and identifies limitations to influence. We next outline the research questions and methodology before providing an overview of UK beef sector. The main empirical content of the article is then introduced. The discussion is organised around the sustainability initiatives of 3 types of major purchaser; 1) large foodservice firms; 2) small and medium retailers; and 3) large retailers. Major purchasers are grouped according to a number of criteria including scale and relative commercial importance of beef in their overall product portfolio. The types of supply chain sustainability initiatives undertaken by these major purchasers are next described, and structural characteristics that shape activities and interactions are identified. The diversity of responses to the same (sustainability) problem among the different categories of major purchaser is an important focus. The paper concludes by reflecting on the implications of variety in supply chain structures for the organisation of eco-innovation and the potential for focal organisations to direct supply chain (i.e. upstream) eco-innovation.

CO-ORDINATING INNOVATION IN FOOD SUPPLY CHAINS

MAJOR PURCHASERS IN FOOD SUPPLY CHAINS

Large retail organisations play a pivotal role in the food sector (e.g. Lang et al, 2004; Hingley, 2005; Yakovleva and Flynn, 2004) and supermarkets are widely identified as the most powerful actors in the food system. Highly concentrated supply chains exist for most food groups in most countries (Wilkinson, 2006) and most food is purchased by individuals from supermarkets or caterers that buy in large quantities from relatively centralised processing firms. Even organic foods (whose production system values local consumption) are primarily purchased at supermarkets (Smith, 2006). Supermarkets are positioned as the gatekeepers to consumers, with a level of control over market access that predicts a high degree of power and influence (e.g. Harvey, 2002).

Thus food chains can accurately be described as buyer-driven commodity chains (Gereffi, 1994; Gereffi et al, 2005). Retailers are the major buyers that determine what is supplied and how it is produced: focal organisations able to govern supply chains with the "authority and power relationships (to) determine how financial, material and human resources are allocated and flow within a chain" (Gereffi, 1994, p97). The high share of the value-added retained by retailers is evidence of this power.

MAJOR PURCHASERS AS LEADERS OF SUPPLY CHAIN INNOVATION

The considerable control retailers exercise over the organisation, governance and management of food supply-chains (Burch and Lawrence, 2005; Busch and Bain, 2004; Cox et al, 2002; Cox and Chicksand, 2007; Gereffi, 1994; Hughes, 1996) *could* enable

them to coordinate supply-chain eco-innovation (Huber, 2008). Innovation takes different forms. Product, process and organisational innovation can be discrete or highly interdependent and radical innovation is commonly distinguished from incremental. Firms pursue innovation to enhance profitability through efficiency gains, introduction of new products and services or value addition to existing activities. Eco-innovation is distinctive in addressing a collective good (the environment); eco-innovations may or may not enhance profitability in the firms that introduce them (see Carillo-Hermisilla *et al* (2010) for an overview on types of eco-innovation). However if there is no clear link between eco-innovation and profitability, then firms have little incentive to pursue them directly. Incentives for firms to support eco-innovation along the supply-chain could be even lower. It is appropriate then to look for evidence of major purchasers successfully driving innovation upstream in supply-chains.

The supply-chain management literature has emphasised the importance of long-term, coordinated relationships between a manufacturing firm and its supplier(s) for innovation; and examples of firms collaborating with their suppliers on incremental and radical *product* innovations are relatively common (for example, Malhotra et al, 2001). There are also empirical examples of major buyers driving eco-innovation along their supply-chains (a form of demand-led innovation); including McDonalds' elimination of polystyrene packaging along its US supply chain (Lowe and Gereffi, 2009), which also influenced the firm's industry counterparts. Conversely, Carrillo-Hermosilla et al (2010) report few, if any cases in which focal organisations stimulate transformational *process* innovation in remote (2nd-tier and beyond) suppliers. Broadly, Pagell and Wu (2009) confirm that long-term, coordinated buyer-supplier relationships are a key element of more sustainable supply-chain management in exemplar firms. The quality of relationships along the supply-chain is likely to influence attempts to stimulate upstream innovation by major purchasers of processed beef and beef products ("downstream" actors).

There is also evidence in the literature of major purchasers stimulating innovation in extended systems. Indeed, as the most powerful and influential actors in the food supply chain, retailers provide a corporate leverage point with potential to effect industry-wide change (e.g. Lowe and Gereffi, 2009). In a case of system transformation led by a group of major purchasers, Fernie et al (2000) report how retailers led the transformation of grocery logistics in the UK through the 1980's and 1990's. Similarly, the transformation of both the UK milk (Dewick and Foster, 2011) and chicken (Yakovleva and Flynn, 2004) supply systems has been led by major buyers and informed by selection pressures, such as regulation, societal pressure, institutional and technological change. In the public sector, Gee and Uyarra (2013) have shown how a major purchaser orchestrated the transformation of an extended system, using its leverage as a major purchaser to co-ordinate the alignment of inter-dependent subsystems and actors.

However, doubt remains about the potential for buyer-led supply-chain and system innovation to go beyond incremental change. Bruce (1999) and Benner & Tushman (2003) found supply-chain collaborations & process improvement techniques like total quality management (TQM) to favour incremental innovation, but to restrain more radical change. In the examples of supply-chain and system innovation cited above, the focal organisation has not operated in isolation; for example the Environmental Defence Fund was involved in McDonalds packaging revision. Further, Pagell and Wu's (2009) exemplar firms engaged in a search for "novel partners to bring new knowledge and opportunities to the whole value chain, while Hartwich et al (2010) found adoption was triggered by a combination of private and public actors' support, as well as information from peers. This suggests that focal organisations may need to work with actors outside the supply-chain to achieve innovation along it, while the conditions under which they can or will invest in more radical change are uncertain.

LIMITATIONS TO THE INFLUENCE OF MAJOR PURCHASERS

Despite their dominant position, large retail organisations may be unwilling or unable to realise supply-chain eco-innovation. A focal organisation's power is moderated by structural, political and commercial factors. For example, a highly fragmented production base may reduce major purchasers' ability to demand and enforce particular standards, and will increase the costs of monitoring. When production is highly fragmented, intermediary firms such as wholesalers or farmer-representative marketing groups can emerge to mediate between primary producers and their customers[1]. The need to act through intermediaries, inevitably having their own interests, can dilute the influence of focal organisations. In some sectors, primary processors occupy pivotal positions that allow them to retain power; for example sugar processors in the sugar supply chain (Cox et al 2002). If we understand power as relational (e.g. Harvey, 2007) then the presence of primary processors in such pivotal positions will affect how, and by how much, focal organisations can stimulate innovation further upstream.

The nature of structural ties may also impede attempts by major purchasers to stimulate upstream eco-innovation. As noted in the previous section, long-term coordinated relationships between buyers and their suppliers are positively associated with innovation. Trust and reciprocity are important for learning and innovation (Child and Faulkner, 1998; Dodgson, 1996), while transactional and distant relationships between actors undermine learning and ultimately impede innovation, particularly when such relationships are mistrustful. Dewick and Foster (2011) describe how retailers developed relationships (including direct contractual links) with dairy farmers in the early 2000's as a means of gaining more direct influence over farmers' behaviour and farm performance.

[1] Cowburn (2003) describes the part played by established intermediaries (auctioneers and wholesalers) in the emergence of an organisation supplying regionally-branded meat in Cumbria.

The state plays a critical role in regulating industrial activity and can create 'landscape pressures' that stimulate and direct innovative activity. The state also influences industrial structure and thus the relative power of focal organisations. Under the Common Agricultural Policy farmers in Europe still receive significant payments from governments. These payments influence farmers' behaviour (Gray, 2000) and some payments are contingent on farmers employing standards of practice established by the state (e.g. for environmental protection). Statutory institutions funded by levies on producers also help to shape food production and processing (Cox et al 2002b). So mechanisms are available through which governments can support eco-innovative activity whilst simultaneously reinforcing existing structures and interdependencies. Further, by providing an income stream separate from that derived from product sales, direct state payments to farmers can dilute the purchasing power of focal organisations.

In addition to industrial structure and the role of government, commercial factors may influence the ability and willingness of focal organisations to stimulate supply-chain innovation. There may, for example, be tensions between patterns of consumption and change in the production system. Access to consumers is the basis of retailers' power, so consumers' behaviours and expectations can temper retailers' scope to control, and force change in, the production base (Foster, McMeekin, Mylan 2012). A retailer's customer base will affect its interactions with its supply chain, notably influencing which themes and initiatives are prioritised. Related to this, the relative utility (Cox et al 2002b), or commercial importance, of different product groups influences the scale of investment by major purchasers in their supply chains. In Cox et al's (2002b) analysis of buyer-supplier power relationships, the ability of a buyer or a supplier to "achieve its aims" is portrayed as "a function of two variables: resource utility and resource scarcity". In the examples given by Crook & Combs (2007), "resources" include products that retailers purchase for resale. Extending this logic, highly traded product lines (relative to the overall product portfolio) or product lines with higher margins are more commercially important to retailers and attract more resources for supply-chain innovation.

RESEARCH QUESTIONS AND METHODOLOGY

Major purchasers act as focal organisations in the food supply chain and exert considerable control over their supply chains, determining how financial, material and human resources are allocated and flow within the chain. In this paper we explore how focal organisations are also stimulating and encouraging the creation and uptake of eco-innovations along the beef supply-chain. We hypothesise that focal organisations *can* stimulate eco-innovation that transforms supply-chain environmental performance, but that they do so only in certain circumstances. We expect focal organisations' willingness and ability to stimulate supply-chain eco-innovation to be influenced by regulatory, commercial and structural factors.

Thus the paper addresses four research questions:

1. How have focal organisations started to organise for supply-chain eco-innovation?
2. What types of eco-innovations are emerging?
3. How does the structure of the supply chain condition these activities?
4. How do factors beyond the supply chain, such as consumer expectations & government policy, shape these activities?

The factors influencing supply chain structure and the implications of this variety on eco-innovation are examined through case studies. The analysis is based on five cases of major retail organisations engaged in activities to promote eco-innovation and the adoption of sustainable practices in beef farming. The five cases are organised into three groups, reflecting differences in the scale of their operations, the relative commercial importance of beef as a product group and the consumer base. Two are among the three largest British supermarkets by sales, where beef is of relatively low commercial importance[2]; two are smaller British supermarkets, where beef is of higher commercial importance; and one is a global food service firm, where beef is of very high commercial (and therefore strategic) importance. The global food service firm has historically been subject to close public scrutiny and has invested heavily in developing a positive corporate reputation. The three groups have similarities within, and variations across, their supply chains. Differentiating between focal organisations in this way enables a fine-grained analysis of variety in supply chain structure (for the same product group) and an analysis of the implications of this variety for supply chain eco-innovation.

To generate the case studies, we undertook 18 semi-structured interviews during 2011 with key actors at a number of trade organisations, primary and secondary processors, supermarkets and food service firms. We also interviewed farm input suppliers and independent experts. Interviewees were asked to identify sustainability initiatives being implemented either at their organisation or in their sector. At the outset, interviewees were not prompted with examples of existing sustainability initiatives, because part of our intention was to understand the range of interpretations of the "sustainability" concept encountered across the industry (see Table 1, p.11, for some examples of such initiatives). They were also asked about relationships between the focal organisations and the supply chain, and about their experiences and opinions of the focal organisations' sustainability-oriented activities. These interviews were informed by prior information-gathering, using academic and grey literature, to form a basic understanding of the systems under study. This understanding encompassed: material/energy flows and their environmental consequences; market and supply-chain

[2] Commercial importance is, for the purposes of this article, a function of the extent to which a particular product contributes to total sales revenue or profits of the firm selling it.

structures; key regulations and regulators; technologies and technological trends; the historical development of the sector; the evolution of key organisations; and their inter-relationships. To overcome possible weaknesses in interview methods, including selective memory, retrospective bias, positive emphasis and exaggeration of change, further secondary research was undertaken after interview to validate the interviews and compile the cases (Yin, 2003). This involved, for example, reading material mentioned to us by interviewees as published on the internet, or checking the reported activities of organisations that interviewees said were delivering programmes on their behalf. In the following section we provide an overview of the UK beef sector, before introducing the case studies.

THE UK BEEF SECTOR

INDUSTRIAL STRUCTURE

Approximately 1million tonnes of beef and veal were consumed in 2008 in the UK, although household consumption of beef has declined over the long term (Defra, 2010 a,b). Consumers are regarded as price-sensitive and fickle buyers of red meat (Mintel 2011). Over 80% of the meat sold to consumers after butchering alone (i.e. as joints, steaks, minced beef, etc.) passes through supermarkets (Keynote, 2009). A volume similar to this is processed into other products (burgers, ready meals, etc.) sold by both retailers and foodservice outlets. The largest foodservice businesses demand significant volumes of beef, one large burger chain taking around 40,000 tonnes annually. Three-quarters of the beef consumed in the UK is domestically-produced.

Figure 1 provides an overview of material flows and key actors in the UK beef sector. This provides an important context for the finer-grained analysis of FO-specific value chains presented later in this paper.

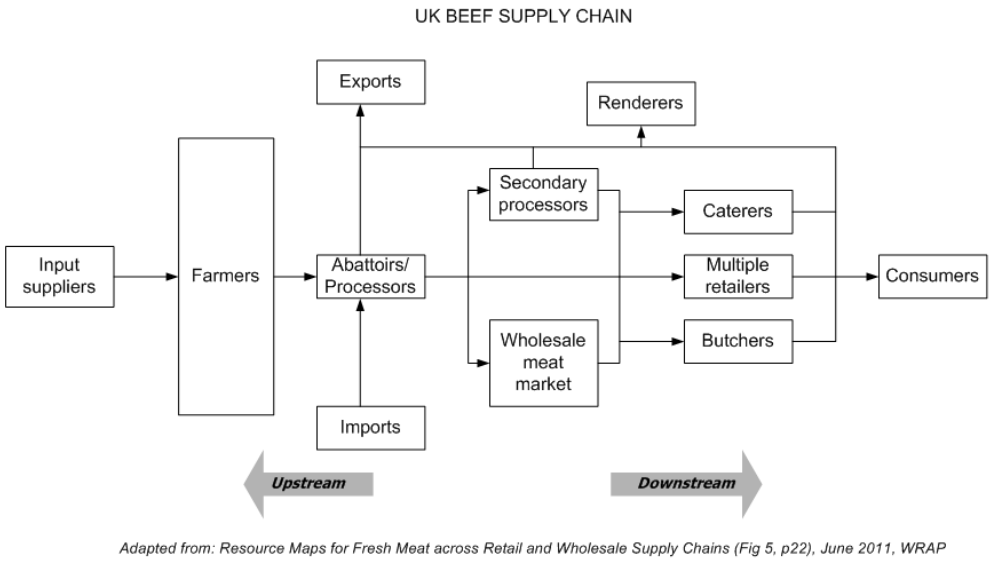

Figure 1. General Structure of the UK Beef System

Some important general features of the sector are:

- a wide and diverse production base. The UK has the second largest beef herd in the EU; over half of UK farms are livestock farms, most are small (rearing on average 12 cows per farm) and there were 70,000 beef producers in the UK in 1998 (Fearne, 1998).
- low profitability in this production base. Unit production costs often exceed farm gate prices. Therefore other sources of income (many beef-cattle farmers are part-time) and agricultural subsidies under the CAP are important. The latter can constitute >50% of total income for beef farmers, particularly on upland farms (Farm Business Survey, 2013).
- low levels of trust between actors. There is a history of frequent animal trading among beef-cattle farmers and of processors purchasing through spot markets. Around 40% of beef cattle were still sold through traditional live ring auctions in 1998, although this system was already in decline (Fearne, 1998). Contracts between farmers and buyers of cattle are correspondingly rare, with the beef industry characterised by adversarial trading relationships, a commodity culture (Simons et, al, 2003; Francis, 2004) and short-term, relatively opportunistic relationships (Cox and Chicksand, 2007). Many interviewees confirmed that widespread mutual mistrust between actors persists, even though auction trading has declined further following BSE and Foot & Mouth episodes more than a decade ago.
- primary processors play a pivotal role. As well as sourcing and processing animals, they allocate the different parts of a carcass between different end uses and customers. Primary processing is relatively concentrated: only a few primary processors have sufficient capacity to supply the volumes required by major retail businesses. Retailers' technical standards coupled with the need to establish a supply base that can service the pattern of demand bring considerable switching costs, which in turn encourage relatively durable relationships between retailers and primary beef processors (for other examples see Hingley, 2005; Lowe and Gereffi, 2009). Close, stable relationships between processors and major buyers can nevertheless be expected to be mistrustful and adversarial.

Three types of actor important to this paper are not shown in Figure 1, viz.:

- *Marketing groups.* Intermediaries (sometimes co-operatives) that arrange the sale of beef cattle from groups of farmers. Some marketing groups co-ordinate contract farming, which in its most developed form involves the marketing group supplying calves and other inputs purchased at scale to farmers who raise the animals following a prescribed set of practices. Blade Farming (http://www.blade-farming.com) is a prominent example of this type of organisation.
- *Farm assurance schemes.* Each of the various extant schemes imposes its own set of criteria to ensure that farmers enact adequate production standards. The criteria encompass animal welfare, environmental protection and other elements of good

agricultural practice to varying degrees, with regulatory compliance the common minimum requirement. Large purchasers may operate their own farm assurance schemes (i.e. impose their own production standards) or accept compliance with third-party schemes.

- *Farm advisors and agricultural consultants* provide specialist expertise to farmers. They may be contracted to government, retail organisations or processors to deliver specific programmes of farm support/advice.

To summarise, in the UK beef is commoditised, despite efforts to add value based on national and regional identity. Highly fragmented farm producers have little economic power; they rely on retailers for market access and the state for their continued viability. Of the five types of buyer-led value chain described by Gereffi, the UK beef sector most resembles a 'captive' value chain, where small suppliers are dependent on a few, powerful buyers. There are nevertheless some similarities with 'relational' value chains, which feature mutual reliance, notably in the factors that tie retailers (i.e. focal organisations) and processors together. In 'captive' chains, the buyer undertakes a high degree of control and monitoring. However, the need for co-ordination of a secure, continuous, high-volume supply of meat from numerous small producers of carcasses limits retailers' power over the UK beef chain. The relatively concentrated primary processors (abattoirs) thus act as a fulcrum in the supply chain, controlling retailer access to the production base.

The analysis in this paper extends the focus, common in value chain research, on governance and the organisation of industries by lead firms. A fine-grained study of supply chain variety within the UK beef value chain reveals how this variety influences the organisation of sustainability initiatives.

SUSTAINABILITY AND THE BEEF SECTOR

The resource and environmental implications of livestock-rearing are well-documented. Pimentel and Pimentel (1979) drew early attention to the relatively high energy intensity of meat production, while more recently Steinfeld et al (2006) quantified livestock's role in biodiversity reduction, rising atmospheric greenhouse gas concentrations, water pollution and water resource depletion. Mitigating factors have also been noted; Garnett (2010) points out that all food production affects the environment in some way and that pasture land stores carbon. Tudge (2010) reminds us that herbivores (principally cattle and sheep in Western Europe) were traditionally used to produce food from land unfit for crop-growing and to return fertility to arable fields; upland grazing still supports many beef cattle in the UK. Nevertheless, life cycle assessment (LCA) studies (e.g. Williams et al 2006) show that beef is highly environmentally-intensive and that changing the production method has rather small effects on many of its impacts. Furthermore, both LCAs and other research suggest that changes in the production system lead to reductions in some impacts but increases in others. For example Evans *et al* (2003) argue that a reduction in beef producers (i.e. economic concentration in the sector) will have a negative effect on biodiversity, while

Williams et al (2009) note the pressure on rainforest lands associated with marginal expansion of beef production in Brazil.

Diverse policy, technical and management options are available to address the environmental challenges of livestock production (see, for example, Steinfeld et al, 2006; Garnett, 2007). Many involve innovation at the agricultural end of the value-chain; Table 1 contains a few examples classified as radical or incremental, process or product-oriented to reflect the discussion in Sections 2.2 and 5.

Table 1. Sustainability Initiatives in the Beef System Involving Innovation

	More incremental: mainly supported by demonstration & dissemination	*More radical: mainly supported by knowledge creation activities*
Process	Precision grassland farming Feed regime optimisation Emission-reducing feed additives	Novel grass varieties Intensification
Product	Feeding and husbandry to optimise lean weight gain Cattle breeds optimised for feed conversion to lean meat	Genetically-modified cattle Lab-cultured meat

EU farm policy has both social and environmental aims, while stakeholder-led initiatives in the beef system are numerous and varied in their objectives. Trade organisations and NGO initiatives also influence which eco-innovations are taken up. Focal organisations themselves are under pressure to become more "sustainable" and their interpretation of the concept is shaped by the broader selection pressures acting on them.

RETAIL ORGANISATIONS AND SUSTAINABILITY IN BEEF FARMING

This section describes how five focal organisations engage in eco-innovation along their beef supply chains. We segregate these major beef retailers into three groups as described in the methodology; a global foodservice chain; two small-medium sized retailers and two large retailers. The two key criteria informing these groupings are the scale of members' demand for beef and the relative commercial importance of beef in their product portfolios. Sales volume and beef market share were used as indicators of the scale of demand, supplemented by figures on tonnage used where these were available. As indicators of commercial importance we used proportion of the organisation's sales attributable to beef products and market share of the category relative to overall food market share. Sources of this information included Mintel (2012) and the interviewees themselves. The differences between the groups based on these criteria are summarised in Figure 2.

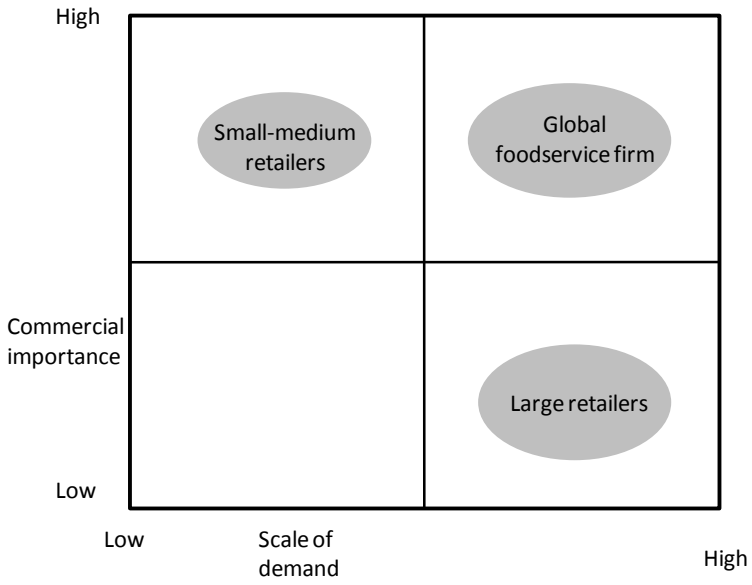

Figure 2: Characteristics of case study beef retailing organisations

The remainder of this section presents empirical data on the structural differences between the supply-chains of these three groups and the ways in which they are organising for supply chain eco-innovation. In the following discussion (Section 6), we consider how supply chain structure conditions the eco-innovative activities, and how these activities are influenced by external factors, such as consumer expectations & government policy.

SUPPLY CHAIN STRUCTURES

A. GLOBAL FOODSERVICE FIRM

A single, dedicated beef pattie supplier mediates supply to this focal organisation, purchasing forequarter and flank from abattoirs and processing it into beef patties for sale to the foodservice firm. The relationship between the focal organisation and this first-tier supplier is exclusive and long-term although there is no co-ownership and no formal contract between the two firms (interviewee, 2011). The pattie supplier actively sources meat from 27 selected, approved abattoirs owned by 12 different companies and claims never to buy from spot markets. The pattie supplier recognises the pivotal role of abattoirs (primary processors), describing them as the "fulcrum of the supply chain" (interviewee, 2011). The abattoir's role is to supply the quantity and quality demanded by the pattie supplier. Farmers have no formal contract with the foodservice firm, the pattie supplier or the abattoir. Despite a lack of formal contracts, the foodservice firm focuses on long-term relationships and seldom changes its first-tier suppliers. One interviewee at the foodservice firm argued that it wants suppliers to make long term investments (5-10 years) in their businesses and continue to supply it, i.e. the firm aims to build loyalty to ensure supply continuity. In practice the foodservice firm's closest ties are with the downstream end of its supply-chain, in particular first-tier suppliers, not the highly distributed cattle-farming base.

In 2011, the foodservice firm's UK business purchased beef from over 16,000 farmers, at an average rate of 7,000 head of cattle per week. Carcass provenance is recorded and the pattie supplier records which farm assurance scheme applies to each carcass from which it takes meat. Monitoring is stringent and undertaken by the pattie supplier on behalf of the focal organisation. The focal organisation is committed to local sourcing; since 1990, its UK arm has sourced beef entirely from British and Irish farmers except for a short period during the BSE crisis (interviewee, 2011). The high volume required presents a major challenge in terms of securing continual local supply from a highly dispersed production base.

B. SMALL-MEDIUM RETAILERS

Both the smaller retailers have close links with the primary processors serving them. One retailer owns the primary processor while the other uses one dedicated processor and approximately 10 additional processors. Neither retailer buys (directly or indirectly through processors) from spot markets. As the preferred buyers of beef in the UK (from a farmer's perspective), the smaller retailers are more likely to have direct, longer term relationships with farmers (e.g. Fearne, 1998a). To ensure security of supply one of the smaller retailers pays famers a premium for cattle of a certain specification. One requires farmers to join its livestock producer club in order to sell to it at all, effectively bounding its production base. This producer club has operated for 20 years and there is a waiting list of farmers wanting to join it. Overall, the supply chains of the smaller retailers are the most integrated of the three groups. This structure facilitates communication and enables cooperation with both the processors and producers. Each of the firms (as well as external experts & trade group representatives) attests that its supply chain structure confers competitive advantage, demonstrates commitment to and builds trust with producers, and enables improvement in beef quality through more direct communication.

The scale of beef demand from the smaller retailers is considerably less than that of the foodservice firm or the large retailers. These two firms accounted for 15.5% of consumer spending on meat and fish in 2009 & 2010, while the three largest food retailers in the UK accounted for 50% (Mintel, 2012). Each smaller retailer is strongly connected to a particular demographic, which influences its offering and sales. For example the smallest retailer sells much less mince (the lowest-priced beef meat, often sold at promotional prices) than the national average, purchases a third of all the UK's organic beef and has a local sourcing strategy. Both of the smaller retailers emphasise beef quality as a unique selling point. Like the foodservice firm both buy only British beef, but unlike the foodservice firm or larger retailers, they purchase whole carcasses from farmers rather than 'cuts' from processors.

C. LARGE RETAILERS

Primary processors play a key role in co-ordinating a continuous supply of beef cuts for the large retailers. One large retailer sources beef from over 14,000 farmers (interviewee, 2011), with no single farmer supplying more than 80 cattle. Primary

processors purchase from farmers directly and through auctions. Farmers have contracts with neither the large retailers nor the processors. However, marketing groups also co-ordinate beef supply through contract farming arrangements (particularly of bull calves from dairy herds). Arrangements for sourcing cattle in large retailers' supply chains are more flexible than those of the previous two groups and the number of intermediary organisations greater.

Supply arrangements between primary processors and large retailers are also more flexible than for the other two groups. For example, retailer future spend is distributed between approved processors on a quarterly basis according to price criteria. This practice reflects the transactional and commodity-based culture of the larger retailers. However, total flexibility of supply is constrained by technical requirements, such as food safety and quality assurance systems, which differ between retailers. Few processors or individual abattoirs can serve more than one major retailer at a time as a result. Monitoring systems partially lock in processor-retailer relationships, yet these relationships are observed to be more adversarial than in the other groups.

The volume of beef demanded by the larger retailers is three times that taken by the smaller retailers. Each large retailer serves a wide cross-section of consumers, but price and "value" are major elements of the competition for food market share between these firms; as Mintel (2011) states, "price and promotions play a major role in dictating consumer choice of protein". The larger retailers do not commit to sourcing only British beef and have the flexibility to meet demand through imports. The proportion of British beef sold varies; in 2009 one of the large retailers sourced approximately 60% British beef whereas another reported selling 95% British beef (National Beef Association, 2009; HoC, 2009).

ORGANISING FOR SUPPLY CHAIN ECO-INNOVATION

A. GLOBAL FOODSERVICE FIRM

The foodservice firm's sustainability initiatives appear to be comprehensive and strategically linked. Like the smallest retailer in this study (discussed later), it publishes a broad definition of sustainability. This was initially developed in 2006 through a multi-stakeholder consultation process (interviewee, 2011). The consultation identified a broad landscape of issues, subsequently narrowed through the lens of the firm's product portfolio to reach an operational definition. According to a livestock industry consultant, the foodservice firm studied is the only one actively pursuing the sustainability agenda. The resource committed to defining sustainability supports this view.

The foodservice firm engages in knowledge creation activities through partnership programmes. For example it sponsors agricultural R&D through the Farm Animal Initiative (FAI), while a senior firm representative chairs the Sustainable Agriculture Initiative (SAI) Platform's Beef Working Group. The foodservice firm also engages in

demonstration activities. For example, in a four-year project run in conjunction with the FAI, a small number of European supplier farms (initially 7, currently 15 of which 3 are beef producers) are promoted as best practice case studies, highlighting benefits from techniques such as soil monitoring for more precise fertiliser application. Attention is given to affordability of measures and return on investment for suppliers to incentivise the uptake of practices.

Finally, three strands of dissemination activity are identifiable. One strand uses the common mechanism of a producer "club" and is administered by abattoirs. In 2009, the firm began a three year project in which a consultancy calculates carbon footprints for 350 beef farms in the UK and Ireland. This data is being used to identify and prioritise sustainable practices for wider uptake. By way of comparison, Tesco, the UK's largest food retailer, has a programme of carbon footprinting covering 400 of its contracted farm suppliers of liquid milk: a strategically important product for the large retailers. A second strand of dissemination is the pattie supplier's environmental supply-chain improvement work with processors, encouraging implementation of formal environmental management systems. The third dissemination strand is perhaps more distinctive. Practice and performance of the demonstration farms, and targets generated from its sustainability definition, inform the foodservice firm's agricultural standards, which encompass quality, safety and environmental issues. The firm has assessed over 300 farm assurance schemes, rating each on the extent to which its criteria match the company's own agricultural standards. The extent of compliance with these can thus be monitored in terms of supplying farms' compliance with the various farm assurance schemes. The pattie supplier collects and collates this data, while the foodservice firm sets a target for overall compliance and lobbies to shift farm assurance schemes' criteria closer to its own agricultural standards. Since supplying farms must comply with one or other farm assurance schemes, this represents a mechanism for improving the performance of a broad and fragmented production base.

B. SMALL AND MEDIUM RETAILERS

The smaller retailers' sustainability initiatives are both strategically linked but differ in their breadth. The smallest retailer's sustainability strategy has been administered for longer than those of the other retailers. Drawing, like the foodservice firm, on wider expertise and external legitimacy this firm uses standards developed by an independent charity. This charity operates a sustainability assurance scheme with a wide, primarily environmental, remit ranging from wildlife protection, fertiliser reduction, recycling and water efficiency. This retailer promotes a relatively broad interpretation of beef sustainability that encompasses grazing, nutrition, biodiversity, farm business health and native breed genetics (FWI, 2008; Scottish Government, 2009). The larger of these two firms historically had a less clearly defined definition of sustainability; its 2007 CSR report, for example, focused on the development of local supplying farms. Its sustainability-oriented initiatives focus on feed conversion efficiency, improving yield while reducing inputs, genetics and GHG emissions, all closely-related to farm business

efficiency. This firm's highest-profile beef supply initiative is collaboration with a 200-farmer owned marketing group to develop a breed that converts feed to lean meat more efficiently.

Both firms in this group engage in activities of all three types noted for the foodservice firm. However, the approaches and scales are rather different. The smallest retailer funds a University Chair in Sustainable Agriculture, focused on grassland-related research. Both retailers also engage in farm best practice demonstration, with the larger one operating a research and demonstration farm in a joint venture with the Scottish Agricultural College (SAC) and 6-10 farmers. Reflecting strong differences between the two firms' approach to organising for eco-innovation, the larger of them has no formal producer group, whereas the smaller one requires all supplying farms in the UK to join its producer club, making it the most extensive operated by any of the retailers studied.

C. LARGE RETAILERS

Both of the large retailers consulted prioritise *economic* sustainability at the farm level, i.e. business efficiency for continuing economic viability. This position reflects the volumes of beef demanded, concerns over medium-term security of supply and the dominant commodity culture. A broader interpretation of sustainability and a role for external bodies in defining 'sustainable farming' are not evident in these cases.

These two firms also differ in their engagement with, and organisation of, supply chain eco-innovation. At one, previous best practice demonstration activities appear to have stopped entirely. The other has a more strategic approach and engages in some sustainability activities. However, a global corporate remit has focused work on reducing GHG emissions associated with beef production in major exporting countries like Brazil, so there is limited activity at UK level. Development groups (involving a small number of 'best practice' farmers) are or have been used for best practice demonstration, while producer clubs (with more members than development groups) aid dissemination. Joining either is optional for producers, and membership levels are difficult to gauge accurately. Group purchasing is used to engage input suppliers to some degree, and to lower the costs to farmers of implementing best practices; examples include group buying of subsidised semen and newer grass varieties. This is the only regular engagement of input suppliers with retailers' sustainability programmes found in this research.

These large retailers rely more heavily than the smaller ones on intermediary firms to deliver sustainability initiatives in the beef chain; interviews and grey literature reveal that large marketing groups, farm advisors and primary processors all play active roles, with the last group also running their own initiatives. There is a marked contrast with sustainability initiatives in the liquid milk chain, where the largest UK retailers have made significant financial and resource investments (Dewick & Foster 2011). But while the foodservice firm also displays this reliance on intermediaries, we found no evidence that the large retailers monitor sustainability performance in their supply bases at all as

intensively as it does. This suggests that the relative commercial importance of the product group affects the nature of supply-chain eco-innovation activities, even when large scale demand draws on a fragmented production base, creating security of supply issues.

DISCUSSION

The discussion is organised into two sub-sections that refer to the different questions posed at the beginning of Section 3. The first sub-section considers the influence of supply-chain structure on the ways in which the different focal organisations have started to organise for supply chain eco-innovation and the eco-innovations emerging, while the second focuses on the influence of factors beyond the supply chain, such as commercial priorities and sustainability framings on these activities.

Supply chain structure & eco-innovation

The focal organisations with more integrated beef supply chains have more active supply chain sustainability initiatives. The smallest retailer with the most integrated supply chain has developed collaborative relationships with farmers as well as processors to improve overall (including environmental) performance along the chain. A high degree of integration is easier to achieve with a smaller production base. However, the larger foodservice firm – with demand commensurate to that of the larger retailers - is served by a large primary production base but a single (closely aligned) secondary processor. This processor co-ordinates a sustainability programme for the large foodservice firm, which specifies its technical details closely. The foodservice firm also acts through farm assurance scheme operators, seeking leverage on a very wide and remote farm supply base using a secondary mechanism not employed by the supermarkets. Assurance schemes are an additional mechanism for focal organisations to influence farmers without establishing direct collaborative relationships. Although the success of this mechanism is not yet clear (the foodservice firm claims considerable progress but does not disclose details), certification is used in several agri-food systems as a supply-chain engagement mechanism (e.g. Styles et al, 2012). Like Pagell & Wu's (2009) exemplar firms, the foodservice firm and the smallest retailer place the strongest emphasis on supply-base stability and are most engaged in knowledge creation activities. We extend Pagell and Wu's reasoning to suggest that not only does new knowledge bring new opportunities to the value chain, it is essential for eco-innovation that takes performance beyond the limits of current practice. The foodservice firm's investment in monitoring its beef supply and producer performance differentiates it from the largest retailers.

However, the highly fragmented production base seems to limit each focal organisations' ability to engage upstream actors, such as input suppliers, in their proprietary supply-chain eco-innovation activities. Farmers innovate on the basis of information from many sources (e.g. Hartwich, 2010) and the absence of input suppliers

from focal organisation-led schemes may limit innovative activity in the production base. The role of external organisations in supporting focal organisation-driven supply chain eco-innovation is a strong theme in the empirical cases and is supported in the literature (e.g. Lowe and Gereffi, 2009). Conversely, intermediary organisations can serve as structural barriers. Primary beef processors act as intermediaries in the supply chain and seek to extract value from the chain (e.g. Cox et al, 2002; Gereffi and Lowe, 2009). Their position gives them 'co-ordinating power' that tempers the economic power of the major buyers. Similarly, the larger and more diverse the supply base in the beef sector the harder it is for focal organisations to overcome historical structures, circumvent intermediaries and engage in collaborative innovation processes. Contract farming (see p.9) represents an indirect mechanism through which focal organisation can influence farmers, but again gives strong co-ordinating power to intermediaries. The co-ordinating power of the primary processors reflects the retailers' reliance on them to organise supply and also their emergence as the practical implementing agents of focal organisations' sustainability initiatives. The smaller retailers circumvent these barriers by vertically integrating with primary processors (through ownership or dedicated relationships). Similarly, the foodservice firm maintains a long-term mutually interdependent relationship with its sole pattie supplier. These mechanisms for supply-chain integration increase major purchasers' control over both provision and upstream eco-innovation.

Commercial priorities, sustainability framings & eco-innovation

The level of commitment by a focal organisation to supply-chain sustainability initiatives reflects the relative commercial importance or resource utility (Cox et al, 2002) of the product. A useful indicator of this commitment is the longevity and breadth of the sustainability programmes. The smallest retailer overtrades in beef (relative to their overall product portfolio) and beef is of high commercial importance (Crook and Combs, 2007) to the foodservice firm (comprising $\simeq$50% of their product offering). These are the two focal organisations with the broadest and most comprehensive definitions of sustainability, in both cases developed with wider stakeholder input. Economic sustainability is one factor in these comprehensive, strategic-level framings that aligns with longer-term, multifaceted, sustainability programmes in beef supply systems. Conversely, the larger retailers focus almost entirely on economic sustainability, linking this to resource efficient production and thence to greenhouse gas emissions. This focus derives from a framing of "sustainability" grounded in the low profitability of the sector, its low level of industrialisation (in comparison to poultry and pork), and the price sensitivity of consumers. This link between economic and environmental sustainability is also found in the national industry body's initiative (EBLEX, 2009a, b). The larger retailers commit fewer resources to supply chain sustainability initiatives and their sustainability programmes in beef are less well established than those of the smaller retailers or the foodservice firm. The largest retailer studied engages the least with its beef supply-chain over sustainability; this contrasts sharply with very active engagement with its

milk supply chain, which includes funding for a university-based dairy R&D programme (Dewick and Foster, 2011). Liquid milk is a 'destination category' and the single biggest selling food item for UK supermarkets, and therefore of high commercial importance to the larger retailers. Overall, our research supports findings of Styles et al's (2012) survey: large retailers are less proactive than specialist and co-operative retailers, and the most proactive firms use certification schemes and engage in R&D.

Even when beef is a commercial priority for a focal organisation, its sustainability initiatives are more oriented towards incremental innovations and diffusing best practice than knowledge creation or radical innovation (confirming Bruce, 1999; Benner & Tushman, 2003). All retailers encourage use of dairy calves for beef production to reduce GHG emissions, as well as to avoid culling. Little of the reported eco-innovative activity involves development relating to fertiliser or feed inputs. The absence of retailer engagement in more radical innovations could indicate that selection pressures remain weak in the beef sector, or that signals from different actors with power in the beef system (for example policymakers, retailers, processors) are in conflict. In the smallest retailer's case, we conjecture that the broader approach to sustainability and emphasis on biodiversity – an issue not immediately connected to production costs – may partly reflect the interests of this firm's customer base, its founding principles and its lower price-sensitivity. For the large foodservice firm, this broader definition is influenced by the critical commercial importance of beef.

Overall, the empirical cases reveal significant variety within buyer-driven value chains in the UK beef sector. They show that both supply chain structure and the relative commercial importance of beef to a focal organisation influence the type and organisation of supply chain eco-innovation pursued. But other factors such as government policy, firm strategy and consumer expectations also play a role.

CONCLUSIONS

This paper has differentiated between major purchasers of beef (referred to as focal organisations due to their powerful position in the supply chain) to demonstrate variety in the structure of buyer-driven commodity chains. On the basis of this fine-grained analysis we identified factors informing supply-chain structure and examined how supply-chain variety affects demand-led sustainability initiatives (i.e. supply-chain eco-innovation). We explored the ways in which focal organisations have started to organise for supply chain eco-innovation and the types of eco-innovations emerging from their initiatives, focusing on how supply chain structure conditions these activities and the influence of factors beyond the supply chain, such as commercial priorities, different framings of sustainability and, to a lesser extent, government policy. Three main conclusions are drawn:

Firstly, pressure on firms to pursue more sustainable production and consumption practices is articulated by government policy and the consumer base. Although

common ‘landscape’ pressures are felt by all of the focal organisations in the empirical cases, significant variety is observed in their response. Supply-chains tend to be more integrated and demand-led supply-chain sustainability initiatives more multi-faceted and long standing when beef is a commercially important product. This suggests that the relative commercial importance of beef in the overall product portfolio affects the incentives of large purchasers to pursue upstream eco-innovation. Incentives are also affected by the market positioning of the firm, probably reflecting different interpretations of "sustainability" by different segments of the consumer base. In all cases, retailer-led initiatives focus on incremental rather than radical innovation, reflecting the interests of the dominant firms.

Secondly, the scale of demand and the quality of supply-chain relationships affects the nature of retailers' initiatives, well as their ability to pursue them. Longer-term and closer relationships support collaboration and learning, and are positively associated with innovation. Processors act as a fulcrum in the supply-chain mediating between supply and demand. Focal organisation-led sustainability initiatives are often coordinated by primary processors (abattoirs) and close interaction between major buyers and their processors supports the implementation of schemes. Pursuing this in practice is easier for the smaller retailers, as the large scale of demand limits opportunities for upstream supply chain integration by the largest retailers. The larger retailers use indirect mechanisms (such as assurance schemes and standards) to improve production practices. However, they are also less likely to be actively pursuing upstream eco-innovation, and have less direct control over provision generally. The case of the foodservice firm suggests that a high level of monitoring is possible even if the volume demanded is very high, and that indirect mechanisms can be effective if sufficient resources are deployed.

Finally, the largest retailers, despite having very considerable purchasing power, rely on the co-ordinating power of the primary processors to implement supply-chain improvement programmes. From this we conclude that not only do key leverage points exist in value chains at which actors have the potential to effect industry wide change, but that both co-ordinating power and purchasing power are needed at that point to effect change. In the UK beef system retailers' purchasing power is diluted by farmers’ non-product income (e.g. CAP payments), which may further restrict retailers' ability to effect change in the system. External actors play an important role in developing comprehensive definitions of sustainability and supporting knowledge-creation and dissemination activities. Further work could explore the importance of either co-ordinating power or purchasing power in engaging external actors with supply-chains.

The empirical evidence supports the hypotheses that supply chain structure affects the nature of demand-led sustainability initiatives along supply chains, and the organisation of these activities. There is also little incentive for focal organisations to sustainability initiatives that do not enhance or maintain profitability. In aggregate, this analysis extends the concept buyer-driven commodity chains, demonstrating the variety of value

chains within a single product group and providing evidence for the need to incorporate commercial, market and policy factors in any analysis of the governance of whole-chain eco-innovation.

BIBLIOGRAPHY

Audsley, E., Brander, M., Chatterton, J., Murphy-Bokern, D., Webster, C., and Williams, A. (2009). How low can we go? An assessment of greenhouse gas emissions from the UK food system and the scope to reduce them by 2050. *FCRN-WWF-U*

Benner, M.J. and Tushman, M.L. (2003) Exploitation, Exploration, and Process Management: The Productivity Dilemma Revisited, The Academy of Management Review, Vol. 28 (2) 238-256.

Bruce, M. (1999) Dangerous Liaisons: An Application of Supply Chain Modelling for Studying Innovation within the UK Clothing Industry. *Technology Analysis & Strategic Management*, Vol. 11(1), 113-125.

Burch, D. and Lawrence, G. (2005) Supermarket Own Brands, Supply Chains and the Transformation of the Agri-food System, *International Journal of Sociology of Agriculture and Food*, Vol. 13(1), 1-28.

Burch, D. and Lawrence, G. (2007) *Supermarkets and Agri-food Supply Chains: Transformations in the Production and Consumption of Foods*, Edward Elgar, UK

Busch, L. and Bain, C. (2004) New! Improved? The transformation of the global agrifood system, *Rural Sociology*, 69, (3), 321-346.

Carrillo-Hermosilla, J., del Río, P., Könnölä, T. (2010) Diversity of eco-innovations: Reflections from selected case studies, *Journal of Cleaner Production*, 18, 1073-1083.

Child, J. and Faulkner, D. (1998) Strategies of Cooperation; Managing Alliances, Networks and Joint Ventures, Oxford University Press.

Cowburn, G. (2003) Background: Fellbred brand celebrates pedigree. Westmorland Gazette, 4th July 2003. Available at: http://www.thewestmorlandgazette.co.uk/news/389394.Background__Fellbred_brand_celebrates_pedigree/. Last accessed 14th May 2013.

Cox, A. and Chicksand, D. (2007) Are win-wins feasible? Power Relationships in Agri-food Supply Chains and Markets, in Burch, D. and Lawrence, G. (2007) *Supermarkets and Agri-food Supply Chains; Transformations in the Production and Consumption of Foods*, Edward Elgar; Cheltenham, UK., p74-99.

Cox, A. Ireland, P., Lonsdale, C., Sanderson, J. and Watson, G. (2002) *Supply Chains, Markets and Power: mapping buyer and supplier power regimes*, Routledge.

Crook, T.R., Combs J.G. (2007). Sources and consequences of bargaining power in supply chains, *Journal of Operations Management,* 25, 546–555

Defra (2010a) Adjusted National Food Survey data 1974 to 2000, Expenditure and Food Survey 2001-02 to 2007, and Living Costs and Food Survey 2008 onwards. *Defra Food Statistics.*

Defra (2010b) UK production and supply of beef and veal, 1985-2009, *Defra Food Statistics*.

Dewick, P. and Foster, C. (2011) Focal actors and eco–innovation in production-distribution systems, paper presented to the *DRUID Society Conference*, Copenhagen, June.

Dodgson, M. (1996) 'Learning, Trust and Inter-firm Technological Linkages: Some Theoretical Associations', in R. Coombs A. Richards, P. Saviotti and V. Walsh (eds.), *Technological Collaboration: The Dynamics of Cooperation and Industrial Innovation*, Cheltenham: Edward Elgar.

EBLEX (2009a) Change in the air: Beef and Sheep Production Roadmap Phase 1. *English Beef and Lamb Executive, Agriculture and Horticulture Development Board,* Kenilworth.

EBLEX (2009b) Testing the water: Beef and Sheep Production Roadmap Phase 2. *English Beef and Lamb Executive, Agriculture and Horticulture Development Board*, Kenilworth.

European Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources. Brussels, 1991.

European Commission (2012) *The History of the CAP*, http://ec.europa.eu/agriculture/cap-history/index_en.htm; Published April 212, last accessed 2nd April 2013.

Farm Business Survey (2013) drawn from Farm Business Survey Region Reports, amalgamated data from livestock farms. At http://www.farmbusinesssurvey.co.uk/index.html Last accessed 2nd April 2013 .

Fearne, A. (1998) The evolution of partnerships in the meat supply chain: insights from the British beef industry, *Supply Chain Management*, Vol. 3 (4), 214-231.

Fernie, J., Pfab, F., Marchant, C. (2000) Retail grocery logistics in the UK .International Journal of Logistics Management; 11, 2; pp83-90.

Foster C., McMeekin A., Mylan J. (2012) The entanglement of consumer expectations and (eco) innovation sequences: the case of orange juice, *Technology Analysis & Strategic Management*, Vol. 24, 391 – 405.

Francis, M. (2004) Application of the Food Value Chain Analysis Method in the UK Red Meat Industry, paper presented at the *9th ISL, Bangalore*, India.

Francis, M., Simons, D. and Bourlakis, M. (2008) Value chain analysis in the UK beef foodservice sector, *Supply Chain Management*, 13, 1, p83-91

FWI (2008) Waitrose asks for greater use of native genetics, *Farmers Weekly Interactive*, 25th January. At http://www.fwi.co.uk/articles/25/01/2008/109144/waitrose-asks-for-greater-use-of-native-genetics.htm Last downloaded 17th April 2013.

Garnett, T. (2007) Meat and dairy production & consumption: exploring the livestock sector's contribution to the UK's greenhouse gas emissions and assessing what less greenhouse gas intensive systems of production and consumption might look like. *Food Climate Research Network Working Paper*. November, University of Surrey.

Garnett, T. (2010) Livestock and Climate Change in D'Silva, J. & Webster, J. *The Meat Crisis*. Earthscan, London.

Gee, S. and Uyarra, E. (in press) A role for public procurement in system innovation: The transformation of the Greater Manchester (UK) waste system, *Technology Analysis & Strategic Management*.

Gray, J. (2000). The Common Agricultural Policy and the Re-invention of the Rural in the European Community. *Sociologica Ruralis*, 40, 30-52.

Gereffi, G. (1994) The organisation of buyer-driven commodity chains: how US retailers shape overseas production networks, in Gereffi, G. and Koreniewicz, M.(eds)*, Commodity chains and global capitalism,* Westport, CT*:* Praeger, 95-122.

Gereffi, G., Humphrey, J. And Sturgeon, T. (2005) The governance of global value chains, *Review of International Political Economy,* 12:1, 78–104.

Gereffi, G. and Fernandez-Stark, K. (2011) Global Value Chain Analysis: A primer, *Centre on Globalization, Governance & Competitiveness (CGGC)*, Duke University, Durham, North Carolina, USA, May 31st.

Green, K. & Foster, C. (2002) Environmental innovation in industry: the importance of environmentally-driven users, *Int. J. Environmental Technology and Management*, Vol.2 (4), 303-314.

Government Office for Science (2011) *Foresight: The Future of Food and Farming*, Final Project Report, London.

Harvey, M. (2002) Markets, supermarkets and the macro-social shaping of demand: An insitutued economic process approach, in. McMeekin, A., Green, K., Tomlinson, M. and Walsh, V. (eds) *Innovation by Demand: An Interdiscipliary Apporach to the Study of Demand and its Role in Innovation,* Manchester University Press, 187-207.

Harvey, M. (2007) Supermarkets and asymmetries of economic power, in Burch, D. and Lawrence, G. (eds) *Supermarkets and Agri-food Supply Chains: Transformations in the Production and Consumption of Foods*, Edward Elgar, UK, 51-73.

Hartwich, F., Fromm, I., Romero, G. (2010) Innovation Trajectories in Honduras' Coffee Value Chain. Public and Private Influence on the Use of New Knowledge and Technology among Coffee Growers. *Int. J. Food System Dynamics,* 3, 237-251.

Hingley, M.K (2005) International Journal of Retail & Distribution Management Vol. 33 No. 8, 2005 pp. 551-569 Power imbalanced relationships: cases from UK fresh food supply

HoC, (2009) Securing food supplies up to 2050: the challenges faced by the UK - Environment, Food and Rural Affairs Committee of House of Commons, Memorandum submitted by Tesco (SFS 75); At: http://www.publications.parliament.uk/pa/cm200809/cmselect/cmenvfru/213/9022506.htm Last accessed 17th April 2013

Huber J. (2008) Technological environmental innovations (TEIs) in a chain-analytical and life-cycle-analytical perspective, *Journal of Cleaner Production,* Vol. 16, 1980-1986.

Hughes, A. (1996) Forging new cultures of food retailer-manufacturer relations? In Wrigley, N. and Lowe, M. (eds) *Retailing, Consumption and Capital: Towards the New Retail Geography*, Essex: Longman, 90-115.

Hunt, J. (2011) Native beef is a hit in Booths' stores, *Farmers' Weekly* (online edition) Monday 28 February 2011. At: http://www.fwi.co.uk/Articles/28/02/2011/125713/Native-beef-is-a-hit-in-Booths39-stores.htm

Keynote (2009) *Meat & Meat Products Market Report*, at: http://www.keynote.co.uk/market-intelligence/view/product/10302/meat-%26-meat-products Last accessed 17th April 2013.

Lang, T. and Heasman, M. (2004) *Food Wars, The Global Battle for Mouths, Minds and Markets*. Earthscan, London

Lowe, M. and Gereffi, G. (2009) A Value Chain Analysis of the U.S. Beef and Dairy Industries, Report Prepared for Environmental Defense Fund (EDF), by *Center on Globalization, Governance & Competitiveness*, Duke University, February 16.

Lundvall, B-Å (1988) Innovation as an interactive process –from user-producer interaction to national systems of innovation.In*Technical Change and Economic Theory*, eds G Dosi, CFreeman, R Nelson, G Silverberg and L L G Soete, 349–367. London: Pinter.

Malhotra, A., Majchrzak,A., Carma, R. and Lott, V. (2001) Radical Innovation without Collocation: A Case Study at Boeing-Rocketdyne. *MIS Quarterly,* Vol. 25(2), 229-249.

Marsden, T., Banks, J and Bristow, G. (2000) Food Supply Chain Approaches: Exploring their Role in Rural Development, *SociologicaRuralis*, Vol 40, No 4.

Marsden, T. Lee, R., Flynn, A. and Thankappan, S. (2009) *The New Regulation and Governance of Food: Beyond the Food Crisis*, Section Two) The Operation of the Hybrid Model: The case of Red Meat, Routledge, p182-205.

Mason, R. and Mitroff, I (1981) *Challenging strategic planning assumptions*, John Wiley and Sons, New York, P324.

Mintel, 2011 Meat, Poultry and Fish - UK - October 2011 *MINTEL*

Mintel 2012 The Retailing of Food and Drink - UK - March 2012, *MINTEL*

National Beef Association (2009) Press Release - Cheaper imports from the Republic of Ireland are making life difficult for UK beef farmers, *National Beef Association*, 18th March. At: **h**ttp://www.nationalbeefassociation.com/news_details.php?RegionID=1&NewsID=204 / additional information from http://www.tracingpaper.org.uk/2009/03/20/supermarket-beef-sourcing/ Last accessed 17th April 2013.

Pagell, M. and Wu, Z. (2009) Building a More Complete Theory of Sustainable Supply Chain Management Using Case Studies of 10 Exemplars. *Journal of Supply Chain Management*, 45, 37–56.

Pimentel, D. and Pimentel, M.(1979) *Food, Energy and Society*, Edward Arnold, London.

Scottish Government (2009) Beef farm visit, *Scottish Government News Release*, 1st December, downloadable from: http://www.scotland.gov.uk/News/Releases/2009/12/02162253

Simons, D., Francis, M., Bourlakis, M. and Fearne, A. (2003) Identifying the determinants of the value in the UK red meat industry: a value chain analysis approach, Chain and Network Science.

Smith A, 2006, "Green niches in sustainable development: the case of organic food in the United Kingdom" *Environment and Planning C: Government and Policy, Vol.* 24(3), 439 – 458.

Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M., de Haan, C. (2006) Livestock's Long Shadow, *UN Food Agriculture Organisation*, Rome.

Styles, D. Schoenberger, H. and Galvez-Martos, J.L. (2012) Environmental improvement of product supply chains: A review of European retailers' performance. *Resources, Conservation and Recycling,* 65, 57-78.

Tudge, C. (2010)"How to raise livestock – and how not to in D'Silva, J. & Webster, J. (eds) *The Meat Crisis,* Earthscan, London.

Tukker, A., Huppes, G., Guinée,J., Heijungs,R. de Koning, A., van Oers, L. Suh,S., Geerken, T., van Holderbeke, M., Jansen, B., Nielsen,P. (2006) Environmental Impact Of Products (EIPRO). Analysis of the life cycle environmental impacts related to the total final consumption of the EU25. *IPTS/ESTO 2005*

Wilkinson, J. (2006) Fish: A Global Value Chain Driven onto the Rocks, *SociologiaRuralis*, Vol 46, (2), 139-153..

Williams, A.G., Audsley, E. and Sandars, D.L. (2006) Determining the environmental burdens and resource use in the production of agricultural and horticultural commodities. Main Report, *Defra Research Project IS0205*.

Williams, A.G., Pell, E. Webb, J. Tribe, E., Evans, D., Moorhouse, E. and Watkiss P.(2009) Comparative Life Cycle Assessment of Food Commodities Procured for UK Consumption through a Diversity of Supply Chains, Final Report for *Defra Project FO0103*, London.

WWF (n.d.) Sustainable Beef – FAQ http://www.worldwildlife.org/what/globalmarkets/agriculture/WWFBinaryitem21252.pdf. Last accessed 23rd Feb 2012.

Yakovleva, N. and Flynn, A. (2004): Innovation and sustainability in the food system: A case of chicken production and consumption in the UK, *Journal of Environmental Policy & Planning*, Vol. 6 (3-4), 227-250.

Yin, R.K. (2003) *Case Study Research: Designs and Methods*, Sage Publications.