


The evidence for private sector drivers for climate action in Scottish agriculture

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1 Executive summary

1.1 Background and aims

The Scottish Government published the [Vision for Agriculture](#) in March 2022, which sets the ambition to become a global leader in sustainable and regenerative agriculture. This includes a commitment to work with and alongside farmers, crofters and land managers to ensure that they have the right support to deliver a range of outcomes, including emission reductions in line with Scottish climate targets. These are given in the [Climate Change Plan update](#) and will inform the forthcoming new Climate Change Plan.

Commercial operators are anticipating an increased demand for low carbon goods from consumers, including food. As the majority of emissions in the agricultural supply chain are generated at farm level, farmers face pressure to take mitigating action. However, detailed evidence regarding the extent and nature of private sector drivers of on-farm climate action is lacking.

This research provides an overview of the evidence for private sector drivers for climate change action in Scottish agriculture.

1.2 Key findings

- The main driver placed on Scottish agricultural producers from the private sector is to complete baseline carbon audits of their current operations. Although this is as yet not widespread, it is common in some sub-sectors (e.g. dairy) and is anticipated to rapidly spread across the whole industry. This is effectively being driven by retailers, although some processors have moved first in anticipation of retailer demands.
- There is little evidence to suggest that the process of carbon audits and action plan creation has led to significant tangible impacts in GHG reduction in Scottish agriculture at the producer level.

- Beyond carbon auditing and action plan creation, there is little evidence of further demands currently being placed on agricultural producers in Scotland. Many stakeholders suggested that more concrete prescriptive actions were likely to be placed on producers by the private sector in the near future, but there were uncertainties about details and timescales.
- The evidence strongly suggests that farmers respond primarily to policy and market signals, although the balance between these varies across sectors. For example, extensive livestock (beef, sheep) are more dependent on public support than intensive livestock (pigs, poultry) or field and glasshouse crops.
- Inescapable market pressures, such as short and long-term movements in commodity markets, are forcing more immediate responses from many farmers. For example, the spike in fertilizer prices caused by the conflict in the Ukraine has reduced fertilizer usage and will lead to lower farm emissions.
- Market pressures also include attempts by other parts of the supply chain to directly influence on-farm mitigation. This reflects the consumer and regulatory pressures that supply chain processors, retailers and banks face to reduce their own carbon footprints; on-farm emissions represent the dominant source of supply-chain emissions for downstream agri-food processors and retailers. Examples of the types of mitigation this has led to on farm can be found in the [Case Studies](#) section and [Appendix A](#).
- On-farm actions encouraged – or required by – downstream buyers range from measurement and planning through to actual management changes. For example, carbon audits, carbon planning, improved resource efficiencies and the adoption of new technologies. Perhaps unsurprisingly, these essentially mirror the types of actions identified as appropriate for agricultural policy to encourage or require.
- Consumer preferences shape the food products that retailers, wholesalers and processors (RWPs) market and sell. Consumer demand for low carbon goods is set to increase, and therefore decarbonising value chains (including producers) will be part of staying in business in a competitive market.
- The UK retail industry is largely consolidated into a handful of large organisations, which possesses significant leverage over producers. Retailers have set improved environmental standards in some areas, such as the recyclability of packaging, but our evidence suggests that they are still in the early stages of decarbonising their supply chain. However, industry expectations suggest that mitigation demands placed on upstream suppliers will increase rapidly. Further details of specific retailer actions and commitments can be found in [Appendix A](#).
- Supply chain pressures are growing rapidly in strength and coverage. Some sectors (e.g. dairy) are more advanced than others (e.g. beef). We only found evidence of price incentives being used to improve environmental performance in the dairy and malting barley sector. Sectors already familiar with contractual conditions may be more willing to accept further contractual obligations based on this familiarity. For example, contracts are already commonplace in dairying and cereals, but rare in beef and lamb. Anecdotally, industry contacts suggest that:
 - almost all dairy farms will be on contracts, as will ~90% of malting barley.
 - this percentage will be lower for cereals in general.
 - contracts are largely absent from beef and certainly absent from lamb.
 - contractual requirements to engage in mitigation actions are relatively light touch at first, such as undertaking carbon audits. Thereafter, requirements become progressively more stringent, specifying performance targets and management actions. As yet, the more stringent requirements (i.e. actual management changes building upon prior audits and planning) are most

apparent in dairying and cereals (especially for malting) but other sectors are expected to follow in the near future.

- Some supply chains are supporting farmers to transition to climate actions through the provision of advice, training and (limited) financial aid. In some cases, a price premium (or a price penalty for non-compliance) is offered. However, the medium-term expectation is that undertaking climate action will become a condition of operating in a given supply chain, with any costs regarded as the cost of being a supplier rather than meriting any additional price premium.
- Market signals are emerging in the form of carbon credits, but relatively few farmers are responding to them as yet. This reflects significant uncertainties around voluntary carbon markets but also the caution being urged by farming leaders and others

1.2.1 Who is driving climate action?

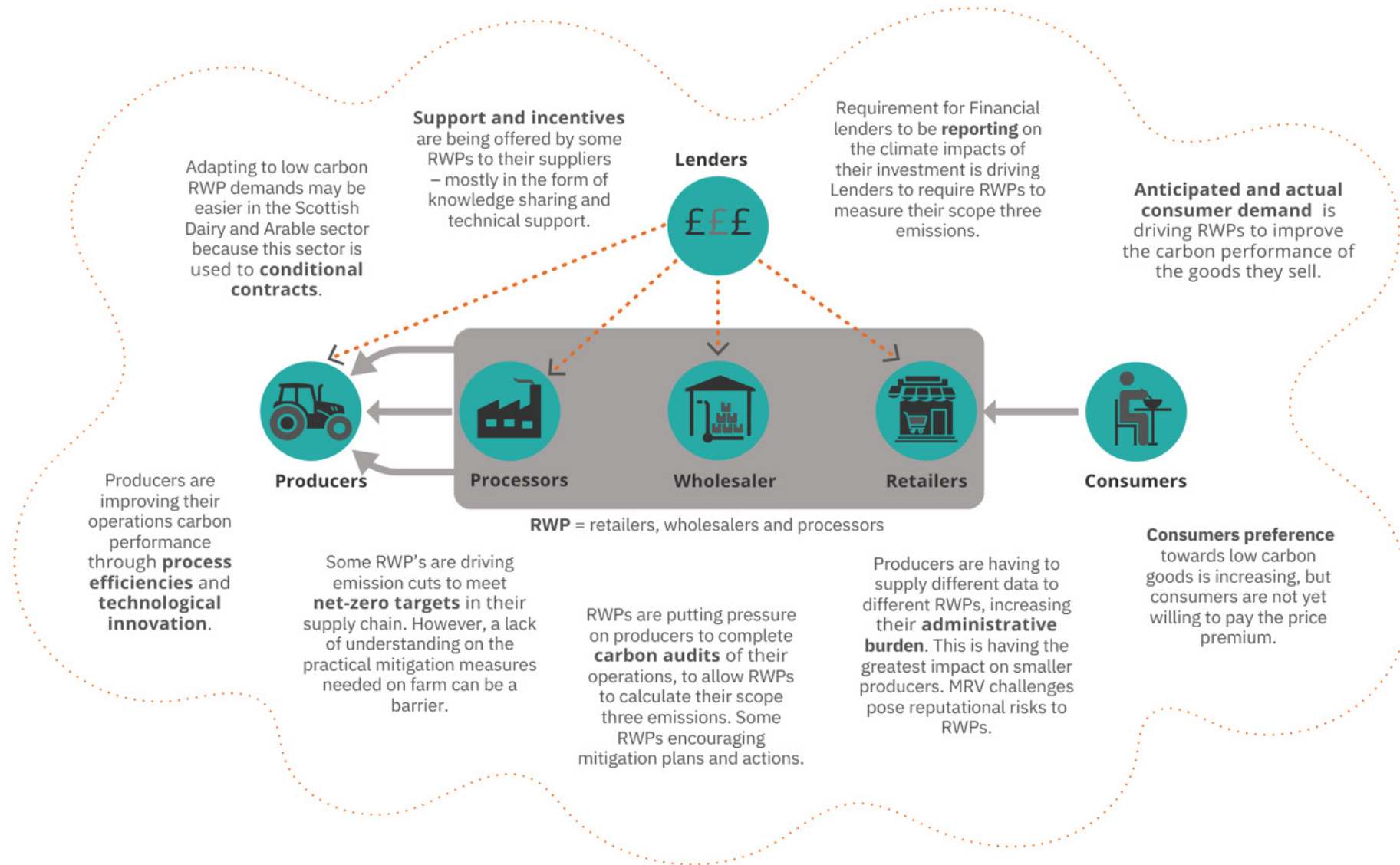
The infographic on the following page outlines the main private sector drivers and themes that influence producer climate change mitigation in Scotland.

Consumers are presented at the right of the visual, representing the downstream end of the supply chain. Producers are presented at the left of the visual, representing the upstream end of the supply chain. Processors, wholesalers and retailers are in between the two ends of the supply chain, with financial lenders sitting outside the supply chain but still having an influence.

The infographic summarises that:

- Adapting to low carbon Retailer, Wholesaler and Processor (RWP) demands may be easier in the Scottish dairy and arable sector because this sector is used to conditional contracts.
- Support and incentives are being offered by some RWP's to their suppliers - mostly in the form of knowledge sharing and technical support.
- Requirement for financial lenders to be reporting on the climate impacts of their investment is driving lenders to require RWP's to measure their scope three emissions.
- Anticipated and actual consumer demand is driving RWPs to improve the carbon performance of the goods they sell.
- Consumers' preference towards low carbon goods is increasing but consumers are not yet willing to pay the price premium.
- Producers are having to supply different data to different RWPs, increasing their administrative burden. This is having the greatest impact on smaller producers. Measurement Reporting and Verification (MRV) challenges pose reputational risks to RWPs.
- RWPs are putting pressure on producers to complete carbon audits of their operations to allow RWPs to calculate their scope three emissions. Some RWPs are encouraging mitigation plans and actions.
- Some RWP's are driving emission cuts to meet net zero targets in their supply chain however a lack of understanding on the practical mitigation measures needed on farm can be a barrier.
- Producers are improving their operations carbon performance through process efficiencies and technological innovation.

Who is driving climate change action?



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2 Glossary

Defra	Department for Environment, Food & Rural Affairs
Farmer Led Climate Change Groups	Farmer led groups were established to develop advice and proposals to the Scottish Government on how to cut emissions and tackle climate change as reaffirmed in the recently published Climate Change Plan update.
Financial Stability Board	The Financial Stability Board is an international body that monitors and makes recommendations about the global financial system.
Greenhouse gas (GHG)	A type of gas that absorbs and emits radiant energy within the thermal infrared range, causing the greenhouse effect.
Gross Value Added	The value generated by any unit engaged in the production of goods and services.
LEAF	Linking Environment and Farming
Net zero	Balancing the removal and emissions of GHGs
QMS	Quality Meat Scotland
Red Tractor	Red Tractor is a product certification programme that comprises a number of farm assurance schemes for food products, animal feed and fertiliser.
Science Based Targets initiative	Science-based targets provide companies with a clearly-defined path to reduce emissions in line with the Paris Agreement goals.
Scope 1 emissions	Scope 1 covers emissions from sources that an organisation owns or controls directly. For example, emissions from vehicles operated by a company. Some organisations are legally obliged to report Scope 1 emissions.
Scope 2 emissions	Scope 2 are emissions that a company causes indirectly and come from where the energy it purchases and uses is produced. e.g. emissions from electricity used on site but generated off-site. Some organisations are legally obliged to report Scope 2 emissions.
Scope 3 emissions	Scope 3 encompasses emissions that are not produced by the company itself, and not the result of activities from assets owned or controlled by them, but by those that it's indirectly responsible for, up and down its value chain. For downstream parts of agri-food supply chains, Scope 3 emissions greatly exceed Scope 1 and Scope 2, with the majority of Scope 3 arising from on-farm production. Reporting of Scope 3 emissions is entirely voluntary.
Spot-market	Where financial instruments, such as commodities, are traded for immediate delivery.
Task Force on Climate Related Financial Disclosures	The Financial Stability Board created the Task Force on Climate-related Financial Disclosures (TCFD) to improve and increase reporting of climate-related financial information.
United Nations Environment Programme Finance Initiative	UNEP Finance Initiative brings together a large network of banks, insurers and investors to deliver more sustainable global economies.

3 Introduction

The Scottish Government has set ambitious greenhouse gas (GHG) emission reduction targets to achieve net zero by 2045.

In 2020, agriculture was responsible for 7.4 MtCO₂e of emissions, representing 18.5% of all emissions in Scotland. The updated Climate Change Plan¹ (CCPu) (Scottish Government, 2020) targets emission reductions in the agricultural sector of around 28% between 2020 and 2030. The sector is also economically important, with the food and drink sector in Scotland employing 129,000 people in 2021, accounting for 4.0% of employment in Scotland (Scottish Government, 2023). Exports from the sector totalled £11.7 billion in 2019, accounting for 13.4% of all Scotland's exports.

Meeting these targets (as set out in the CCPu) requires mitigation activities across the agricultural supply chain. In parallel, due to regulatory and market pressures, downstream processors and customer-facing businesses have formulated their own net zero plans and ambitions.

Some firms are under legal obligations to report Scope 1 and 2 emissions with no such obligations apply as yet to Scope 3 reporting in the UK. For downstream agricultural firms, Scope 1 (direct, on-site emissions) and Scope 2 (indirect emissions from generating electricity used on-site) will typically be dwarfed by Scope 3 (indirect, upstream emissions) emissions. The majority of emissions are generated during the production phase (on farm), with the bulk of mitigation activities likely to be found at the producer level. Despite this, evidence suggests that some downstream firms are voluntarily reporting Scope 3 emissions under, for example, the Science Based Target Initiative (SBTi) or the Carbon Disclosure Project (CDP).

Although there have been some cross supply chain efforts at standardization of approaches, such as under the Courtauld 2030 initiative², detailed information on how private sector net zero ambitions are reported (and will actually be achieved) is lacking. This finding is supported by a recent publication from Ernst & Young (at the time of writing) stating that only 5% of FTSE 100 companies have 'credible' climate transition plans under draft British government guidance.³

Credible plans could include, for example, assumed emission factors, prescribed management practices or performance targets, monitoring/reporting obligations, price premium (or deductions) applied and ownership of carbon credits.

Each farming business is unique and will interact with market and policy signals in a different manner. Moreover, account must be taken of heterogeneity across Scottish agriculture, both between and within sectors. For example, more intensive sectors (e.g., pigs, dairy, soft fruit) are already commonly exposed to contractual relationships specifying performance metrics and/or prescribed management. On the other hand, more extensive sectors (e.g., sheep and beef) are not – despite enteric methane from the latter dominating Scottish farm emissions.

This partly reflects underlying differences in production methods, but also different traditions of (perceived) managerial autonomy at the farm level. Under-performers are

¹ <https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/documents/>

² The Courtauld Commitment 2030 is a UK voluntary agreement for collaborative action across the UK food chain see <https://wrap.org.uk/taking-action/food-drink/initiatives/courtauld-commitment> and also <https://wrap.org.uk/media-centre/press-releases/vital-new-collaboration-will-drive-action-cutting-climate-impact-uk>

³ https://www.ey.com/en_uk/news/2023/04/only-five-percentage-of-ftse-100-have-published-net-zero-plans

less likely to be able to respond to buyer demands and will have less leverage when it comes to contract negotiations.

This study was therefore undertaken to build a better picture of how private sector drivers in Scottish agriculture are influencing climate change mitigation measures at producer level.

It is important to note that the Scottish agricultural industry lies within the wider UK agricultural industry. Therefore, data, trends and influences from the wider UK economy (e.g., retailers) will strongly influence the Scottish context.

3.1.1 Our approach

We undertook a rapid evidence review of the available literature in combination with stakeholder interviews (see Annex B for further details). The rapid evidence review drew primarily on results generated from Google Scholar and Web of Science using search terms agreed with the project steering group, supplemented with cross-referencing via tracing of forward and backward citations of final selected publications. To manage the volume of results, attention was restricted to English language publications from the last 20 years and only the first page of results from each individual search was considered. Search results were filtered by manual inspection of publication titles and abstracts, leading to a total of 92 publications for actual review. Findings from the rapid evidence review are summarised in Section 4.

Insights from the rapid evidence review were used to draft a discussion guide to use in semi-structured interviews with stakeholders drawn across the supply chain. Candidate interviewees were agreed with the project steering group and chosen to reflect the perspectives of businesses producing farm output and businesses buying farm output (end consumers were not included). In addition, interviewees from farm advisory services, livestock auction marts and banks were also selected, on the basis that they could offer further useful insights.

Given commercial sensitivities, the focus was on interviewing representative bodies rather than individual businesses from different parts of the supply chain, although some individual businesses did agree to participate (others declined). In total, 20 interviews were conducted, offering perspectives from different sub-sectors of agriculture, including arable, beef and lamb, dairy, and fruit and vegetables (see Annex C). Findings from the stakeholder interviews are summarised in Section 5 and 6. To preserve anonymity and respect commercial sensitivities, specific points made by interviewees are not attributed to individual sources, but it should also be noted that there was a high degree of commonality in insights offered by interviewees regardless of their position within the supply chain. In addition, some short case studies are presented, drawing on published information for selected downstream processors and retailers.

4 Private sector drivers of emission reductions at producer level – evidence base

4.1 Introduction

Although Scottish agriculture receives around £0.5bn of annual public support payments, market revenue from the sale of farm output is six times higher at over £3.0bn (ERSA, 2020). This highlights the significant influence exerted by supply chains over production with respect to its volume, composition and (increasingly) management practices. This has implications for whether and how policy support should seek to

reinforce private drivers of on-farm action or indeed is necessary (Mangla et al., 2018; Nematollahi and Tajbakhsh, 2020; Deconinck et al., 2023).

4.1.1 Specifying product attributes

Supply chain buyers of farm output specify a price at which produce will be accepted but also a range of other attributes relating to, for example, the time and place of delivery plus various quality attributes (Kohls and Uhl, 2002). Examples of the latter include the butterfat and bacterial content of milk, the moisture and protein content of grain, and the weight and health of finished livestock.

However, perceptions of quality also increasingly extend to production methods. For example, the extent to which animal welfare is respected, biodiversity is protected and pollution is avoided. Such wider ‘sustainability’ attributes are not observable at the point of delivery but have to be taken on trust – hence they are sometimes referred to as credence attributes or credence goods (Vetter and Karantininis, 2002; Balafoutas, and Kerschbamer, 2020).

Credence goods are typically associated with the use of additional product labelling and mechanisms such as accredited inspections to reassure buyers of adherence to specified production practices (Nematollahi and Tajbakhsh, 2020; Rao et al., 2021; McGarr-O’Brien et al., 2023). However, this raises significant issues around administrative burdens (to both farms and buyers) and whether the accuracy of information can be judged sufficiently through current Monitoring/Recording/Verification (MRV) procedures (Freidberg, 2020; Fleurke, 2022).

Market expectations of quality ultimately reflect consumer preferences, but most farm output is not marketed direct to consumers but rather to supply chain intermediaries (e.g. processors, retailers) who then sell-on to end consumers. These market intermediaries translate final consumer preferences into requirements that farms must meet to sell into the supply chain (Kohls and Uhl, 2002; Nurhayati et al., 2021).

Currently, many agri-food supply chains are extending specified product attributes to include explicit consideration of sustainability issues, including specific attention to greenhouse gas emissions generated from on-farm production (Hall et al., 2004; Lang, 2020; Meemken et al., 2021; Amin-Chaudry et al., 2022). This reflects processor and retailer commitments to reduce their carbon footprints, of which Scope 3 emissions are the dominant component (FDF, 2021; SFD, 2021; WRAP, 2021).

These published, and often internationally accredited, commitments reflect competitive market pressure on processors and retailers to meet consumer expectations but also pressure from banks who themselves face competitive pressure and regulatory obligations (McKinsey, 2021; NatWest, 2022) to report and reduce emissions associated with their lending portfolio, reinforcing processor and retailer interest in reducing emissions in order to access more favourable finance (banking pressure may directly affect farms seeking finance, as well as indirectly through its effect on supply chain buyers of farm output).

4.1.2 The link with emissions reduction

Given that market power is more concentrated in downstream parts of supply chains, the ability of individual farms to sell at high prices without having to meet high expectations for other product attributes is limited. Consequently, provided that downstream buyers and banks remain committed to lowering their Scope 3 emissions, private drivers for on-farm climate action are increasingly likely to become unavoidable (Fałkowski et al., 2017; Glover and Touboulis, 2020; Nurhayati et al., 2021; Hatanaka et al., 2022).

The precise requirements imposed on farms to meet downstream emission reduction (and/or wider sustainability) commitments vary across supply chains. For example,

ranging from simply undertaking baseline measurements, through drafting management plans to identify mitigation options, through to actual adjustments to management practices. This variation reflects that some sectors, such as dairying, developed net zero supply chain commitments earlier than others (Traldi, 2021; Chever et al., 2022; McGarr-O'Brien et al., 2023).

The existence of private sector drivers of on-farm emission reductions raises some issues for public policy. In principle, if the private sector is already seeking reductions, the need for public farm support to do so is reduced. This also applies to other private drivers of action, including individual farmers' altruistic motivations and/or engagement with emerging voluntary markets for carbon and biodiversity but (whilst important) these are generally secondary or mediating influences in relation to more pervasive and dominant commercial motivations and market pressures (Allen and Lueck, 2004; Bartkowski et al., 2022; Farstad et al., 2022).

4.1.3 Climate related disclosure requirements

As discussed in the introduction, some downstream firms are voluntarily reporting Scope 3 emissions under, for example, the Science Based Target Initiative (SBTi) or the Carbon Disclosure Project (CDP).

UK legislation⁴ requires larger companies and organisations to report their annual Scope 1 and Scope 2 GHG emissions (smaller companies are encouraged to do so on a voluntary basis). Reporting of Scope 3 emissions is not obligatory, but some organisations are choosing to voluntarily report them. In many cases, voluntary reporting adheres to (non-binding) international guidelines such as the Carbon Disclosure Project (CDP), the Partnership for Carbon Accounting Financials (PCAF) and the Science Based Target Initiative (SBTi).⁵ However, international guidelines primarily relate to reporting processes rather than specific methodologies or data sources, meaning that cross-comparisons between different organisations are often hampered.

Moreover, the reporting basis for Scope 1, 2 and 3 emissions differs to that used for the National Inventory. The latter focuses on the domestic sectoral source as opposed to the Life Cycle Analysis (LCA) approach (i.e. a focus on processes wherever they occur) used for private sector net zero commitments.

This difference matters since Scope 3 calculations span multiple parts of the National Inventory, not just 'Agriculture' but also include the emissions associated with imported inputs which are excluded from the National Inventory estimates. Policy targets are defined in terms of reducing absolute emissions, whereas commercial entities may set targets in terms of reducing emission intensities to avoid curtailing their ability to grow over time.

This means that whilst private drivers may contribute towards achieving policy targets, they may not be sufficient and policy measures remain relevant. Differences in the specific LCA methodologies used by specific supply chains mean that comparability across supply chains is impaired but also farmers may face duplication of effort if they

⁴ Specifically the Companies Act 2006, the Large and Medium-sized Companies and Groups (Accounts and Reports) Regulations 2008, the Companies Act 2006 (Strategic Report and Directors' Reports) Regulations 2013, and the Companies (Directors' Report) and Limited Liability Partnerships (Energy and Carbon Report) Regulations 2018 – see UK government Environmental Reporting Guidelines: reporting guidance https://assets.publishing.service.gov.uk/media/5de6acc4e5274a65dc12a33a/Env-reporting-guidance_inc_SECR_31March.pdf

⁵ See <https://www.cdp.net/en>, <https://sciencebasedtargets.org/>, <https://carbonaccountingfinancials.com/>

sell into more than one chain and/or wish to switch chains. Consequently, policy may have a role in guiding harmonisation of calculation and MRV methods (Chever et al., 2022; Deconinck et al., 2023).

The following sub-sections explore some of these points in greater detail.

4.2 Standards and product labelling

Communicating these environmental impacts is important. The credence given to attributes inferred from information about the product depends upon the perceived trustworthiness of the information⁶. Consequently, meeting expectations about food increasingly rests on providing sufficient information in a sufficiently robust manner to instil consumer confidence in product provenance and authenticity (Jahn *et al.*, 2005; Fernqvist and Ekelund, 2014; Macready *et al.*, 2020). Despite the importance of information transfer to consumers, the main drivers of sustainability in food systems are found to be the cost of key inputs, product markets where customers increasingly seek sustainability in products, the ethos and values of the businesses and people involved, and legislation and strategies of industry bodies (Leat et al., 2011).

Non-food products are also subject to increasing expectations about production processes (e.g., labour rights), but food has some distinctive characteristics. For example, seasonality of production, product perishability, and fragmentation of production across multiple and heterogenous producers (Maloni and Brown, 2006; Wiese and Toporowski, 2013; Rueda *et al.*, 2017). Therefore, food producers in Scotland face a unique set of circumstances that makes responding to supply chain pressures challenging.

4.2.1 Government regulated requirements

In response to this complexity, further information is offered through government regulation and applies to all products in a given category. For example, requirements for nutritional and allergens labelling. In other cases, it is offered through private supply chain responses to consumer preferences and purchasing behaviour (Goodhue, 2011; Roberts, 2011; Jira and Toffel, 2013).

4.2.2 Voluntary or market based labelling

Whereas regulatory requirements oblige supply chains to provide product information, responses to consumer demand are discretionary and reflect firms' competitive strategic choices. For example, voluntarily providing additional information or instead focusing on market segments for which product information is less important. This has been the case so far regarding the communication of GHG performance of agricultural goods. In the agricultural sector, conditions are usually placed on producers due to their direct impact on ecological wellbeing and, increasingly, GHG emissions (Fischer et al., 2009; Duvaléix et al., 2020; Ciliberti et al., 2022)

As consumer demand shifts towards goods that have a stronger environmental performance (for example, lower carbon emissions), there is an increasing prerogative to communicate this to consumers to gain a competitive advantage in the sector.

Consumers are therefore driving this trend in the agriculture sector, requiring producers to quantify the environmental performance of their goods if they are to stay competitive within the agricultural supply chain.

⁶ Products for which key quality attributes are inferred from information provided are sometimes referred to as credence goods.

4.3 Market structures

The supply chains for agricultural producers in Scotland are often complex, spanning multiple stages and locations. Their governance is highly variable, ranging from vertically integrated chains controlled by one entity, through to highly fragmented chains reliant on spot-market transactions. Therefore, communication in these complex supply chains can often be fragmented if sector wide verification schemes are not implemented.

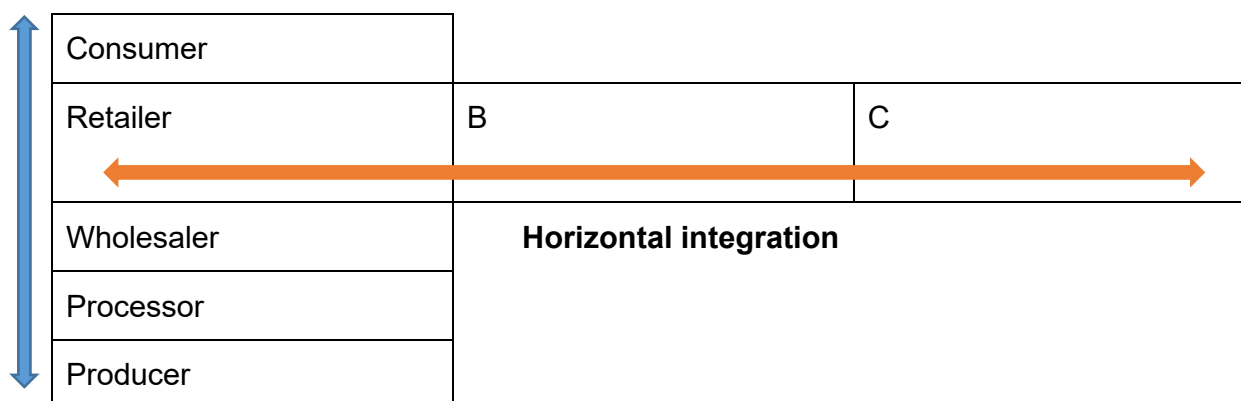
Downstream agents, such as processors and retailers, source from a wide range of producers to mitigate risks (Kohls and Uhl, 2002; Grandori, 2015; Rueda et al, 2017; Ménard, 2018). Therefore, an individual farmer in Scotland may be supplying a variety of different processors and retailers. As different forms of organisations share information in alternative ways across their supply chains, this may require producers to comply with multiple standards due to the lack of cross compatibility in the supply chain.

Agricultural producers in Scotland will generally be involved in a vertically integrated supply chain (Morrisons for example, is one of the only supermarkets to own its own processing plants) or reliant on the spot-market. Vertical integration offers a high degree of control across all stages of the supply chain, reducing opportunities for misunderstandings or misrepresentations⁷ to arise. It does, however, require investment and can reduce operational flexibility (Kohls and Uhl, 2022; Goodhue, 2011; Roberts, 2011).

By contrast, relying on spot-markets offers a high degree of flexibility and avoids some investment and management costs; but it offers relatively little control over how information is gathered and reported. Quality Assurance (QA) schemes (including Geographical Indications, GIs)⁸ are an attempt to compensate for this lack of control by horizontally standardising information across suppliers, but much depends on the (perceived) rigour of a QA scheme in terms of requirements and enforcement by competent, independent inspectors (Leat et al., 1998; Hobbs et al., 2002; Jahn et al., 2005). A common example of this in the UK is 'Red Tractor' label, which intends to signify high levels of animal welfare, food safety, traceability and environmental protection in UK food goods.

⁷ Suppliers knowing more about their production practices than buyers is an example of asymmetric information, leading to opportunities for moral hazard (i.e., suppliers not doing what they say) and adverse selection (i.e., buyers selecting the wrong suppliers). Buyers risk reputational damage if information they provide to consumers is subsequently found to be unreliable, and hence they need to guard against receiving upstream misinformation (e.g., Wiese and Toporowski, 2013). Hierarchical, vertically integrated structures remove the distinction between supplier and buyer, thereby reducing the asymmetry relative to reliance on spot markets, but contracts and QA can also address information asymmetries.

⁸ e.g., see Gorton and Tregear, 2005.



Vertical integration

Figure 1 – Vertical integration refers to an organisation increasing control over different stages of the supply chain. Horizontal integration involves expanding by integrating at the same level of the supply chain.

4.3.1 The role of contracts

In-between these two extreme supply chain positions lie contracts specifying the terms and conditions for purchases. These can differ in their degree of complexity, from simply stating quantities and prices through to detailed specifications of quality attributes (including information) and delivery timings. As such, they offer more certainty than spot markets at less cost than vertical integration, but less flexibility than spot markets and less certainty than vertical integration (Mitkidis, 2014 & 2017; Frascarelli *et al.*, 2021; Ciliberti *et al.*, 2022). While certification and compliance with standards can provide benefits for farmers via price premiums and negotiated supply agreements (or less formal arrangements providing market access), the capacity to complete necessary reporting and capital to cover the costs of certification can be an obstacle, especially for smallholder farmers (Kissinger, 2012).

Contract specification incurs transaction costs, for example, through terms and conditions of supply and attempting to identify contingencies. Further costs arise from contract monitoring and enforcement, and from the addressing unforeseen⁹ eventualities through renegotiation requiring discretion and adaptation. Contracts can also be implemented simply as one-off events or as part of a longer-term relationship that builds mutual trust through repeated interactions. The latter can include knowledge exchange and co-development of new process improvements to raise overall supply chain performance (Frascarelli *et al.*, 2021; Ciliberti *et al.*, 2022; Houska, 2022).

Different forms reflect the varying nature of different agricultural producers in terms of, for instance, production systems, industry structure and market demands. For example, dairy supply chains tend towards a greater use of contracts and vertical integration than beef and sheep chains (Grunert *et al.*, 1995; Fischer *et al.*, 2009). This variation in farms' familiarity with different forms of supply chain has potential implications for the ease and manner with which new expectations relating to greenhouse gas emissions lead to farm-level actions (Rueda *et al.*, 2017; Dahlmann and Roehrich, 2019; Ciliberti *et al.*, 2022). This point is highlighted in the case study of Arla, where dairy farmers in the cooperative are currently incentivised to measure their carbon footprint and rewarded for emission reductions as a result of beneficial actions. More detail can be found in [8.2](#).

⁹ 'Incomplete' contracts are the norm since covering all eventualities is disproportionately burdensome, if not actually impossible see e.g., Tirole, 1999; Ménard, 2018.

Agricultural producers already familiar with prescriptive contracts and/or vertical integration may accept additional obligations more readily than sectors used to a greater degree of autonomy. Equally, downstream buyers may need to offer advice and technical support to entice engagement from farmers lacking familiarity/trust with supply chain partners.

Producers often obtain new information through their own research and experimentation and through peer learning (Jira and Toffel, 2013; Rueda *et al.*, 2017; Dahlmann and Roehrich, 2019).

4.3.2 Reporting challenges

Contracts will often specify certain criteria to demonstrate that a product delivers certain climate benefits. This might require a baseline measure of farm-level emissions and reporting of compliance with subsequent mitigation measures. Domestic and international standards exist for how emissions should be calculated, but they merely suggest rather than prescribe. This means some variation in assumed system boundaries and emission factors, hampering comparisons between individual businesses or supply chains (Whittaker *et al.*, 2013; Sykes *et al.*, 2017; Adewale *et al.*, 2018).

Reliance upon self-reporting by farmers also raises issues around monitoring, reporting and verification (MRV), both in terms of burdens on farmers but also reputational risks to buyers of unaudited information. Addressing MRV issues leads to consideration of, for example, the role of third-party inspections, the potential to utilise digital technologies and alignment between public and private initiatives (Meemken *et al.*, 2021; Hatanaka *et al.*, 2022; Perosa *et al.*, 2023). Governments have a strong role to play in shaping private sector supply chain commitments in order to ensure such approaches promote their own food security, comply with national greenhouse gas emission reduction commitments, and do not marginalise smallholder producers (Kissinger, 2012).

The above summary of perspectives reported in academic literature suggests that interviews with Scottish agricultural supply chain stakeholders should focus on three main issues: motivations for seeking reductions in on-farm emissions; credibility of information relating to emissions/emission reductions; and the nature of supply chain relationships used to incentivise/oblige/support on-farm adjustments.

5 Overview of private sector drivers on Scottish agricultural producers

The following section provides an overview of the key agents within the agricultural supply chain and the pressures they are exerting on agricultural producers in Scotland to mitigate their GHG emissions from operations. With this knowledge, we will explore what this means for agricultural producers in Scotland and what actions are currently being taken and anticipated at the farm level to reduce operational carbon emissions that are being driven by the supply chain.

The agricultural supply chain consists of five main sectors: Producers (farmers), Processors (manufacturers), Wholesalers (distributors), Retailers (supermarkets) and Consumers (customers). The movement of money flows upwards from Consumers and the movement of food flows downwards from Producers as shown in Figure 2. The following section provides an overview of the agents in the supply chain that are driving emission reduction measures at producer level and what this means for GHG mitigation and producer decision making. This allows us to understand where the private sector

drivers of emission reductions are originating from within the supply chain and the influence they are having on Scottish producers.



Figure 2 – Movement of money and food in the Scottish agricultural supply chain

These drivers were identified through stakeholder interviews with key members of the Scottish agriculture industry, along with wider supply chain players. Please see Appendix B for further details on the stakeholder interviews, including those sectors interviewed and the positives and limitations of this approach.

5.1 Retailers, wholesalers and processors

The agri-food industry in the UK contributed £116.2 billion, or 6%, to national Gross Value Added (GVA) in 2020¹⁰.

- Food and drink retailing is responsible for £36.2bn
- food and drink wholesaling £13.2bn and
- food and drink manufacturing (processing) £28.8bn.

In comparison, agriculture and fishing - the producers - is responsible for £11.5bn.

In Scotland, the food and drink industry adds £3.4 billion to Scottish GVA, including a turnover of £10.3 billion and export values of £8.1 billion. Scotland is integrated into the UK-wide system, with significant cross-border flows in both directions of inputs to agricultural production (e.g. seeds, feedstuffs, fertilisers), farm output (e.g. livestock for slaughter, fruit) and products for consumption (e.g. specific cuts of meat, processed dairy products) (Hasnain et al., 2020; Scottish Government, 2023; UK Government, 2023).¹¹

The majority of registered value-added is accounted for by RWP. These three groups are the main buyers of agricultural goods produced in Scotland and therefore possess a significant influence over producer decision making. Even export dependent producers, such as barley, sheep meat and potatoes are likely to be selling their goods to a wholesaler rather than directly to consumers.

The most consolidated group - retail - is dominated by a few large entities, with the top four leading retailers capturing almost two-thirds of the market share in the UK, including Scotland (Oxford Farming Conference, 2023). This gives certain food retailers considerable leverage in buyer-seller interactions and agreements, a theme that is recurrent throughout the grey literature (Oxford Farming Conference., 2023; Defra, 2022). This phenomenon was noted as early as 2005 by Hingley (2005), who suggested

¹⁰ GVA represents the total value of goods and services produced in the UK, showing that agricultural output is a significant part of the economy.

that power in the UK agri-food industry lay in the hands of large multiple retailers, suggesting that this issue is well ingrained in the industry.

Although the processor and wholesaler sectors are not as concentrated as the retail sector, they are both still reasonably consolidated, with large organisations holding large market shares. For example, in 2021, the 11 largest processing plants accounted for 92% of the total slaughtered pigs, while 70% of the UK's annual milk intake is processed by nine companies (Oxford Farming Conference, 2023). Similar concentration is apparent in Scotland, although patterns are masked by cross-border flows and by data gaps (QMS, 2023). All of these sectors directly interact upstream with producers, purchasing their goods to supply downstream consumers. Given their position in the agricultural supply chain and the comparative value that they generate, retailers, processors and wholesalers wield significant influence over the decision making of producers. This dynamic is seen across the whole of the UK, including Scotland.

5.1.1 Scotland-specific evidence

It is important to note that supply chains frequently cross borders, both within the UK and internationally. For example, a high proportion of sheep reared in Scotland are slaughtered in England and of those slaughtered in Scotland, most are consumed outwith Scotland. Therefore, understanding and exploring the Scotland specific evidence regarding the private sector drivers of emissions reduction in agriculture is challenging due to the intertwined nature of the UK supply chain.

Moreover, as noted in section 4.1.3 above, a proportion of inputs to Scottish agriculture (e.g., fertilisers, animal feed) are imported from the rest of the UK and/or abroad (Scottish Government, 2019). This means that the Scope 3 emissions of downstream buyers based in Scotland are not restricted to Scottish emission sources, but equally Scottish sources are also relevant to downstream buyers not based in Scotland. This is a different accounting perspective to that imposed by the National Inventory approach used by Government to set policy targets and means that firms cannot manipulate results simply by using imports rather than domestic production.

5.1.2 Leverage from retailers, wholesalers and processors

Our evidence review (both the literature and stakeholder interviews) suggests that RWPs possess significant leverage and power over their suppliers (farm producers) due to the rise of consolidated organisations with large purchasing power. That is, whereas individual farms remain numerous and typically small, downstream parts of supply chains have become increasingly dominated by a few very large firms. For example, four supermarkets account for over half of all retail food sales and five foodservice companies account for 80% of supplies to catering outlets¹² This asymmetric concentration is acknowledged – including by the existence of the Groceries Code Adjudicator - to give large downstream buyers a negotiation advantage, meaning that they can and do exert significant influence on farms (Ilbery & Maye, 2005; Hingley, 2005; Lang, T. 2020, Donner & de Vries, 2023)¹³.

Although retailers may suggest that they merely reflect consumer demand, they can and do drive changes within the agricultural supply chain due to their power in the supply chain, providing standards and setting an example to follow (Leat et al., 2012). For example, a recent report from the WWF suggest that retailers have successfully driven industry standards on the reduction of food waste, recyclability of waste and their own direct GHG reduction commitments (WWF, 2022). In more general terms, retailers have

¹² <https://www.eci.ox.ac.uk/sites/default/files/2022-05/Mapping-the-UK-food-system-digital.pdf>

¹³ <https://www.port.ac.uk/news-events-and-blogs/blogs/democratic-citizenship/food-prices-are-rising-but-farmers-profits-are-still-small-heres-why>,

also improved the quality of goods produced and the condition to which these reach the end user through contractual obligations placed on suppliers (Nicholson & Young, 2012).

They are also beholden to consumer demand, and consumers' buying preferences influence management towards sustainability and GHG reductions (Wognum et al., 2011). As these groups anticipate an increase in demand from consumers for low carbon goods, commercial operators are also increasing their attention to measuring the environmental performance of their agricultural suppliers (Thompson, 2021). However, agricultural supply chains are also subject to other external influences, including external shocks such as global inflationary pressures, labour availability following the UK's EU-exit and the implications of climate change for the future reliability/availability of imports. The relative importance of these different influences is difficult to quantify, but published commitments by downstream firms to achieving carbon reductions by specified dates suggest that reducing their Scope 3 emissions remains a key driver.

This point was confirmed by a wide range of stakeholders throughout the complete supply chain who indicated that retailers, wholesalers and processors are anticipating consumer demand for low carbon and sustainable food goods. Therefore, many organisations are looking to address GHG emissions within their supply chain to ensure that they can validly claim that their goods have a lower environmental impact, appealing to consumers who are environmentally conscious. One stakeholder in the food and drink industry noted that:

“Not being seen to have net zero ambitions is now becoming a competitive disadvantage”

As the retailer, wholesale and producer sector is beholden to consumer demand due to the flow of capital and goods (see Figure 2), anticipating consumer demand is crucial to business success in a competitive and low margin market. Our evidence review has suggested that consumers show a preference towards climate friendly goods, however they are not willing to pay the price premium associated with these. Food retailers are often stuck between delivering on their sustainability ambitions and their commercial interests, which dilutes action and sends mixed market signals (Oxford Farming Conference, 2022). Retailers are therefore attempting to boost the environmental credence of their goods without passing on any additional costs to consumers. This cost is likely to be absorbed by agricultural producers.

There is also anticipation that government regulation and investor demands will also influence RWPs sustainability ambitions. One stakeholder in the finance sector noted:

“Downstream players feel the need to be seen to be taking emissions seriously, partly for government audience but also for consumers plus investors and staff”

With another, in the food processing industry, stating that business planning for GHG reductions is:

“Reflecting consumer demand (and competitors' actions), bank lending criteria and anticipated government policy”

To show customers and investors that their GHG reduction intentions are credible, many RWPs have set net zero targets for both their internal operations and in their supply chain.

5.1.3 Scope 3 emissions reporting

The majority of GHG emissions across agri-food supply chains occur at producer level. As RWPs all rely on producers to supply their goods, producers fall into the Scope 3 emission¹⁴ bracket of RWPs carbon footprint.

The voluntary [Science Based Target initiative](#)¹⁵ (SBTi), a partnership between Carbon Disclosure Project (CDP) the United Nations Global Compact, World Resources Institute (WRI) and the World Wide Fund for Nature (WWF), states that if Scope 3 emissions account for more than 40% of a company's overall emissions, the SBTi requires they set a target to cover this impact¹⁶. As major RWPs sign up to the SBTi and set net zero targets, addressing Scope 3 emissions, which sometimes account for over 90% of their footprint, will be at the forefront of business planning. Indeed, the four main retailers in Scotland (Tesco, Asda, Aldi, Morrisons), have all publicly committed to science based targets which include their Scope 3 emissions. To date, none of these retailers have claimed significant Scope 3 emission reductions, therefore suggesting that this is not yet having a significant impact on agricultural producers in Scotland.

Stakeholders noted because of this, many RWPs are engaging with their agricultural suppliers to gain a complete picture of their footprint. This is so that RWPs can include scope 3 reduction targets in their voluntary emission reduction targets. One stakeholder in the agricultural consulting sector summarised this:

“At the moment, emphasis is mostly on carbon audits and planning for change – but hitting targets will require real changes soon.”

RWP are putting drivers upon agricultural producers in Scotland in two ways:

- 1) Many RWPs (Tesco, Morrisons, Sainsburys etc.) are engaging with their suppliers and supporting/requesting them to perform carbon audits of their operations. Some RWPs are also providing technical support and network collaboration initiatives, whereas others are simply stating that improving GHG performance will be a requirement to be in business (Examples of how this is working in practice can be found in the [Case Studies](#) section and [Appendix A](#)) (Specific Retailer Commitments).
- 2) Stakeholders suggested that some RWPs will be enforcing compliance with low carbon production through prescriptive contracts. The literature suggests that consumers do not want to pay more for low carbon goods, and therefore retailers will pass this cost on to producers. Therefore, producers are likely to bear any net burden of measuring and mitigating emissions in the agricultural supply chain, and will incur any net adjustment costs.
- 3) Our evidence suggests that agricultural producers in Scotland are concerned about their ability to meet any new prescriptive demands placed on them by buyers. The need for new equipment, changes in management practices and new MMV requirements will prove to be a challenge to producers and may not be achieved without additional support.

In summary, RWPs are looking to decarbonise their value chains. Scope 3 emissions dominate and agricultural emissions are the main source of these. Hence value-chain decarbonisation necessarily requires on-farm mitigation. Although commercial confidentiality can obscure some of the details, it is apparent that RWPs are seeking such mitigation through a mix of approaches. Most commonly, farms are encouraged to undertake carbon audits, and then possibly to draft mitigation action plans. Thereafter,

¹⁴ Scope 3 emissions are those that an organisation are indirectly responsible for along its value chain

¹⁵ <https://sciencebasedtargets.org/>

¹⁶ <https://sciencebasedtargets.org/blog/how-can-companies-address-their-scope-3-greenhouse-gas-emissions>

farms may be encouragement to adopt particular technologies and/or to improve resource efficiencies. Encouragement can be through the provision of information and advice, funding for capital investments and a price premium on produce. However, it can also be encouraged through a price penalty for non-compliance or even a threat of delisting as a supplier. (see [Case Studies](#) & [Appendix A](#) for further details). Complying with RWP demands for lower carbon goods may become an essential condition of being part of their supply chain.

This happens alongside wider market forces. At the time of writing, increasing inflation and the cost of living crisis is having a significant impact in Scotland and the UK. All retailers are looking to reduce their costs to stay competitive in a market where operating margins are small.¹⁷

This questions how much financial support retailers and processors will be willing to offer suppliers to change their practices. Without this, substantial change may be slow and smaller or less profitable producers may be driven out of business, resulting in further consolidation within the sector or a net loss of production.

5.2 Consumers

Consumers sit at the opposite end of the agricultural value chain from the producers (see Figure 2). Consumer preferences therefore shape the food products RWPs market and sell. Stakeholders suggested that many RWPs are anticipating that consumer demand for low carbon goods is set to increase, and therefore decarbonising their value chains (including producers) will be part of staying in business in a competitive market.

Our literature review suggested that consumers are looking for higher environmental standards from the goods they purchase, however, they are wary of paying a price premium for these goods and are concerned about the impacts of price rises on those in society with lower incomes.

5.2.1 Demand for low carbon food

Interviewees across the agricultural supply chain agreed on the view that consumers are increasingly conscious of the environmental impact of food and the importance of their choices regarding GHG emission reductions. A retailer remarked that:

“We also know that customers care about the climate as they tell us about this. We conduct an annual survey with 5000 customers to assess what is important to them for how supermarkets should prioritise sustainability and corporate responsibility”

This indicates a preference for low carbon goods. However, interviewees shared the view that consumers, on the whole, are not currently willing to pay the price premium for low carbon and environmentally sustainable goods. One interviewee from a farmer cooperative simply put this:

“Consumers on a whole do not want to pay more for goods but want to see carbon improvements”

5.2.2 Demand based on price

We heard repeated mention that the key driver of consumer behaviour is price. Interviewees suggested that only at higher end retailers, where consumers potentially

¹⁷ <https://www.reuters.com/business/retail-consumer/britains-tesco-says-store-management-changes-impact-1750-jobs-2023-01-31/>

have more disposable income, would consumers be willing to pay the additional price premium for a low carbon good.

5.2.3 Credentials

Interviewees agreed that conveying the low carbon credentials of goods is a significant challenge in meeting consumer demand. One stakeholder working in the food and grocery industry noted:

“There are big issues around comparability of information from different approaches and recognition that standardisation and simplification is desirable, but hard to achieve”

This is an important topic that is discussed further below in Section 6. An example of the producer industry attempting to address this information transfer is Quality Meat Scotland’s statement of intent on registering trademarks and certification marks to represent sustainable beef production.¹⁸ This is with the hope that:

“Ensuring that the industry responds to consumer concerns and trends through the provision of properly labelled, climate and environmentally friendly Scottish produce, and may help to generate a premium price for a premium product”

This may explain why retailers and processors are looking to achieve net zero (to meet regulatory targets and appease consumer demand/consciousness) without increasing the pricing burden to consumers.

As consumers may not be willing to pay at this moment in time, this could be a severe competitive disadvantage to retailers and processors who are operating in a hypercompetitive market with tight operating margins. Therefore, the increased costs of low carbon farming will be passed down to the producers and set as a condition of business due to the large purchasing power of retailers/processors and the closed nature of the market for producers. The extent to which this may disadvantage domestic sources of food relative to imported sources is unclear. Measurement of Scope 3 emissions includes those generated by overseas production. Moreover, many processors sell into multiple markets and wish to minimise administrative differences. Hence all of their producers should be subject to the same supply-chain requirements. However, scrutiny of overseas sources may be harder, perhaps leading to laxer adherence in favour of cheaper imports. Yet the risk of reputational damage to buyers if laxity (intentional or accidental) is subsequently revealed may favour easier-to-monitor domestic sources. How these divergent forces play-out remains to be seen.

5.3 Finance

All parts of the agricultural supply chain, including Scottish producers, rely on financial institutions to provide capital funding to support a range of activities. External finance is essential to fund growth (as evidenced by the recent trend of supermarket takeovers by private equity firms¹⁹) and producers sometimes rely on finance to enact process efficiencies and mitigation measures (such as installing renewables or purchasing machinery).

¹⁸ QMS – Our Strategy 2018-2023 (2018), Available at: https://www.qmscotland.co.uk/sites/default/files/op2977_business_strategy_document_aw_single_0618_-_corrected_0706.pdf

¹⁹ <https://www.ft.com/content/7fb5f5d7-a397-4300-b0f3-90387ddb292a>

5.3.1 International context for sustainable finance

In 1992, the United Nations Environment Programme Finance Initiative²⁰ (UNEP FI) was created with the objective of embedding sustainability within the financial industry. Since then, the United Nations has employed further initiatives and regulations in the financial sector. The Task Force on Climate Related Financial Disclosures²¹ (TCFD) was created in 2015 by the Financial Stability Board²² (FSB) to develop consistent climate-related financial risk disclosures for use by companies, banks and investors when providing information to stakeholders. This includes a method to embed climate change in governance, strategy and risk management.

5.3.2 Sustainable finance in the UK today

As climate change is seen as a key risk and opportunity in the financial sector, it has become important to the resilience and stability of the financial sector (UK Government, 2021). The UK government has recognised the recommendations of the FSBs TCFD as one of the most effective frameworks for organisations to analyse, understand and ultimately disclose climate-related financial information against and has mandated TCFD-aligned disclosure for large entities in the UK private sector. This has led many UK banks attempting to reduce the GHG impacts of their operations. Naturally, this will influence lending decisions and conditions, with climate reporting likely to become a requirement in the near future (Scottish Government, 2021d).

Multiple interviewees across the agricultural supply chain noted this trend, suggesting that banks are already looking to understand the impact of their investments and lending. One interviewee from the financial sector stated:

“Banks are responding to the obligation on them to report the emissions profile of their lending portfolio”

Another stakeholder from the financial sector suggested that banks are particularly interested in agriculture as the emissions from this sector make up a proportionally large amount of their emission profile relative to the share of lending, yet mitigation is somewhat challenging.²³

“Decarbonising lending portfolios is more challenging (than own activities), especially for agriculture which accounts for circa 2% of lending but circa 20% of portfolio emissions”

A further interviewee, who mentioned that they were mindful of regulation and investor interest, including their TCFD obligations when it came to sourcing low carbon goods and reporting on their supply chain GHG emissions.

Interviewees suggested that financial conditions would not affect producers to a significant level, as only farms that are exposed to a significant degree of debt likely to be leveraged by lenders. There was also the suggestion that smaller holdings would bypass conditions by using alternative lending schemes, such as via Auction Mart²⁴ credit.

Tesco presents an interesting example. Along with their partner financial institution, Santander, they are offering preferential financing rates to producers in their supply chain who are willing to sign up to science-based emissions reduction targets.

²⁰ <https://www.unepfi.org/>

²¹ <https://www.fsb-tcfid.org/>

²² <https://www.fsb.org/>

²³ e.g., see https://www.bankersfornetzero.co.uk/wp-content/uploads/2023/03/B4NZ-Net-Zero-Agriculture-Report_March23.pdf

²⁴ Auction where livestock is bought/sold – Marts offer direct credit facilities to allow farmers to buy at an auction sale and defer payment until they subsequently sell the animals for (e.g.) slaughter.

Participating producers will be continuously monitored, and any improvement of carbon performance on farm will be rewarded by incentives in the Santander's supply chain finance platform. More details on this example can be found in [Case Study 8.3](#). There is no evidence on the effectiveness of this scheme or how much capital has been lent through this platform. However, this suggests that producers may be receiving a degree of support to implement carbon audits of their operations and implement measures to improve the performance of this.

Much like the RWP sector, it appears that the financial sector is fragmented in their approach to implementing GHG conditions in lending. This has led to a cascade effect, with financial institutions requiring RWPs to report on their carbon footprint and formulate net zero plans. RWPs, as discussed in Section 5.1, then put pressure on producers to report on GHG emissions from their operations. One interviewee from the agricultural consulting sector noted that many agricultural carbon calculator users were:

“Being driven by pressure from banks. This may not apply to farms directly, but will apply to processors and retailers who will then put pressure on farmers”

6 Supply chain GHG mitigation – key themes and trends

The previous section of this report outlined the different private sector entities that are putting pressure on the agricultural sector in Scotland to improve the carbon performance of their operations to different extents.

Building upon this, the following section outline key trends within this pressure, explaining how producers are expected to respond/comply and what this means for actual GHG mitigation at producer level. The following trends were ascertained from stakeholder interviews and the rapid literature review. Each subsection will summarise the main actions of producer decision making being driven by the private sector.

However, it is also important to acknowledge that on-farm climate action may also result from other drivers. For example, some farmers may have altruistic motives to improve environmental performance and others may be exploiting emerging voluntary carbon markets. Stakeholders agreed that these drivers may exist to a certain extent, but (with the exception of some high-profile cases with deep pockets) the business viability of most farms depends on generating sufficient conventional market revenue alongside policy support payments.

As one farmer-body stakeholder put it:

“It is hard to be green when you are in the red.”

Similarly, stakeholders noted that selling carbon credits from on-farm sequestration was viewed with mistrust by most farmers. Although the potential to earn additional revenue outwith conventional agricultural supply chains was appealing, uncertainty about the stability of voluntary carbon markets and the long-term impacts on business viability of selling credits that might later be needed on-farm dampened enthusiasm somewhat amongst ordinary farmers (again, some high-profile individual landowners are engaging with carbon markets).

This wariness was reinforced by cautionary guidance published by bodies such as the Scottish Land Commission and the NFUS. One stakeholder likened the situation to:

“The Wild West – lots of cowboys and snake oil salesmen. Most farmers are rightly sitting tight.”

Stakeholders did observe that some on-farm emission reductions were being driven by trends and volatility in agricultural input and output markets rather than specific climate-action pressure from downstream supply chain buyers. For example, recent spikes in fertiliser prices due to events in Ukraine had reduced fertilizer usage, which will have reduced Scottish farm emissions. As one processor-level stakeholder noted:

“Some on-farm emission reductions are arising anyway as a result of normal market pressures without any additional steer from us. The trick will be to lock those in so things don’t bounce back if input prices ease in the future.”

Stakeholders stressed, however, that they did not regard these other drivers of on-farm climate action as the focus requiring attention. Rather, attention should be directed towards why and how supply chains are organising themselves to reduce emissions, to lock-in any recent savings arising from normal market dynamics and to complement evolving policy signals. With respect to the latter, although it is anticipated that future agricultural policy will require, or at least encourage, on-farm climate action, stakeholders considered current proposals to be insufficiently detailed to guide farm decisions. As one stakeholder put it:

“The direction of travel is more-or-less understood, but the devil is in the detail and the practical on-farm implications still need to be thrashed out.”

The following sections summarise findings on supply chain drivers rather than these broader considerations.

6.1 Carbon baselining

The main driver placed on Scottish agricultural producers from the private sector is to complete baseline carbon audits of their current operations.

Although this is as yet not widespread, it is common in some sub-sectors (e.g. dairy) and is anticipated to rapidly spread across the whole industry. This is effectively being driven by retailers, although some processors have moved first in anticipation of retailer demands.

Carbon baselining at producer level is being driven by RWP pressure, as these businesses look to quantify GHG emissions within their extensive supply chains. Farmers will therefore (if not already engaged), have to complete carbon audits of their operations and provide this information to downstream members of the supply chain. It was also suggested that many RWPs are offering technical support to their producers to assist them in increasing the carbon performance of their operations. This is seen as the necessary starting point for action but will inevitably be followed by requirements to draft action plans to reduce emissions and then actual mitigation. Producers are having to gather GHG baseline information on the behalf of RWPs who are looking to build a picture of their complete supply chain emission envelope and begin to develop plans to address this source of emissions.

6.1.1 Potential for technical support

Some RWPs are already offering technical support, in the form of knowledge transfer and business planning, to facilitate producers’ net zero ambitions. For example, the major retailer Sainsburys’ states:

“We are committed to working with our suppliers, collaborating with supply chain stakeholders, and engaging with broader supply chain initiatives to achieve our sustainable sourcing goals and drive lasting, positive change”²⁵

²⁵ <https://www.about.sainsburys.co.uk/sustainability/plan-for-better/sustainable-sourcing>

In the case of Sainsburys', this includes engaging with existing supply chain initiatives, such as the Courtauld 2030 commitment. Other retailers, such as Morrisons, have taken a more direct approach, founding the [School of Sustainable Food and Farming](#), producing research and training on low carbon farming practices. It was clear through stakeholder interviews that, although the direction of travel seemed consistent, there was no consolidated approach across the industry and therefore producers are having to comply with variable demands from different buyers. Some downstream operations appear committed to achieving their net zero ambitions, whereas others see this as a market opportunity/regulatory burden. One interviewee in the dairy farming industry summarised this:

“Most processors and retailers are currently offering price incentives and technical support. Some are lagging and offer neither.”

Another interviewee from a farmer cooperative remarked:

“In enforcing net zero targets some buyers are still relatively light touch, others are really quite intrusive in the level of detail required on management practices e.g., diary entries for individual fields”

6.1.2 Carbon footprinting tools

For RWPs already requesting actual mitigation actions, rather than simply baseline carbon footprinting and/or planning, the type of mitigation measures is consistent with those in the academic and grey literature. It is also consistent with the types of measures identified by government as appropriate for policy to encourage or require.²⁶ For example, more efficient use of farm inputs (e.g., fertiliser, feed), adoption of innovation (e.g., electric vehicles, methane inhibitors), better animal health and fertility (e.g., biosecurity, breeding/genetics) and faster finishing of livestock. In addition, usage of renewable energy (generated on-farm or not) is encouraged, as is sourcing more sustainable inputs.²⁷

However, sequestration actions do not yet feature prominently. This appears to reflect continuing uncertainty over the treatment of sequestration under voluntary reporting initiatives. For example, whilst sequestration can be reported it cannot simply be counted against emission reduction targets which remain set in terms of gross emission reductions.²⁸ Moreover, not all carbon footprinting tools handle sequestration accurately as of yet. In terms of the process of carbon baselining, there was a sense from interviewees that there is currently no industry standard methodology being utilised across the supply chain to calculate GHG emissions at a producer level. RWPs are using a variety of external, free for farm use, verification tools ([AgreCalc](#), [Farm Carbon Calculator](#), [Cool Farm Tool](#)) alongside their own tools (Tesco, Arla etc.), with limited guidance on which tools are most appropriate to specific industries or geographies. This has led to some producers having to complete multiple carbon audits for different downstream buyers who are using their own verification tools and methods. One interviewee who works in the agricultural finance sector commented that:

²⁶ e.g. see the various Farmer Led group reports [Farmer-led climate change groups - Agriculture and the environment - gov.scot \(www.gov.scot\)](#) and the Scottish Government's National Test Programme and Agriculture Reform List of Measures: [Preparing for Sustainable Farming \(PSF\) \(ruralpayments.org\)](#) [Agricultural Reform List of Measures \(ruralpayments.org\)](#)

²⁷ Again, this reflects a supply chain rather than Inventory perspective which, for example, would attribute renewable energy emission savings achieved on-farm to the energy sector rather than agriculture.

²⁸ e.g., see latest AFLOU elements SBTi guidance and the GHG Protocol <https://sciencebasedtargets.org/blog/carbon-removals-in-forest-land-and-agriculture-flag-pathways> <https://ghgprotocol.org/blog/update-greenhouse-gas-protocol-carbon-removals-and-land-sector-initiative>

“A variety of carbon calculators are available – but results are highly sensitive to the quality of input data and choice of calculator. Some retailers have developed their own calculator, others have opted for pre-existing ones”

As a consequence, interviewees across the supply chain suggested that there are issues surrounding the comparability of different tools and audits. This will negatively affect producers’ abilities to claim and market the environmental benefits of their goods, as some RWPs may not recognise the tool they have used to complete their audit.

Others also doubted the credibility of the outcomes produced by certain tools. This was due to the different methodologies used by each tool, reliance on user inputs and measurements, and the proliferation of consultants undertaking carbon audits. One interviewee had doubts about the reliability of the outputs of measurements tools due to the inconsistencies in data input from producers, where collecting the data required is an additional administrative burden. Some stakeholders noted that it was easy to influence the results of carbon audits and that without this, most tools recommend reducing production to mitigate GHG emissions. As this outcome is not palatable to producer business, there remains widespread doubts in the agricultural supply chain about the validity of the current suite of carbon audit tools in use.

6.1.3 Validating target contributions

These issues raised wider doubts about the credibility of net zero targets within the Scottish agricultural supply chain. One of the most common themes mentioned by interviewees suggested that although many net zero plans have been validated by external organisations, this is a theoretical exercise without enough understanding of practical measures that need to be employed to achieve targets. Therefore, the link to carbon mitigation actions/measures on farm is insignificant, with little detail as to how carbon reductions are going to be achieved in practice. One working in the agricultural consulting sector commented that:

“Many net zero plans have been verified as plausible by (e.g.) SBTi or the Carbon Trust. But the link to practical actions is often weak, based on assumptions rather than an understanding of what might actually be feasible”

While another interviewee in the arable sector noted:

“There are real issues around accuracy and comparability – hard to believe that supposedly ‘credible’ net zero plans have actually been ground-truthed. Lots of corporate clients are effectively asking for advice on what can be done to achieve their targets”

Another important theme that was identified by stakeholders was that as the private sector has had to take the initiative in selecting which tools/standards they have requested producers to use in monitoring their GHG emissions. As this approach has been fragmented, the opportunity to harmonise standards in this regard may have been missed. One stakeholder from the finance sector noted:

“Given international carbon standards take the form of guidance rather than prescriptive requirements, and different firms have already started down different ways of measuring emissions it is very unlikely that standardisation and cross-case comparability is achievable now”

6.1.4 Producer concerns

Producers are concerned about the risk of being “busy fools ticking boxes” to no real climate benefit when the big wins are outwith farmers’ control e.g., embedded emissions in fertiliser manufacturing and bought-in feed. It is easier to verify on-farm actions than provenance of inputs. For example, traceability of imports (e.g., animal feed) is

imperfect, so verifying emissions for them is difficult. Indeed, downstream firms are concerned about the reputational risk of relying upon farm-level data that have not been independently verified. This applies particularly to imports but also to domestic production and is stimulating interest in the use of (e.g.) remote sensing and digital data gathering.

It is important to note that we found very little evidence on the impact of carbon baselining and action plan formulation to date on producer GHG mitigation. The private sector drivers currently being placed on producers are limited to baselining and plan formulation, with little evidence of management practice prescriptions. Therefore, it is unlikely that existing drivers are leading to significant reductions in GHG emissions at a producer level. Stakeholders suggested that they expect more prescriptive demands to be placed on producers in the near future, with mandatory GHG reduction evidence becoming standard practices in commercial contracts and supply chains.

In summary, producers are currently being pressured into using a range of different calculation tools and methodologies to calculate on farm emissions at the behest of RWPs. Some producers are also being provided with technical support and wider informational support, with some required to produce carbon reduction action plans/roadmaps.

The private sector has driven this process, with minimal coordination with producers. This has led to issues of comparability, verification and credibility of the outputs of producer carbon audits. Interviewees suggested that harmonised standards and a singular calculation tool would be beneficial to the producers, allowing comparability and benchmarking across sectors.

6.2 Standardised Metrics, Measurement, Reporting and Verification (MRV)

Private sector drivers in the Scottish agricultural supply chain are driving producers to comply with multiple carbon standards across multiple buyers.

Many interviewees brought up the issue of the lack of standardised metrics and quality assurance schemes in relation to Scope 3 emissions in producer carbon baselining. This is interlinked with the comparability issue raised regarding the use of multiple carbon audit methodologies. Interviewees, on the whole, suggested that taking a harmonised approach to the MRV of GHG emissions would be beneficial to agricultural producers in Scotland. This was supported by interviewees, with concern noted that the MRV burden is currently being placed on producers due to the lack of a joined up approach from buyers in the supply chain. One interviewee in the arable sector noted:

“Lots of buyers are doing similar things, but all in their own way – so farmers selling into multiple supply chains (either for the same product or for different products) face a dizzying array of different reporting demands and formats. Some buyers (e.g. distillers) have been asking about carbon for years, others (e.g., manufacturers, retailers) are now starting to do so”

6.2.1 Differential impact on a diverse sector

Importantly, many suggested that many smaller holdings will not be able to keep up with the increased MRV burden, which will lead to some sinking under the weight of increased responsibilities. As the private sector has driven producer baselining activities, there has not been an adequate consideration of the pressures placed on smaller producers. Some interviewees mentioned that harmonising reporting standards would improve credibility issues and reduce the administrative burden on farmers by allowing

comparability across producers. This was directly stated by one interviewee, representing arable producers, who suggested a government initiative could help resolve this issue:

“Government could help by standardising information needs and carbon calculators, otherwise businesses utilising multiple supply chains will drown under the inspection/reporting burden”

Another from the food processing industry suggested that:

“Harmonising emission factors and carbon calculators might be helpful, and aware that UK may follow Ireland/Denmark/New Zealand in seeking one domestic approach – but it will be a struggle”

6.2.2 Quality assurance schemes

One measure mentioned by multiple stakeholders involved integrating GHG emissions into Quality Assurance (QA) schemes. QA schemes, such as Red Tractor²⁹, provide reassurance to customers that products meet a certain quality standard. An interviewee in the food processing industry noted:

“Harmonizing emission factors and carbon calculators would be helpful but will be a struggle. Using QA schemes (e.g., Red Tractor) is an obvious route to take, including allowing earned equivalence between separate verification processes”

A wider theme from the interviews was the need for more qualitative metrics to be factored into the GHG mitigation audit process. Current metrics focus exclusively on quantitative elements, such as GHG emissions and process efficiencies. Including qualitative metrics, such as farmer engagement, would improve the uptake and performance of producers. One interviewee from a trade body also suggested that:

“Focus on quantitative metrics needs to be supplemented by a consideration of engagement with the process i.e., do farmers understand the ask of them and are they responding”

QA standards can potentially provide benefits for producers via price premiums and increased product visibility, however, there is still the possibility that smaller farm holding would not be able to cover the cost associated with certification or manage the MRV burden (Kissinger, 2012).

This may offer some opportunities for co-ordination across the private and public sectors, both in terms of which indicators are chosen and how they are monitored. For example, it might be possible, and sensible, to align and share information between processor/retailer requirements, levy board quality assurance standards and ‘cross-compliance’ with public support schemes (e.g. QMS, Red Tractor, LEAF etc.). Ideally, data are provided once, in an agreed common format, and are then available for repeated use by the farmer when needed and to (only) nominated other users (Thomson, 2021a). On this topic, Red Tractor have recently announced a timetable to make its Greener Farms Commitment available from the 1st of April 2024³⁰, which will attempt to provide a singular standard and common set of sustainability criteria, as an add on module to the existing Red Tractor, for agricultural goods produced in the UK. Major retailers, such as Tesco, Morrisons and Sainsburys have endorsed the commitment.

In summary, interviewees were concerned that the MRV burden, imposed by buyers on agricultural producers in Scotland, has the potential to become unmanageable for

²⁹ <https://redtractor.org.uk/>

³⁰ <https://redtractorassurance.org.uk/news/red-tractor-sets-out-next-steps-to-making-voluntary-environment-module-available-next-year/>

producers. Mandating common data requirements, reporting methods across the supply chain will ensure that the burden is not disproportionately put on producers, especially those from smaller holdings. Thompson (2021) suggests that information can be aligned and shared between processor/retailer requirements, levy board quality assurance standards and 'cross compliance' with public support schemes (Red Tractor, LEAF etc.). The result of this would be that data from a producer would only need to be provided in one format that could be shared across the whole value chain when required. However, achieving 'earned equivalence' between different reporting mechanisms has proven challenging in the past. Such issues are being considered at the UK level by the Food Data Transparency Partnership led by Defra with Devolved Administrations' involvement.

6.3 Farmer engagement and costs

Many interviewees noted issues surrounding producer engagement and willingness to implement the drivers being requested by buyers in the agricultural supply chain. One stakeholder from the finance sector noted:

“There is a massive challenge in communicating issues to farmers and gaining their engagement with a programme of change. Some measures may be win-win, but costs of capital investment and skills development may be high”

For some producers, the burden of change may dis-incentivise engagement as the rest of the supply chain transitions towards low carbon production. This may be particularly relevant to smaller holdings, where traditional methods of production are more evident and the resources available to adopt new practices and administration are limited. One interviewee from the arable sector mentioned that this point was particularly pertinent to holdings that use a range of machinery, suggesting that:

“Change takes time and needs long-term commitment. For example, life-span of machinery is 10-20 years, so no chance of a quick conversion to (e.g.) electric tractors”

Another interviewee, on this theme, suggested that farmer buy in to carbon audits is poor and that they are only completing audits because they believe that they have to. Where farmers are not willing or able to engage, there are often expectations that government administrations should provide support for those who are not able to comply with new sustainability regulations due to the cost of transition and the administrative burden (Leat et al, 2011).

6.4 Contractual obligations and buyer conditions

Some producers are having to fulfil contractual obligations regarding the improvement of carbon performance on farm, whereas others are not. This varies depending on the producer type and their relationship with their buyers. As discussed in the literature review, agricultural producers enter contracts with buyers for different reasons (risk reduction, product quality etc.).

6.4.1 Contractual obligations

In a Scottish context, the dairy, arable and legume industry are familiar with relatively prescriptive contracts, with conditions being imposed on them by buyers. Other producers, such as beef and sheep, are not used to these prescriptions and usually sell their produce at spot markets rather than through contractual agreements with buyers. Therefore, the dairy, arable and legume industry are more likely to be impacted by private sector drivers for emission reduction on farm than beef and sheep. For example,

Tesco offer long term contracts to their potato farmers, many of which are based in Scotland, giving them confidence to plan and invest in long term changes such as GHG reduction measures. Further details of the kind of prescriptions being placed on the dairy industry can be found in the case study of Arla in section [8.1](#).

Retailers can also influence sales by promoting goods such as local produce or other “green” marketing. This feeds into the larger picture of competitive advantage within the retail sector and will influence the move towards low carbon and sustainable food goods from suppliers able to show they can meet the requirements. However, as there is currently no price incentive for suppliers to meet any additional requirements to fulfil the marketing ambitions, unless there is a contract in place, they are unlikely to make changes to access these markets, favouring instead the highest available sale price.

Many interviewees noted that contracts in the supply chain are an integral part of how the system functions, and that ensuring that these are fair to all stakeholders involved is a challenge. This is supported by the findings of the Oxford Farming Conference (2023), which suggested that contracts, and the rules that govern them, are a consistent challenge – making transformation even more difficult. The Conference also noted that many stakeholders in the industry believe that there is an asymmetric power dynamic in many supply chains.

During this research, it became clear that contracts were not being consistently applied in the same way across all farm types within the agricultural sector. Interviewees suggested that the dairy and arable industry are more advanced in achieving low carbon production due to its previous history of a closer relationship between suppliers and buyers, resulting in a familiarity with contracts and quality specifications. One interviewee from the dairy industry noted:

“Dairy farmers are used to prescriptive contracts, just another aspect of being in business”

With another from a trade body stating:

“Beef and sheep farmers are most worried about autonomy because they are not used to prescriptive contracts”

Within the beef, sheep and pig industry, prescriptive contracts have not been commonplace, suggesting that some producers in these sectors would face challenges in adapting their supply chain relationships. Despite existing familiarity with contracts, the dairy industry has faced challenges in ensuring that the power dynamics in these contracts are effectively regulated. A recent Defra consultation revealed stakeholder evidence of poor contractual relations in the dairy sector in the UK. This was characterised by imposition on producers of short-term changes to specifications and contract terms, difficulties in terminating contracts within a reasonable period if changes are made to prices or contract terms (Defra, 2020). In the consultation responses, stakeholders noted that producers occupy vulnerable positions in the supply chain, with a bargaining power that is “virtually non-existent”, which led to difficulties in business planning in the long term due to uncertainties (Defra, 2021).

6.4.2 Contractual incentives

Rather than imposing prescriptive contracts, processors and retailers can offer incentives to producers. One dairy processor outlined how they have implemented a point-based incentive to their suppliers. Producers are awarded points for a range of pre-defined mitigation actions. If producers achieve a threshold score (40 out of 80) they will avoid penalties on their standard contract price. This is with the aim of reinforcing best practice through scalable solutions, and rewarding those producers who follow this. It should also be noted that the multinational processor Nestle currently offers its milk

suppliers a 'sustainability contribution' for delivering milk with a lower milk contribution and First Milk, a dairy cooperative with a strong presence in Scotland (who feed into Nestle's milk pool), who employ a similar mechanism.

Despite instances of incentives, the evidence as a whole suggests that producers will need to improve the carbon performance of their operations simply as a condition of staying in business. Monitoring and addressing the carbon impacts of producer operations will become a requirement of being a supplier. One processor commented:

“Farmers need to fund any actual investment or management change and are not offered any price premia – low carbon management will simply become a condition of being a supplier. Farms will face burden of measuring and reporting emissions, plus will probably incur adjustment costs to mitigate emissions”

This view is supported by the findings from the latest Oxford Farming Conference³¹, where it was noted that new reporting requirements are usually seen as the cost of market access and any additional time and cost commitments are absorbed by the farmer (Oxford Farming Conference, 2023). Although many mitigation measures identified by carbon reduction plans are efficiency measures that will be financially beneficial for farm business in the long term, finding the upfront capital costs for these improvements is often challenging. This has potential implications for the long-term viability of less efficient farms, and therefore for policy responses relating to the retention of incumbent farmers and/or support for a Just Transition.

Stakeholders noted that retailer aligned contracts may become commonplace in the future. Currently, these are mostly seen in the dairy supply chain. Through retailer-aligned contracts, the dairy industry has seen success in delivering carbon reduction on farms in return for a premium price (Scottish Government, 2021d). One stakeholder from the arable sector suggested that RWPs are:

“Mainly still nudging (to encourage low carbon practices), seeking information and plans plus offering technical support. But some prescriptive contracts exist, and these will surely become more commonplace”

This approach is echoed by advice given by the Food & Drink Federations 'Roadmap to net zero' guidance, advising the UK food and drink sector on how to achieve net zero in their supply chains:

“Ingredients are likely 50 to 75% of your total corporate emissions. The first action is to understand the carbon footprint of your products, and where high impacts reside.

Procure lower carbon ingredients from your producers and other suppliers. Ingredient emissions are determined by your upstream suppliers. Suppliers should be engaged, and over time, procurement requirements introduced for climate performance.

Incorporate carbon targets into product reformulations and new product development.

Current product formulations may need to be updated or reformulated, to reduce high emission ingredients in line with requirements for net zero” (Food & Drink Federation, 2021).

³¹ Oxford Farming Conference (2023) Supply Chain Synergies. 1

6.5 Policy signals

Agricultural producers are not sure what actions to take on farm as they are unsure as to if they should follow the private sector initiatives, such as carbon baselining through multiple different tools, or wait for a firm indication of a standardised approach from the Scottish Government regarding carbon baselining and reduction measures.

Stakeholders suggested that policy signals in Scotland were not clear, which has a detrimental effect on the uptake of climate change mitigation at all levels across the supply chain. One interviewee in the finance sector summarised this:

“Lack of clear policy signals in Scotland is hampering long-term planning, and private sector is overtaking policy – which risks fragmentation and confusion”

Others suggested that the government could set minimum data standards, allowing comparability across the supply chain. As this currently does not exist, many parts of the supply chain are progressing with their own initiatives. All of those involved in the supply chain suggested that a clearer policy steer would be appreciated. One interviewee suggested that agricultural producers are holding off as they are unsure of the political change of direction.

It is clear from the interviews that the majority of stakeholders believe that government intervention, especially in regard to reporting standards and metrics, would be beneficial.

7 Impact of private sector drivers on agricultural producer decision making

The evidence reviewed here confirms significant drivers affecting producer decision-making on GHG mitigation measures in Scottish Agriculture. Although mostly limited to carbon baselining and action plan drafting, some producers are responding to wider private sector drivers either through choice or obligations, whereas others are not willing or are incapable of meeting these demands.

7.1 Producer responses to buyer pressures

Agricultural producers are responding to the private sector drivers by attempting to improve process efficiencies on farm. The reasons behind this are commonly given as improving the financial viability of the farm (market access, price premium etc.), improving process efficiencies and sense of responsibility to mitigate the negative effects of the business on the environment.

Stakeholder interviews confirmed many of these themes. One interviewee from a farmer cooperative put this simply:

“We have a moral responsibility as a producer to make a change”

Another noted that:

“Many mitigation measures improve the bottom-line through improving productivity, so costs can be viewed as an investment rather than a burden”

Despite agricultural producers broadly supporting GHG mitigation measures, stakeholders suggested that farmers were adopting these mainly due to buyer demands. This would suggest that for some producers, carbon reduction measures are seen as an obligation, rather than what they would undertake through their own initiative. One interviewee representing producers noted:

“Farmers addressing GHG reductions are not in their own plans per se - but have to bend to buyers’ demands”

7.1.1 Administrative issues

Our research confirmed existing concerns that producers are struggling with the administrative burden of MRV, as multiple buyers request data in different formats due to the lack of cohesion and comparability across the wider agricultural supply chain. This suggests that the wide range of private sector drivers coming from different parts of the supply chain is preventing agricultural producers from taking effective action due to the uncertainty this creates. Another theme noted by stakeholders is that some producers do not have the support needed to act on both buyer demands and their own initiatives, both in financial and knowledge terms.

Whilst many producers are supportive of GHG emission reduction measures on farm, some may view this as a burden. Stakeholders identified gaps in funding and knowledge as key barriers that may be preventing the uptake of mitigation measures by certain producers in response to buyer drivers.

7.2 On farm mitigation measures

In response to buyer demand for increased carbon performance, producers are looking to improve the carbon performance of their farms by improving process efficiencies. This

theme runs through the Farmer Led Climate Change Groups³² commissioned by the Scottish Government, with all groups signifying their intent to reduce the emissions intensity of their farming systems by improving on-farm production and greenhouse gas efficiencies through better input and resource utilisation (Scottish Government, 2021a). This aim is also summarised by the Independent enquiry on farming and climate change in Scotland (2022), who state:

“We must produce at least the same national output per capita in terms of protein, calories and micronutrients for people while reducing the negative impact of that production”

The alternative to improving process efficiencies would be to reduce production volume, which is an unattractive solution to producers. One interviewee representing producers summarises this:

“We ran our own study on 8 farms using a carbon calculator and concluded the only thing that would make a difference was reducing production – which is not an economically viable solution”

Therefore, farmers intend to continue to produce the same level of output whilst decreasing emissions intensity through improved operations and technological innovation. Although there will be significant differences between sectors, general mitigation measures that are currently the focus of producers include

- improving feed efficiency
- herd health and selective breeding
- slurry management
- plant breeding
- fertiliser management
- renewable energy generation
- new technologies (e.g. alternative fuels) and
- soil health/carbon sequestration and wider carbon sequestration on farm.

One stakeholder in the arable sector summarised their thoughts as:

“Plant breeding can (and has) delivered significant productivity improvements over time – not smoothly but in sudden jumps – and this will contribute to emission savings. However, the big savings depend on producing fertiliser in a different way and converting machinery away from diesel fuel”

Another stakeholder in the dairy sector shared this view, stating that the mitigation efforts they are planning are:

“Breeding and methane inhibitors probably in the future, but more immediately just adoption of best practice e.g., carbon audits, nutrient and health management”

In summary, producers are responding to private sector drivers by looking to improve productivity gains on farms by employing best practice mitigation measures. However, many producers are anticipating that further reaching emission reduction measures will rely on the introduction of new technologies and novel management practices. Anticipated technological solutions include low carbon fuels for static and mobile machinery and management innovations such as sky farming (using drones for herd management).

³² <https://www.gov.scot/policies/agriculture-and-the-environment/farmer-led-climate-change-groups/>

7.3 Producer attitudes towards drivers

Stakeholders largely agreed that complying with increasing buyer demands for improved carbon performance will be the price of being in business in the near future for many Scottish agricultural producers. Most agreed that producers will have to absorb the cost and administrative burden of the transition to low carbon farming methods. One interviewee summarised this viewpoint:

“Farmers need to fund any actual investment or management change and are not offered any price premium – low carbon management will simply become a condition of being a supplier”

With this in mind, many industry bodies have laid out their route to decarbonising food production. This is with the aim of complying with producer demands and enabling farmers to recoup a price premium for lower carbon goods. One example of this is from the Scottish Red Meat Industry (2022) report, where the following target is set:

“As an industry, we commit to bringing forward a full science-backed route map to net zero by the end of 2023, working with our Scottish scientific and research institutes to detail how as an industry we will reach our legislative goal of net zero by 2045”

8 Case studies

We have included here case studies that exemplify some of the main private sector drivers being placed on producers within the agricultural supply chain, and what this means for GHG emission reductions.

8.1 Producer – Arla

Arla is a farmer owned multinational dairy cooperative with a strong presence in the UK, with a revenue of £2.17bn in the UK in 2021. Of the 9,700 dairy farmers in the cooperative, 2,053 are British. Arla is a typical example of horizontal integration, where the cooperative has developed a significant market share in both producing and processing. Arla claim to have half the emissions intensity per litre of milk than the global average.

Arla has a carbon reduction emission target of 30% by 2030 and net zero by 2050. The Science Based Targets initiative has approved this target. To achieve this, Arla has developed its own QA scheme, Arlagarden, that has been in place since 2003. The programme focuses on milk quality, food safety and animal welfare and ensures that all of Arla’s cooperative farmers are aligned to the same standards.

The three main aims of Arla in the near future are:

- 1) Integrating environmental performance into the Arlagarden programme
- 2) A globally aligned Climate Check programme (a form of carbon audit for Arla farms and GHG mitigation measure advice)
- 3) Developing a Digital Farm Management Platform to record data and support farmers

To support its Climate Check programme, Arla is offering a one eurocent per kilo of milk financial incentive programme to support the initial rollout and encourage accelerated uptake.

Within the Climate Check programme, farmers are still responsible for collecting data, including feed consumption, energy use, fertiliser use, crop yields, herd data, manure

storage and application and products sold. Once farmers have input this data into Arla's Digital Management platform, a carbon report is generated and an advisory visit is booked in to suggest mitigation measures specific to that farm.

8.2 Retailer – Tesco

Tesco is the UK's biggest supermarket group, holding just under 30% of the UK's supermarket market share.

Tesco has estimated that over 90% of its total emissions footprint occurs in its products and supply chain. With this in mind, Tesco has committed to achieving zero emissions across its supply chain by 2050, covering all scope 3 emissions.

To achieve this ambition, Tesco has prioritised the following actions:

- Supporting all suppliers to establish a net zero ambition and set science-based targets
- Accelerating operational decarbonisation across key emissions hotspots such as refrigeration, heating and transport
- Trialling innovations with suppliers to reduce emissions from agriculture, including the use of low-carbon fertiliser and alternative animal feed such as insect meal
- Cutting emissions associated with customer's diets, including increasing the sales of plant-based products
- Advocating for collaborative industry action and support from Government

In April 2021, Tesco announced that it would offer its supply base sustainability-linked supply chain finance, in a move the retailer hopes will encourage more suppliers to sign up to science-based emissions reduction targets. This will involve annual greenhouse gas emissions data provided by suppliers independently verified and assessed by sustainability experts, Anthesis. Tesco suppliers will be offered preferential financing rates via Santander's market leading supply chain finance platform, based on their carbon performance improvements. Tesco will regularly update the scope of the sustainability data requirements in line with market best practice and its own sustainability commitments. The retailer expects the programme to be of particular interest to small and medium-sized businesses. Tesco will provide online tools and support to help these suppliers enrol in the scheme.

8.3 Finance – Barclays

Barclays have allocated £250 million of funding for farmers to make their businesses more environmentally sustainable and energy-efficient. As part of this, Barclays are training all of their 130 agricultural managers across the UK in sustainability and future agricultural policy. To be eligible for this funding, applicants will need to show that their farming project will increase the efficiency and sustainability of their business through the use of technology, information or improved infrastructure. This could include the following types of projects:

- Carbon sequestration – from carbon capture and storage to changing land use to support carbon capture and storage
- Carbon assessment/emission reduction – support for undertaking a carbon footprint exercise alongside emission reduction measures such as low-emission vehicles, renewable energy generation or energy-efficient buildings
- Soil health – projects that improve soil health
- Natural capital – renewable energy generation through solar, wind and hydro

Furthermore, Barclays signed a three-year partnership with Oxford University's Sustainable Finance Group (OxSFG) and the UK Centre for Greening Finance and Investment (CGFI) in October 2022. This is with the aim of generating better emissions data and establish decarbonisation pathways that will enable Barclays and other financial institutions to support clients in the UK agriculture sector to lower emissions and transition to more sustainable practices. The methods developed by this partnership will underpin the medium-term targets by Barclays to reduce emissions resulting from financing activities to agriculture clients. This is in combination with Barclays membership of the Net-Zero Banking Alliance – committing the bank to set science-based targets in relation to its financing for the highest emitting sections by 2024 – including agriculture.

8.4 Producer - Balcaskie Estate³³

Balcaskie Estate covers around 2000 ha in Fife, with a mixture of let family farms covering almost 1/3 of the estate and the rest in-hand operations. They run a mix of species rich grazing with low-stocking density cattle and sheep alongside rotating crops of barley, beans, radishes and vetches.

Balcaskie have been using AgreCalc for three years. They note that the results have not always been completely accurate, favouring intensification as the solution in their situation. Balcaskie noted that AgreCalc does not look at carbon sources that are outside of the system, such as soya feed for their chickens that is imported from abroad.

They also note that newly introduced mitigation measures (such as minimum ploughing) often take 3-4 years to see the effects. This is combined with issues of economies of scale, with large capital investments needed to improve efficiencies and processes.

The estate believes that farmers no longer have knowledge to change their processes as they have been influenced by agri-businesses with commercial interests that have persuaded them to increase their inputs.

Balcaskie are of the opinion that support for selling organic produce is lacking, yet the costs of producing are higher. This is a parallel that is potentially currently seen in the wider industry, with less carbon intensive methods of producing incurring a higher cost to produce but not demanding a higher price premium.

8.5 Processor - ABP Food Group

ABP recently announced the launch of their PRISM (Programme for the Improvement in Sustainability of (red) Meat) 2030 initiative. ABP's PRISM 2030 partners are The Andersons Centre (Andersons), Harper Adams University's Professor Jude Capper, and the carbon calculator being used is provided by AgreCalc. All 350 places on the initiative have been filled by partner farms.

During the next three years, ABP's agricultural team will work closely with the partner farmers to measure, monitor and assess ways to reduce GHGs on farm.

As part of the partnership, individual farmers can access monetary grants from ABP's £250,000 fund, to buy necessary equipment and access practical advice, helping them to reduce their GHGs.

³³ Adapted from Farming for 1.5° (2022), One farm at a time: different pathways to reducing emissions.

Each farm has the option for confidential benchmarking for both their carbon footprint and enterprise performance. Participants receive a report from Andersons and tailored recommendations on how to make reductions, from Harper Adams.

8.6 Producer/Processor – Diageo

In October 2023 Diageo announced that two regenerative agriculture programmes across its tequila and scotch brands in Mexico and Scotland respectively. The programmes are focused on reducing the carbon emissions of farming barley and wheat for Scotch whisky, whilst driving additional benefits for the farmers.

The programme aims to drive positive outcomes of enhanced biodiversity, improved water stewardship, carbon reduction and better soil health management. The programmes will look at locally adapted practices such as cover crops, reduced cultivations and crop rotations.

The first phase of the pilot project will focus on 20 farms in key barley and wheat sourcing regions in Scotland.

Diageo have not provided details on the scale of finance and/or incentives that suppliers could be promised if they implement regenerative agricultural practices.

8.7 Processor - Dunbia

Dunbia has announced that it is investing an initial £1 million in a supply chain project to measure the carbon footprint of 500 farms in their supply chain. The project, named 'Bigger Steps for Smaller Footprints', will consist of the following steps:

- The carbon footprint of 500 suppliers will be measured and compiled by Dunbia
- The Carbon Trust will validate the methodology employed in the carbon footprints. With the data from the initial 500 suppliers the Carbon Trust will calculate the representative emissions of the 20,000 farms that supply Dunbia.
- After the carbon audits have taken place, an agricultural consultant will provide advice to farms that have been measured on how they can reduce their environmental impact.

The main aim of this project is to support Dunbia's science based targets to reduce emissions in their supply chain.

8.8 Processor - Simpsons Malt

Simpsons Malt have a target to achieve carbon neutral malting barley and distilling wheat production by 2030.

To achieve this, Simpson Malt have implemented SAI Platform's Farm Sustainability Assessment (FSA). This includes the measurement of greenhouse gas emissions from producing crops, traceability of the seed and crop inputs, maximisation of input-use efficiency and the use of lower carbon products such as low carbon fertilisers and cover cropping.

The findings from the initial trials of this platform will be shared with other suppliers.

9 Conclusions

This research has reviewed the evidence of private sector drivers on agricultural producers in Scotland, and the extent to which these drivers have led to improved environmental management practices and subsequent GHG reductions.

Many agricultural producers in Scotland are completing carbon baseline audits of their operations at the behest of their buyers. As most major retailers (along with some processors and wholesalers) have signed up to science-based targets emission reduction initiatives, they are looking to reduce the impact of their scope 3 emission envelope (to which producers sit within). These groups are therefore either enforcing their suppliers to undertake carbon audits or providing limited support such as technical advice or support groups. We found limited evidence that producers are receiving financial incentives or benefits in undertaking these audits.

There is evidence that agricultural producers in Scotland are receiving support to draft carbon reduction plans that comply with science-based target initiative emission reduction schemes. This is being driven by retailers, who have signed up to these initiatives and require their suppliers to also comply with these standards to ensure that their emission reduction targets appear credible.

Producers are receiving informational support from their buyers, such as knowledge exchange and peer-to-peer learning groups, to facilitate the adoption of low carbon practices on farm.

9.1.1 Carbon auditing

There is little evidence to suggest that the process of carbon audits and action plan creation has led to significant tangible impacts in GHG reduction in Scottish agriculture at the producer level. Stakeholders suggested that carbon audits and the subsequent carbon reduction plans are often not rooted in reality, and follow prescriptive paths set out by initiatives that do not have an in depth understanding of Scottish agriculture. Therefore, there is some doubt that carbon auditing/reduction plans will lead to emission reductions in real terms.

9.1.2 Other prescriptive actions

Beyond carbon auditing and action plan creation, there is little evidence of further demands currently being placed on most agricultural producers in Scotland. Many stakeholders suggested that more concrete prescriptive actions were likely to be placed on producers by the private sector in the near future, but there were uncertainties about the details and timescales of these.³⁴

9.1.3 Financial support

Beyond isolated examples, such as Arla and Tesco, we did not find much evidence that producers in Scotland are receiving financial support to improve the carbon performance of their operations. This is likely to be due to the fact that consumers are unwilling to pay the price premium associated with higher carbon performing goods. Therefore, it is likely that complying with increasing private sector demands in regard to carbon performance will simply be a cost of being an agricultural producer in Scotland. There is a concern that smaller holdings will not be able to absorb the administrative and financial burdens of these drivers without further support.

³⁴ Although the pace of change appears to have quickened since the formal stakeholder interviews were conducted, according to further feedback offered by some interviewees more recently. See also recent announcements such as [Diageo announces regenerative agriculture programmes across Scotch whisky and tequila](#) and [Cefetra UK | The launch of our new ground-breaking initiative](#)

9.1.4 Anticipating change

Some producers are taking mitigation actions in anticipation of future regulatory conditions (from buyers and government), some are complying with current buyer demands and some are unwilling or unable to change the nature of their operations.

Of those that are taking action due to private sector pressures, this usually takes the form of process efficiencies on farm, such as more efficient use of farm inputs (e.g., fertiliser, feed), adoption of innovation (e.g., electric vehicles, methane inhibitors), better animal health and fertility (e.g., biosecurity, breeding/genetics) and faster finishing.

In Scotland, the dairy industry (and arable) is best placed to adapt to increased buyer conditions due to their familiarity with prescriptive contracts. Beef and sheep are still lagging behind in addressing the carbon associated with production due to their traditional reliance on spot markets to sell their goods.

We have found clear evidence that within the agricultural supply chain, RWP exert significant influence over agricultural producers in Scotland. Regarding emission reductions, these groups are beginning to exert pressure on producers to complete carbon baselining exercises and formulate carbon action plans. However, there is little evidence that these drivers have as yet led to actionable emission reduction management practice changes on farm. Therefore, there is little evidence that these drivers have led to any emission reductions at the producer level to date. There is limited evidence that private drivers are providing incentives rather than obligations to Scottish producers to improve the carbon performance of their operations, with Arla and First Milk in the dairy sector providing notable exemptions to this.

We found no evidence of customer focused marketing and geographical drivers (e.g. location-based marketing) related sales conditions on producers. We therefore cannot conclude that this does not have an impact and would suggest further research is needed in this area if these topics warrant further consideration.

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11 Appendix A – Specific retailer commitments and actions

Tesco

Tesco has committed to achieving zero emissions across its supply chain by 2050. Tesco wrote to all of its suppliers to ask for their support in the transition to a low carbon economy and will support all suppliers to set science-based targets.

“We are requesting that all of our first-tier suppliers across Tesco Group report on emissions, working with our supplier partners to co-design our decarbonisation pathways”

In 2017, Tesco set science-based targets for both its own operations and supply chain in line with the Paris Agreement’s 1.5C pathway.

Tesco offers support to its suppliers through its ten Sustainable Farming Groups, aiming to drive industry collaboration. One of these is the Tesco Sustainable Dairy Group (TSDG), set up in 2007. The TSDG helps farmers invest in animal health and welfare, carbon reduction and supporting nature on farm. According to Tesco, Since 2016, the Tesco Sustainable Dairy Group has reduced its carbon emission by 8.5% and is industry leading in this area³⁵. All TSDG farmers receive a carbon assessment report each year from an independent consultant, which highlights their carbon hotspots and outlines interventions (application of nitrogen fertiliser, increasing animal health, improving energy efficiency and building soil organic matter) to address these.

It is not clear if Tesco offers a price incentive or penalty to farms within the TSDG.

On a wider scale, Tesco claims that 100 of its largest suppliers have already reduced manufacturing emissions by 20%.

Asda

Asda has begun the process of trying to measure its Scope 3 emissions. As a result, they have asked suppliers to set carbon reduction targets and will provide support through knowledge sharing initiatives.

“We are currently working with key suppliers to help map a more complete view of our Scope 3 emissions and we continue to hold an annual Supplier Conference to bring together supplier representatives and Asda colleagues to share ideas and solutions to tackling issues across our whole sustainability scope. The Asda Sustain & Save Exchange is an online tool supported by live events, free for our suppliers, which gives them information and ideas, and enables them to share best practice and identify opportunities for increasing resource efficiency”.

The Asda Sustain and Save Exchange (SSE) is an online private community for Asda suppliers to collaborate and share best practice in resource efficiency and sustainability, fully funded by Asda. The programme has been running since 2012, and has since grown to over 2,300 members from 700 suppliers, from across all categories.

According to Asda, this initiative has helped suppliers reduce their carbon footprint by over 72,000 tonnes.

³⁵ <https://www.tescopl.com/sustainability/planet/farming-and-agriculture/tesco-sustainable-dairy-group>

Asda monitors progress through their Asda KPI Tool where suppliers provide annual facility-level environmental metrics. Asda uses this to track improvement across each category and identify potential areas for targeted support. The retailer holds an annual Asda Supplier Sustainability Awards ceremony to celebrate best practice.

Sainsbury's

Sainsbury's has not yet committed to how it will engage with its supply chain to achieve its target of a 30% reduction in Scope 3 emissions by 2030. They have started working with selected suppliers to develop their own emission reduction targets.

Sainsbury's Dairy Development Group was set up 2007 and brings together other 290 dairy farms to establish an independent pricing model and support farmers to achieve their sustainability goals.

In September 2023, Sainsbury's committed to funding £1.7m for sustainability bonuses. Farmers will be rewarded for helping Sainsbury's to achieve its Plan for Better targets, specifically carbon reduction, through activities such as using sustainably sourced feed and using the correct amount of fertiliser,

“As part of Scope 3, Sainsbury's will be working with selected suppliers to develop their own Scope 1 and 2 targets, and measure their performance through industry disclosures such as CDP and the Higg Index”

Morrisons

Morrisons has committed to net zero in its own operations by 2025. Morrisons has indicated that it will look to reduce emissions rather than relying on offsetting. They are looking to reduce Scope 3 emissions by 30% by 2030 and wants to source all of its own brand products from 'net-zero' farms by 2030.

“Morrisons is also committing to reducing its wider 'Scope 3' emissions across its entire own brand supply chain - by 30 per cent by 2030 and is already working with suppliers to support them in this”

In 2021 Morrisons offered 400 of its own-brand suppliers access to a new industry-leading software platform called Manufacture 2030. The tool will help suppliers to accurately measure, track and forecast their operational carbon emissions.

Morrisons is also providing procedural support to suppliers, running webinars and peer-to-peer advice. This focuses on the topics of operational emissions, energy efficiency, on-site renewable energy generation, and waste to landfill – while making processes more resource and cost efficient.

Own-brand suppliers have been invited at no cost to join Morrisons environmental programme. Morrisons will fund the cost of the tool for each of its own-brand suppliers. The programme was intended to be rolled out to a wider group of suppliers in phases throughout 2022.

Lidl

Lidl have taken a slightly different approach in obliging their suppliers to take ownership of their own emission reduction targets. This will include support with carbon auditing and carbon reduction plans.

“To tackle Scope 3, which represents over 98% of all emissions, Lidl will oblige suppliers, representing 75% of product-related Scope 3 emissions, to commit to their own climate protection targets according to the methodology of the Science Based Targets initiative by 2026. This will be delivered through a comprehensive supplier engagement and learning programme across the Group, including

supporting farmers on Lidl GB’s Grassroots programme to conduct carbon footprints on their businesses and develop carbon reduction plans”

12 Appendix B - Methodology

12.1 Desk-based review

We undertook a focused literature review to identify existing policy and research relating to climate change related sales conditions imposed on the agricultural industry in Scotland, also taking lessons from other UK and international markets (e.g. Landscape Enterprise Networks). This focussed on the four main agricultural sectors based in Scotland (as outlined in the project aim and need) and was broken down into three key themes;

- a. customer focused marketing (Carbon Trust’s product carbon footprint label, farm level carbon accounting tools such as Agrecalc)
- b. compliance with regulation, uptake of new technologies and low carbon farming practices (for example, Tesco has committed to net zero emissions from its supply chain by 2050, Triodos bank offers finance for organic, biodynamic and sustainable farming)
- c. location based marketing, with local produce promoted over international alternatives (Morrisons claims that its fresh meat, milk, cheddar and eggs are always 100% British)

A further desk review was undertaken to assess the following drivers in producer decision making on climate change;

- d. market based obligations/incentives that support long-term engagement with a produce sector
- e. government sourced obligations/incentives that support long-term engagement with a produce sector (Agri-Environment and Climate Scheme – Scottish Rural Development Programme (SRDP), Food Processing Marketing and Cooperation Grant Scheme)

In order to conduct a robust, rapid evidence review, key search terms were agreed with the steering group. Search terms were applied to both academic search functions and generic search providers. This ensured a wide range of academic and grey literature was captured. Search terms can be found below in 11.1.1.

12.1.1 Search terms

Theme	Search term
Private sector conditions	<p>Agricultural producer and supplier; contracts, agreements, low-carbon agreements, sustainability agreements, conditions. (Scotland, UK)</p> <p>Low-carbon farming - supplier conditions. (Scotland, UK)</p> <p>Sustainable farming - supplier conditions. (Scotland, UK)</p> <p>Sustainable procurement in agriculture. (Scotland, UK)</p>

	<p>Green finance and agriculture. (Scotland, UK)</p> <p>Public/consumer attitudes towards; low-carbon food, low-carbon products. (Scotland, UK)</p> <p>Demand for; low-carbon food, low-carbon products. (Scotland, UK)</p> <p>Supermarket supply chain and; climate change, sustainability, low-carbon technologies. (Scotland, UK)</p> <p>Supply-side climate change mitigation; adaption, in agriculture. (Scotland, UK)</p> <p>Agricultural supply chain models; and climate change. (Scotland, UK)</p> <p>‘Just in time’ supply chain model in agriculture (Scotland, UK)</p>
<p>Producer decision making</p>	<p>Farmer attitudes towards; decarbonisation, carbon reduction, low-carbon, low-carbon farming, climate change, climate change adaptation. (Scotland, UK)</p> <p>Agricultural perspectives on; decarbonisation, carbon reduction, low-carbon, low-carbon farming, climate change, climate change adaptation. (Scotland, UK)</p> <p>Low-carbon farming; support schemes, incentives. (Scotland, UK)</p> <p>Agricultural decision making and; climate change, climate change mitigation and adaptation, low-carbon practices. (Scotland, UK)</p>

12.2 Stakeholder engagement

A Discussion Guide (see below) for semi-structured interviews was developed and agreed with the Steering Group. A list of target candidate interviewees across different sectors was also drawn up and agreed with the Steering Group. Sectors chosen were dairying, beef and lamb, cereals, and fruit and vegetables, to include a mix of producer interests and downstream supply chain originators of private pressure of farms to mitigate emissions.

It was recognised that commercial confidentialities would limit the willingness of some individual companies to provide information (and this was subsequently confirmed by some target candidates declining interview invitations). Consequently, initial efforts were focused on interviewing representative umbrella bodies, followed by a few individual companies. Representatives of producer interests (i.e. farmers) plus processors (e.g.

creameries, abattoirs, manufacturers) and retailers (e.g. supermarkets) were invited to participate in interviews. Interviews were also sought with representatives of advisory services, auction marts and banks as key supply chain partners.

Semi-structured interviews were arranged in advance by email and conducted mostly by video conferencing, with some conducted by mobile phone. Interviews lasted between 30 to 65 minutes and occurred between 13th January and 20th February 2023. Overall, 19 interviews were conducted with 22 interviewees (see Table below for the list).

Interviewee	Agricultural Sector
East of Scotland Farmers	Cereals
Scottish Agronomy	Cereals, Potatoes
Scotland Food & Drink Net Zero Partnership	All
East of Scotland Growers	Field Vegetables
ABP Food Group	Beef and Sheep
National Farmers Union of Scotland	All
SAC Consulting & AgreCalc	All
Institute of Grocery Distribution	All
Scottish Pig Producers	Pigs
NatWest	All
Courtaulds2030	All
Cattle Information Service	Dairying
Scottish Quality Cereals	Cereals
Arla	Dairying
Dunbia	Beef and Sheep
SAOS & Milk Suppliers Association	Cereals, Dairying
British Growers Association	Fruit and Vegetables
IAAS	Beef and Sheep
Morrisons	All
Quality Meat Scotland	Beef, Sheep and Pigs

Written notes were taken during interviews, and subsequently converted into reflective summaries immediately afterwards to capture key insights. The use of formal thematic

coding and software analysis was not deployed and, to protect commercial confidentiality, quotes were not attributed to individual interviewees.

In addition, a Chatham House rules online workshop hosted by the Courtauld2030 initiative was attended, at which representatives of many major food manufacturers and retailers aired views relevant to the project. Similarly, a physical workshop on net zero agriculture hosted by EIT Food and attended by industry representatives was also used as an opportunity to hear industry views. These supplementary evidence-gathering actions were taken as a way to get at least informal insights from further sources given that some individual manufacturers and retailers declined to be interviewed formally.

As with all efforts to canvass opinion from industry stakeholders, the approach taken was limited by the resources and time available to conduct interviews – further interviews might have produced additional insights. Moreover, it is possible that the profile of interviewees or selective answering of questions by them could bias reported findings. However, each sector was covered by at least two interviews and there was a high degree of consistency across interviews (and with the literature) in terms of the issues and drivers identified, implying that participation was in good faith and bias was unlikely.

Commercial confidentiality did, however, constrain the level of detail that could be discussed and reported. For example, the precise nature and/or number of requirements being imposed on farms. In addition, pressure to meet climate and nature commitments is being rapidly tightened, meaning that drivers identified here are likely to intensify in the near term. Indeed, anecdotal briefings from stakeholders after the formal closure of this project implies that this is already happening.

A key part of this research was identifying and engaging with relevant stakeholders. We undertook 20 interviews with industry stakeholders in the following areas – covering the vast majority of the agricultural sector in Scotland.

- Agricultural lenders (Banks)
- Retailers (Supermarkets)
- Processors (Wholesales and trade bodies)
- Farmers unions
- Validators (Carbon calculators)

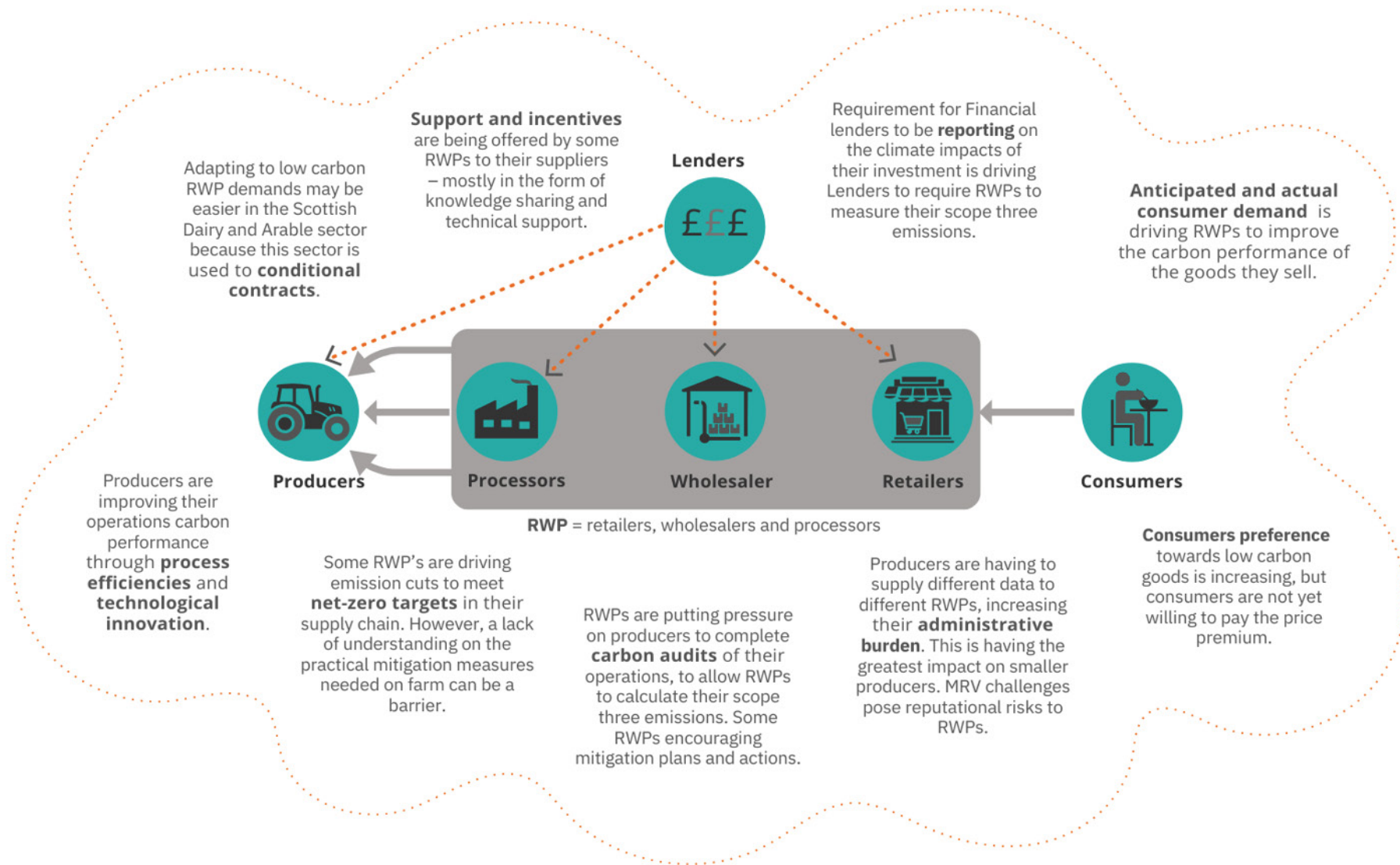
Stakeholders were contacted and interviewed in conjunction with the desk review. The aim of the stakeholder interviews was to explore the views and commitments from each part of the supply chain and how these are directly affecting climate change mitigation actions at farm level in Scotland. Questions were informed by the researchers' prior knowledge, academic literature and industry sources. The full list of questions that were posed to stakeholders can be found below.

12.3 Stakeholder discussion guide

1. How do GHG emission reductions, particularly Scope 3 emissions, feature in your business planning?
2. Are planned reductions motivated by existing/anticipated regulatory obligations or buyer/consumer/investor/staff demands?
3. How have baseline Scope 3 emissions and potential reductions been estimated?
4. What types of emission reduction measures are envisaged at different points along the supply chain?
5. How are Scope 3 emission reductions being sought from suppliers/by buyers?

6. Any issues around cost, feasibility, competence, bureaucracy, loss of autonomy etc.?
7. How are Scope 3 emission reduction efforts being monitored?
8. How are Scope 3 emission reductions being estimated?
9. Any difference in approach/challenge across different supply chains or different regional or export markets?
10. Any compatibility/alignment issues with the public sector, or carbon markets?

Who is driving climate change action?



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