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Meeting the challenge of sustainable ruminant feed: Workshop report

This is a report from a workshop on meeting the challenges of sustainable ruminant feed held at the Edinburgh Centre for Carbon Innovation on 13th May 2014, funded by the Natural Environment Research Council and the Economic and Social Research Council. The purpose of the meeting was to bring together insights from various industry sectors and wider environmental and research perspectives to progress the development of sustainable ruminant feed strategies.

The specific objectives of the meeting were to:

- Progress towards sustainable livestock feed strategies
- Promote an ongoing constructive dialogue between different sectors in research and industry
- Raise awareness of current state of knowledge (resources and remaining needs)
- Identify potential synergies and opportunities for deeper co-operation across disciplines and stakeholders
- Identify opportunities for developing appropriate tools for increasing sustainability

The multi-perspective workshop highlighted the complexity of sustainable ruminant feed. Throughout the day emphasis was given to the need to improve links between the academic research base and on-farm practice and the need to better integrate different disciplinary expertise. It was clear throughout the day that different sectors and disciplines were approaching the challenge in very different ways. Yet, through the workshop a productive dialogue was established, so that participants could look at the issue in the round.

The following sections can be found in this report.

- 1. Desirable outcomes from ruminant feed supply (table 1) – p1-2**
- 2. Pathways to sustainable ruminant feed (figure 1) – p3**
- 3. State of knowledge**
 - a. Securing minimal environmental impact from ruminant feed (table 2) – p4**
 - b. Evaluating choices of protein sources for sustainability (table 3) – p4**
 - c. Contribution of grass to sustainable food systems (table 4) – p5**
- 4. Sustainable ruminant feed strategies**

Questions to ask when developing a sustainable ruminant feed strategy, for different sectors

 - a. Policy makers p 7-8**
 - b. Retailers p 9-10**
 - c. Feed suppliers – p11**
 - d. Agricultural advisers – p12**

Annexes: Participants list (p13), agenda (p14), flip charts (separate document)

1. Desirable outcomes from ruminant feed supply

The first step was to describe the key features of sustainable ruminant feed and to consider how 'sustainability' could be identified. The desirable outcomes are summarised in table 1. They were identified by brainstorming in the group and characterised through a multiplicity of objectives. Desirable outcomes are categorised under key headings, although categories will also interact with each other (e.g. desirable outcomes for wider society will include many of the desirable outcomes for business, animal and environment).

Table 1 Desirable outcomes from ruminant feed supply from different perspectives

Business	Animal	Feed source	Environment	Wider society	Systems
Economically viable solutions	Improve animal feed efficiency	Identify affordable protein sources	Long-term solutions	Approaches that are acceptable to the consumer	Internalising all external costs of production and consumption
Maintenance of livelihoods & jobs	Make better use of forage feeds	Reduced feed environmental footprint	Lower overall negative impact	Contributing to a healthy diet	Stronger links between farmer-retailer-science-application
	Reduce reliance on cereals for feed	Take advantage of ruminants' ability to utilise forage crops	Diversity of systems of production	Minimal competition with human food	Paying attention to distribution of power in the food system.
	Increase use of home produced feed	Take advantage of ruminants' ability to utilise waste products	Resilient to climate shocks	Pay attention to animal welfare	Paying attention to trade-offs within the food system.
	Lower emissions per unit of production		Paying attention to non-food ecosystem services & biodiversity	Healthy animals	Overall efficiency of production system

2. Pathways to sustainable ruminant feed

The second step was to identify what were the pathways that would lead to these sustainable outcomes. A composite chart has been created from the individual group work (Figure 1) which summarises pathways and the different variables that have an impact on sustainable ruminant feed.

3. State of knowledge

The third step was to identify the current state of the knowledge and gaps in knowledge for developing sustainable ruminant feed. In order to focus the conversations, three questions were identified *a priori* based on literature, advocacy group literature and interviews with industry. The three key questions identified were:

- i) How best to secure minimal environmental impact from ruminant-based agriculture?
- ii) How do you evaluate choices of protein sources for ruminant feed in terms of sustainability?
- iii) How can grassland agriculture better contribute to sustainable food systems?

For each of these questions a table is provided, summarising what sub-groups thought is already known about the subject and what additional knowledge would be important to know. It should be noted that there may be people who can answer the questions in the 'what we don't know' column and who might challenge the adequacy of the 'what we know' column.

Fig. 1 SUSTAINABLE RUMINANT FEED

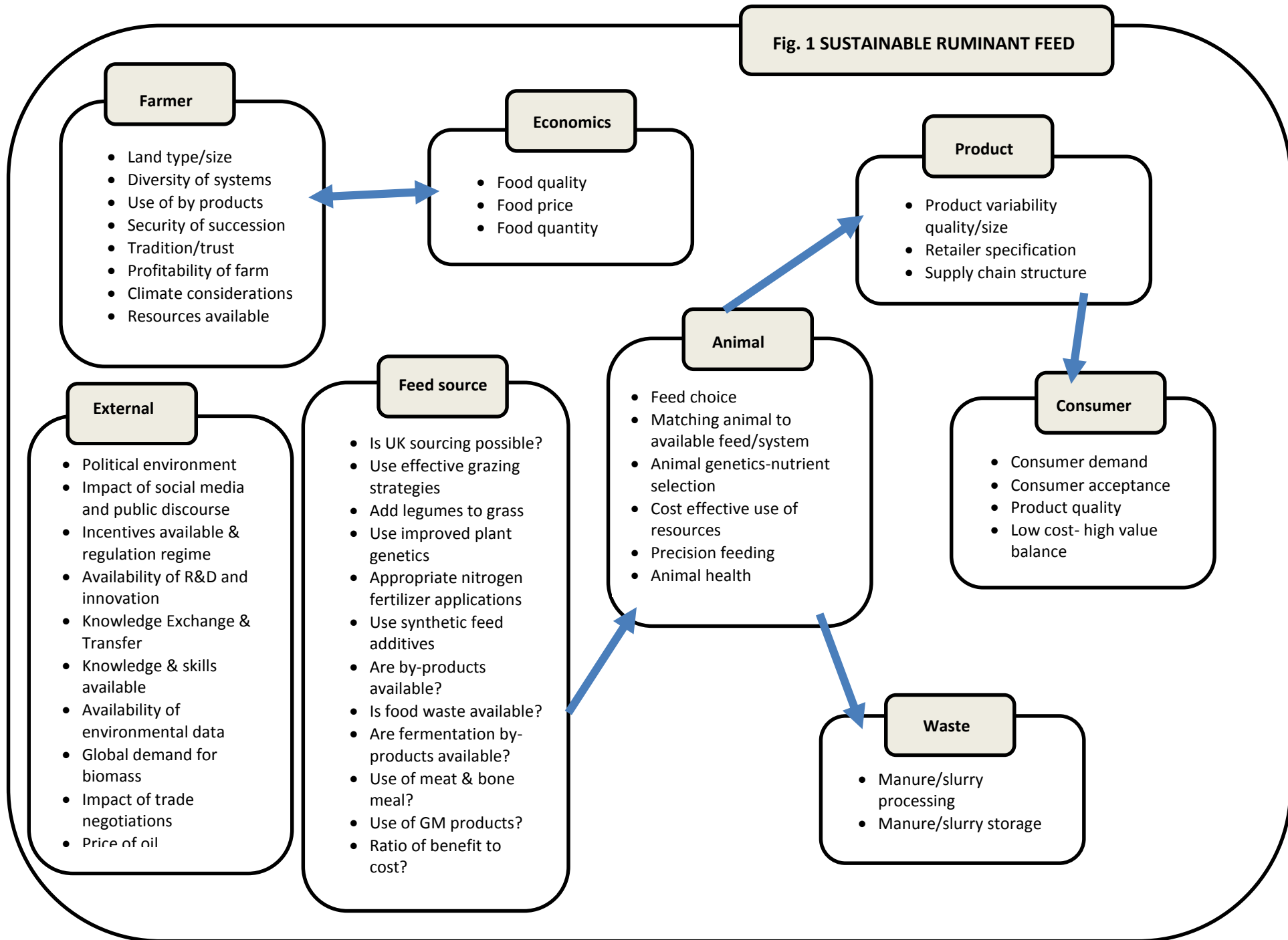


Table 2 How best to secure minimal environmental impact for ruminant feed in terms of sustainability?

What do we know	What don't we know that we should know
Some technologies are available	We don't have tools to measure on-farm emissions
Demand for livestock products is increasing	How will consumption respond to price increases?
There are challenges in both production & consumption	How effective are different proposed measures?
Consumers are unlikely to change easily	Where is the consumer pull?
Voluntary measure to change production don't work	How cost effective are the different measures?
	What would be the effects of a carbon price?
There is no global governance of the problem	What are the equilibrium impacts of unilateral action?
Power is highly concentrated in the food chain	How to scale up different measures?
Techniques to improve manure handling & application exist	How will technology be deployed? Who should transfer technology from lab to field and when?
We can model future UK climate projections	How do we plan for future climate changes?
Genetic improvement can give incremental gains	Is there enough information available to plan 20 years into the future?
	What are the long-term impacts of different measures?
	What are the trade-offs between different measures?
	What would be the impact of removing subsidy payments?

Table 3 How do we evaluate choices of protein sources for ruminant feed in terms of sustainability?

What do we know?	What don't we know that we should know?
Nutritional value	Biodiversity impact
Current price	Future price
Carbon footprint	Carbon footprinting and Life cycle analysis incorporating complexity of systems
Current supply	Future supply
Feed efficiency	Effects of market distortions
Benefits of co-products	Social impacts of varying protein supply
Water footprint	Water footprint (scale?)
Capacity for pollution	Long-term capacity for production (e.g. soil resilience)
	Capacity to counter pollution
	Provenance of protein supply
	Market & supply chains for alternative proteins
	Lost knowledge from the past
	Skills gap

Table 4 How can grassland agriculture better contribute to sustainable food systems?

What do we know?	What don't we know that we should know?
Grassland can capture carbon	How much grassland is there?
Grassland is underutilised	What is the best variety/species mix?
Grass is perceived as natural	What is the best way of grazing management?
Grass has a positive image with consumers	How can we quantify and promote ruminant efficiency response to grass breeding advances in water soluble carbohydrates/dNDF (digestible Neutral Detergent Fibre)/fatty acid?
Grass grows where other crops can't be grown	How accessible is the grass?
There is potential to be utilised better	Do we understand grassland baseline and potential for production?
Cheapest source of feed?	What is the financial impact of the added value of using grass?
Grazing impacts on pathogen levels	What is the pathogen content of grassland?
Provides energy & protein from poor land	What are the appropriate supplements to use?
Provides feed directly at farm level	Don't have rapid (real time) quality analysis of grass in field (discussed potential of satellite technology to provide this)
Provides a method of transferring organic matter to other areas	What is the carbon sequestration potential of grasslands?
Produces micro-environments of biodiversity benefit	What is the variation in nutritional composition of grass e.g. seasonality?
	How can we develop tools to measure grass intake by ruminants?
	What are the likely future constraints on relying on grass e.g. weather, disease & liver fluke?
	What will the future policy context be? E.g. CAP, UK in EU?
	What is the potential of silvopastoral systems?
	How can farmer practices be influenced?

The required knowledge base was further developed by asking and answering 'difficult' questions as identified below.

Difficult questions

Q: How do you meet the global demand for ruminant products using low input systems?

A: Make those more efficient in terms of feed, animals and husbandry. However, the question remains as to how much use should be made of low input systems?

Q: England win World Cup, in retaliation S. American soya exports suspended indefinitely. Now what?

A: Short answer – buy from the US

Long answer – Grow legumes in rotation, redistribute ruminants to suit available land better, make better use of grass. Investigate other sources of soya. There was some discussion regarding the importance of the protein quality in the soya. It was suggested that the more maize that is fed, the greater the requirement for soya (or added urea) but this was disputed by others.

Q: How can the UK increase its beef production without increasing its carbon footprint?

A: Legume based protein, outdoor housing, basic energy saving measures, grazing system, clover based swards, system specific genetics, improved reproductive management, developing twinning suckler herd, grass based systems (with clovers)

Q: How do you define sustainable feed in one sentence?

A: Readily available feed material that when fed through a ruminant production system does not take out more resources from the land than it returns – including rotations.

Q: Regarding the likely responses to introduction of carbon tax.

A: For a beef production system the options are to decrease greenhouse gas emissions and/or increase profit. Possible options for doing this include:

- Sell to niche market
- Increase amount of grass feeding
- Decrease use of diesel and electricity
- Reduce nitrous oxide emissions, feed nitrogen to requirement
- Add lipid/starch to feed
- Consider genetics, for example increase the amount of beef production from Holstein dairy cattle

An evidence base is needed to apply such a tax fairly. Some models are available, for example New Zealand 'Overseer' model.

4. Sustainable ruminant feed strategies

Different aspects of ruminant feed are within the control of different actors/stakeholders which makes systemic change very difficult to achieve. Strategies for sustainable ruminant feed are likely to be somewhat different for different sectors, based on their own perceived opportunities and risks, costs and benefits. During the workshop, due to the limitations of time, breakout groups considered only four sectors: policy, retailer, feed supplier and agricultural advisor. The following sections consist of tailored sets of questions suggested for each sector to ask and answer for itself, when thinking about a sustainable ruminant feed strategy. Furthermore, as these sets of questions arose from an interactive workshop, they have enough similarities to facilitate future dialogue across sectors.

Strategy questions for policy makers

Policy makers set the framework within which the livestock industry in the UK functions, is internationally competitive and provides social goods that are not subject to market forces, as well as ensuring compliance with international obligations. **The group identified five key aspects for policy makers to consider: risks, impact on food security and food safety, taking advantage of innovative opportunities, taking a long term perspective and focussing on implementation.**

The following set of questions is intended as a check list of questions for policy makers to consider when developing a strategy for sustainable livestock feed.

- Financial tools
 - What is the role of financial tools: subsidies, tax, carbon credits?
 - What decision support tools and mechanisms are available?
 - What are the possible unintended consequences of using different financial tools?
- Global competitiveness
 - Should the UK be in the role of leader or follower?
 - What mechanisms exist to stimulate innovation?
 - How does the UK compare against competitors?
 - What is the market value of the sector?
- Knowledge base
 - How is awareness of developments in science and innovation created?
 - How can best use be made of education and training (e.g. schools, farmers, policy makers)?
 - Is the strategy robust and evidence based?
- Risks
 - What is the risk of damage to UK plc?
 - How is the vulnerability and resilience of the UK affected?
 - What are the potential impacts on food safety?
 - What are the likely social impacts e.g. on rural communities?
- Opportunities
 - What are the opportunities for exporting innovation?
 - What are the opportunities for adding value in the supply chain?
 - What are the opportunities for encouraging adaptation to climate change?
 - What role can public procurement play?
 - What opportunities can be identified from horizon scanning?
- Environmental impact
 - What is the environmental impact within the UK and outwith the UK? What is the potential for exporting pollution?
 - What interactions exist with other land use planning requirements?
- International & National politics
 - What are the likely interactions with trade barriers?
 - How acceptable is the strategy to publics?
 - Does it fit party politics?
 - What are the likely impacts of globalisation of regulations?
 - Is the timeframe considered consistent with a long term view?
 - What is the likely impact on price of food?

- How have stakeholders been engaged?
- What are the potential human nutrition benefits?
- What interactions exist with EU policy e.g. changes to the CAP?
- Election proximity?
- Policy to practice
 - Are appropriate, well-informed, extension and knowledge transfer services available?
 - How likely is implementation?
 - What are the best mechanisms to use e.g. legislation, financial?
 - What is the role of price controls?
 - Cost of implementation?
 - What is the outcome of a cost-benefit analysis?

Strategy questions for retailers

Retailers are a key link between consumers and producers and are perceived to exert a large degree of power over the food chain, and hence carry heavy responsibilities. **Three key aspects were identified: the sustainability and reliability of the feed source, impacts of feed on animal welfare and greenhouse gas emissions and co-operative working with others in the food chain with equitable sharing of profits.**

More specifically, the following were identified as key questions a responsible retailer should ask when developing sustainable livestock feed strategies.

- What is the role of certification (or other market mechanisms) in a sustainable ruminant feed strategy?
 - What is the role of verification and testing?
 - What is the evidence-base for certification?
 - Source & supply chain structure: what is the level of integration? Is it possible to trace products?
- What impact is the strategy likely to have on security of supply in:
 - Short term < 1 year?
 - Medium term 2-5 years?
 - Long term 5 +?
- What definition of sustainability is being adopted?
 - What are the potential impacts on food safety?
 - What are the potential impacts on greenhouse gas emissions?
 - What are the potential impacts on animal welfare?
 - What are the impacts of feed on food quality?
 - What are the impacts on the profitability of primary production/producers?
- Risks
 - What are the known risks e.g. climate change?
 - What are the potential unknown risks?
 - What contribution can be made by horizon scanning?
 - What is the role of research informed quantitative risk analysis?
- How feasible is the strategy?
 - How do you ensure consistent standards across UK (and elsewhere)?
 - What will be the cost of the strategy?
 - What are the impacts on integrity of product (brand)?
- What stakeholder concerns exist?
 - What (human) ethical concerns exist?
 - What are likely media reactions?
 - What are likely consumer attitudes? How well are these understood? And what is the underpinning research evidence?
- What are the roles of co-operative working and buying groups?
- How is knowledge transfer with the food chain undertaken?
 - What is the role of brokers and brokerage?
 - What information provision arrangements are in place?
- What opportunities exist for adaptation:
 - In crops?
 - By farmers?

- In the supply chain?
- How are new innovations and novel crops incorporated in the strategy?
 - What interactions exist with plant and animal breeders and breeding research?
 - What are the opportunities from GM/non-GM production?
 - What are the opportunities from local identity and niche production?

Feed suppliers

Feed suppliers are in a critical role in terms of supplying livestock feed. They have responsibility for sustainable sourcing, formulating appropriate diets and ensuring continuity of supply of feed. In terms of strategies for sustainable livestock feed, **a key aspect identified was the need to understand customer requirements in terms of sustainability.**

More specifically, a responsible feed supplier should consider the following questions when developing a strategy for sustainable ruminant feed.

- How does this meet global sustainability standards for:
 - Greenhouse gases?
 - Water usage?
 - Social impacts?
 - Political considerations?
 - Transparency requirements?
 - Traceability requirements?
 - Ethical trading standards?
- How does this impact your risk profile and resilience?
 - How diverse is your portfolio?
 - What are the likely vulnerabilities to the security of your supply chain to a range of scenarios?
 - What vulnerabilities exist to testing procedures?
- Quality Assurance
 - What is the appropriate frequency of quality assurance procedures?
 - How robust are the quality assurance procedures?
 - How do you ensure high quality procedures for quality assurance?
- Energy consumption
 - What are the opportunities for use of genuine renewable?
 - What are the opportunities for reduced consumption?
- What are the appropriate partnerships to have in place?
 - What are the appropriate partnerships with animal breeders?
 - What are the appropriate partnerships with plant breeders?
 - What are the appropriate partnerships with farmers (e.g. for tailored products)?
 - What impact do you have on profitability of partners?
 - What is the role of fostering better relationships with food advisors and vets?
 - What are the appropriate partnerships with retailers?
 - What is the appropriate planning time horizon for working with partners given the long time lag in producing the product (e.g. 5+ years to impact on consumers)?
- Balanced view of success
 - What are your aims in terms of sustainability?
 - What are your aims in terms of profit?
- R&D Investment
 - Developing innovative new products?
 - Identifying novel feed sources?
- Education
 - What is the role of training in the strategy?
 - What is the role of Continuing Professional Development in the strategy?

UK agricultural advisors

There are a very wide range of different agricultural advisors, with different remits, and working in different sectors of the food chain. They are sometimes independent but often linked with particular sales activities, such as fertilizers or feeds. This group may also include vets, buyers, government funded advisors, environmental advisors and NGOs. Advisors are important in effecting links between novel innovations and practical action. **Key aspects for strategy development in this sector were identified as establishing good working relationships with clients by individuals and organisations and ensuring consistent messages are transmitted.** The latter is challenging as different advisors may be providing contradictory advice and questions of the evidence base arise.

More specifically, the following were identified as key questions for responsible agricultural advisors in the UK to consider when developing a sustainable ruminant feed strategy.

- What are your client sustainability needs and market/product specifications?
 - What does sustainable feed mean to the industry?
 - What role could a network of consultation among stakeholders have?
- Capacity to deliver
 - Do you have the appropriate number and quality of staff?
 - What are the infrastructural requirements?
 - What are the financial requirements?
 - Do you have access to sufficiently diverse expertise?
 - Do you have sufficient understanding of the customer and business and sector?
- Knowledge sources/enhanced use of IT- social media
 - What are your interactions with fundamental/basic research e.g. at universities?
 - What are your sources of applied/near market/relevant knowledge?
 - Is there a role for using Government data?
- Knowledge Transfer Strategy
 - Which levels are appropriate for you: suppliers, targeted farmers (including slow adopters), retailers, consumers and policy-makers?
 - How holistic and joined-up is your strategy?
- Measurement of success
 - What measures would make an appropriate starting point?
 - What role could benchmarking or use of demonstration/focus farms make?
 - What is the best way of measuring adoption into practice?
- How will you deal with the heterogeneous nature of farms and farmers? Does one size fit all?
- What options exist for indemnity insurance?
- Linkage between innovation and advisors/do I have understanding?
- How independent are the advisors?
- How do you develop good, trusting relationships with clients?
- How do you best sell your advice?
- What role is there for farmer-to-farmer learning, to identify what works?
- What lessons can be learned from other regions/farmers?
- What is the role of large, step change in comparison to smaller, incremental changes?

This workshop drew together individuals with diverse perspectives, building upon research and analyses of stakeholder input during an ESRC/NERC Knowledge Exchange Fellowship. In considering the future of sustainable ruminant feed, both opportunities and challenges were identified. The overarching challenge is complexity: the multi-faceted nature of the issues themselves (including interactions among different enterprises on farms), the large number of different stakeholders, the industry's ability to implement change particularly given different distributions of power, and the lack of clarity as to who should pay for knowledge exchange. Unfortunately there is as yet no international forum where stakeholders – industry and academics – can work together to address these issues. As the result of an integrative workshop, this report may prove to be a useful step in further deliberations within and across sectors.

Ann Bruce, 26th June 2014 ann.bruce@ed.ac.uk

ANNEXES

A list of participants is provided in annex 1 and the agenda in annex 2.

Annex 3 contains representations of the working flip charts and can be found in a separate document

Annex1: Participants

Laura	Meagher	Facilitator	
Phil	Alcock		RAFT Solutions Ltd
Peter	Beattie	Director	Momentum Consulting
Sam	Beechener	PhD Student	SRUC
Abdul	Chaudhry	Lecturer	Newcastle University
Les	Crompton	Senior Research Fellow	Reading University
Les	Firbank	Chair in Sustainable Agriculture	University of Leeds
Robert	Fish	Senior Research Fellow	University of Exeter
Maggie	Gill	Chair in Integrated Land Use	University of Aberdeen
Trevor	Gilliland	Acting Director	Hillsborough
Bruce	Jackson	Senior Knowledge Exchange Manager	ESRC
Vanessa	King	Sustainable Sourcing Devpt. Manager	Unilever
Michael	Lee	Reader in Sustainable Livestock Systems	University of Bristol
David	Long	Research and Development Manager	Barenbrug UK Ltd
Michael	MacLeod	Researcher	SRUC
Steve	McLean	Head of Agriculture & Fisheries	Marks & Spencer plc
David	McNaughton	Managing Director	Soya UK Ltd
Dominic	Moran	Environmental Economist	SRUC
Jamie	Newbold	Director of Research & Enterprise	Aberystwyth University
Tom	Osborne	Research/KE Fellow	University of Reading
Nicola	Robinson	Agriculture Manager	McDonald's Europe
David	Telford	Knowledge Transfer Manager	Biosciences KTN
Mary	Vickers	Senior Beef and Sheep Scientist	EBLEX - AHDB
Adrian	Williams	Principal Research Fellow	Cranfield University

Annex 2: Agenda Meeting the challenge of sustainable ruminant feed

A sustainable animal feed strategy has been identified as the top priority in knowledge needs for the UK food system to enhance sustainability (recent NERC-consultation¹). Today we will bring together insights from various industry sectors and from wider environmental and research perspectives to progress the development of such a strategy.

Objectives

- Progress towards sustainable livestock feed strategies
- Promote an ongoing constructive dialogue between different sectors in research and industry
- Raise awareness of current state of knowledge (resources and remaining needs)
- Identify potential synergies and opportunities for deeper co-operation across disciplines and stakeholders
- Identify opportunities for developing appropriate tools for increasing sustainability

Outputs

- Networking across disciplines and engagement with industry stakeholders
- Summary document of meeting
- Guidance on key aspects to consider when developing sustainable livestock feed strategies

Session 1: Creative challenges	
08.30	Arrival & coffee
09.00	Welcome & introductions
09.20	Opportunities and challenges exercise
09.50	Desirable outcomes brainstorm
10.10	Exploring pathways
Session 2: What do we know?	
11.30	iv) How best to secure minimal environmental impact from ruminant-based agriculture? v) How do you evaluate choices of protein sources for ruminant feed in terms of sustainability? vi) How can grassland agriculture better contribute to sustainable food systems?
12.30	Lunch
Session 3: Putting things together	
13.30	Hard questions exercise
14.15	Devising questions to guide strategy-making toward sustainable ruminant feed
15.30	Wrap up, next steps, tea & coffee
16.00	Close

Dr Ann Bruce, ESRC-NERC Agri-Food Knowledge Exchange Fellow (ann.bruce@ed.ac.uk)

¹ Dicks, L.V. *et al.* (2013) What do we need to know to enhance the environmental sustainability of agricultural production? A prioritisation of knowledge needs for the UK food system. Sustainability 5:3095-3115.