A targeting framework for research in sustainable farming and food

Defra project code: IF0110

Appendixes to the final report

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Appendix 1. Sustainable development within farming and food

1. Introduction

This paper forms the first stage of the project 'A Framework for Targeting Research in Support of Sustainable Farming and Food', which aims to develop a methodology for Defra to use in prioritising its research under sustainable farming and food (the Framework). By setting the background as to reasons why Defra fund research, the policy areas of interest and the interpretation of sustainable development in the context of farming and food strategies set by the Department, the paper underpins the interpretation of sustainable development that is used in subsequent stages of the project.

The paper attempts to provide an overview of how Defra have interpreted sustainable development with respect to farming and food. It draws from Defra and wider government policy documents and reviews relating to sustainable farming and food, sustainable consumption and production and sustainable development and has been informed by discussions with personnel from Defra, the Sustainable Development Commission and HM Treasury.

2. Why Defra funds research

Defra funds research to inform policy[1]. The meaning, within Defra, of evidence based policy making is set out within the Departmental website as follows, 'an *approach* to policy development and implementation which uses rigorous techniques to develop and maintain a robust evidence base from which to develop policy options[2]'. Thus for any policy area the question may be asked 'do we have enough reliable evidence?' In addition to current and projected policy areas, the Department must also be able to respond to external pressures, such as lobby groups, which themselves do not bear the same responsibility for ensuring that policy is based on sound evidence. Here again, well targeted research can serve to clarify the arguments which the Department must address and help avoid the unintended consequences of following single-issue policies.

In general the research councils and other government research funding bodies are aligned with the Science and Innovation Investment Framework 2004-2014[3], which sets out the role of science in achieving a high technology – high value economy. Defra does not fund research in order to achieve these separate policy objectives and as such their remit is fundamentally different from that of many of the other major funding bodies.

That said Defra does recognise that encouraging innovative processes, products or systems may enable the Department to meet its policy goals. Research funding within the Department is therefore split across a range of 'pots'. For example, LINK funding is targeted at jointly sponsored government/industry research, led by the private sector, and examines innovations in products, systems or processes which are broadly in line with Defra's policy objectives.

The research for which this Framework is designed sits within the Farming and Food Group. The total annual budget for this research fund is approximately £30 million, of which approximately £8million is commissioned annually. This research is categorised into four main strands, as detailed below. Each of these research strands has its own Programme Management Group which includes policy, research and economics representatives.

- Sustainable Farming Systems and Biodiversity
- Water Quality and Water Use
- Agriculture and Climate Change
- Food Chain Meeting Consumer Needs

In addition to commissioned research, evidence may also be sourced from outside the Department (e.g. through the Environment Agency, Natural England, the Commission for Rural Communities, the RSPB, CLA and The Game Conservancy, to name but a few), and through a variety of ongoing monitoring exercises including Defra's own Farm Business Survey (FBS), CAP Observatory and Rural Evidence Hub. The latter of these applies the Rural-Urban Definition[4] to a variety of databases, including the Home Office's crime statistics and the Index of Multiple Deprivation, and so provides a wealth of information on the social context of rural communities.

3. Definitions of Sustainable Development

The Brundtland Commission (1987) defined sustainable development as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs". The UK government and Devolved Administrations interpret this as follows, "The goal of sustainable development is to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life, without compromising the quality of life of future generations".

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[1] Our Approach to Evidence and Innovation, Defra 2006
[2] http://www.defra.gov.uk/science/how/evidence.htm
[3] HM Treasury, DTI, DFES, July 2004
[4] www.statistics.gov.uk/geography/urban_rural.asp

More detailed definitions of sustainability generally address three central concerns; social, environmental and economic, on the pretext that activities must be sustainable in all three of these in order to be classed as sustainable overall. A Better Quality of Life, the 1999 Sustainable Development Strategy, interpreted these central concerns as including 'social progress', 'environment protection and resources' and 'economic growth and employment'. Subsequent definitions have broadened the remit of sustainable development to include factors such as animal health and welfare and human health.

Securing the Future, the most recent UK Government Sustainable Development Strategy, stated four priority areas for immediate action, as follows;

- Sustainable consumption and production
- Climate change and energy
- Natural resource protection and environmental enhancement
- Sustainable communities

It is of note that of the four priorities, three address primarily environmental concerns:- climate change and energy, natural resource protection and environmental enhancement, and to a large extent, sustainable consumption and production, whilst the remaining priority addresses social goals. The document as a whole emphasises the importance of environmental concerns, from the Government's perspective, in the balance between environmental, social and economic considerations. This may be seen as a reflection of the historic policy emphasis on achieving economic and social goals (perhaps at the expense of the environment), and a re-balancing of the three elements of sustainable development.

The shared principles that the government uses to promote the 'sustainable development purpose' add further layers to the meaning of sustainable development. These principles are given as i) living within environmental limits, ii) ensuring a strong, healthy and just society, iii) achieving a sustainable economy, iv) promoting good governance and v) using sound science responsibly[5]. Whilst entirely laudable, these also serve to broaden the definition and extend the concept to cover both the process of policy development (e.g. using sound science responsibly) and intended policy objectives (e.g. achieving a sustainable economy).

3.1 Sustainable Consumption and Production

The central purpose of strategies within Sustainable Consumption and Production (SCP) is to 'decouple economic growth from environmental degradation'[6]. As such, SCP is no different from the overall aims of sustainable development, to balance environmental, social and economic factors. However, what it does is to bring to the fore the clear linkage between environmental impacts and individual (as well as institutional or business) activity and to make clear that all of the processes involved in production, transport, retail, consumption and disposal are of importance in assessing the social, environmental and economic impacts of products.

Sustainable Consumption and Production (SCP) requires that any assessment of sustainability is made from the perspective of product life-cycles, taking into account how goods are consumed as well as how they are produced. Life-cycle analysis, the assessment of the environmental and social impacts of goods or services from production and through to disposal is a central theme of SCP, and should allow interventions to reduce negative environmental or social impacts to be best targeted. However, whilst sustainable production is relatively simple to address (e.g. through environmental legislation), sustainable consumption means consuming differently and, inevitably, consuming less than would otherwise be the case of environmentally damaging products[7]. This presents particular challenges for policy.

In essence, SCP takes what has been achieved within individual sectors (e.g. in farming through the Sustainable Farming and Food Strategy) and broadens the scope of our assessment to examine what happens to products post-farm gate, and to examine what impacts the inputs to farm systems have pre-farm gate.

3.2 One planet living

One Planet Living is a term coined by the World Wild Fund for Nature (WWF), as a target for individuals, organisations and governments to reduce resource use and other environmental impacts. The WWF's Living Planet Reports[8] have since 1998 provided a review of various indices of the environmental impact that man has upon the planet, taking into account biodiversity, waste production, land needed for food and fibre, and so on. Using these indices the WWF calculate that patterns of production and consumption in the developed world could not be replicated world-wide without the resources of three planets. Hence the call for 'One Planet Living'; where patterns of consumption and production in the developed world are reduced sufficiently that the resources of only one planet are required.

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[5] Securing the Future. The UK Government Sustainable Development Strategy. HM Government, March 2005

[6] Changing Patterns. UK Government Framework for Sustainable Consumption and Production. Defra, September 2003

[7] For a detailed review of sustainable consumption, refer to Jackson & Michaelis, 2003. Policies for Sustainable Consumption. Report to the Sustainable Development Commission

[8] For the latest report see http://www.panda.org.....

In his letter to the Prime Minister of July 2006, The Minister of State for Environment, Food and Rural Affairs stated his view of Defra's mission as 'enabling a move towards what the WWF has called "one planet living"'. As with the focus of the Government's Sustainable Development Strategy, this reference to one planet living highlights the current importance of environmental concerns, from the Government's perspective, in the balance between environmental, social and economic considerations.

3.3 Geographical scope

Given the nature of the concepts of one planet living and sustainable consumption and production, both of which force us to look at environmental impacts outside of our immediate geographical boundaries, the extent to which the government's sustainable development priorities should cut across these boundaries must be addressed.

We might ask whether or not we should consider the environmental (or social, or economic) impacts of UK policies outside of the UK? Government policy is clear as far as exporting environmental impacts from the UK to overseas, stating within Securing the Future that 'there would be little value in reducing environmental impacts in the UK if the result were merely to displace those impacts overseas or close off benefits at home or abroad'.

Whilst it is necessary to respect the sovereignty of other countries, valuing the local environmental, economic and social impacts which may occur in these may not be helpful in operational terms (except in the case where these occur as a direct result of a change in UK policy) and the detailed examination of the impacts of policies outside the UK creates a possible burden on Departmental resources. However, global issues such as climate change, or the protection of unique global assets (such as rainforests) might be more easily prioritised and addressed through targeted interventions.

4. Factors included within the application of Sustainable Development to farming and food

Since the publication of the Strategy for Sustainable Farming and Food (Defra, 2002) there has been a series of strategy documents published by the Defra and by other government departments addressing elements of primary production, processing and retail of agricultural produce. The following list provides a summary of the range and focus of these;

- Delivering the Essentials of Life. Defra's Five Year Strategy (Defra, 2004)
- Sustainable Farming and Food Strategy: Forward Look (Defra, 2006)
- Food Industry Sustainability Strategy (Defra, 2006)
- A strategy for non-food crops and uses (Defra & DTI 2004)
- Action plan to develop organic food and farming in England. Two Years on (Defra, 2004)
- A Vision for the Common Agricultural Policy (HM Treasury & Defra, 2005)

The sections below outline how sustainable development is currently interpreted at an operational level, within Defra, for each of the three elements:- social, environmental and economic. Recent strategy papers on sustainable farming and food identify consequences *of* farming on measures of sustainable development and also the consequences *for* farming of a changing economic, social and environmental scenario. Whilst these are not in general separated in strategy documents, they do present radically different questions for policy makers.

4.1 Economic sustainability

Economic sustainability of the farming industry is interpreted as 'succeeding in the market'[9], i.e. without production subsidies. Since the Mid Term Review reforms of the CAP (2003, 2004) a large element of direct production support has been removed, replaced by the single farm payment (SFP). The SFP is not linked to production, but is used as a lever to ensure that various regulations are implemented at farm level through cross compliance (i.e. compliance across a range of regulations). The SFP will reduce on a year on year basis to 2012, at which point further reform of the CAP will be implemented. There are a number of business improvement initiatives underway aimed at helping farmers through the transition from subsidised to non-subsidised agriculture.

With agricultural production operating without the 'perverse incentives' of the CAP, it is fair to assume that agricultural production efficiency will be driven by market forces. As such improving the production efficiency of farming is not an objective of Defra's. *However, policies will need to take into account how economic drivers behind agriculture interact with environmental and social impacts.*

The joint HM Treasury / Defra paper, 'A Vision for the Common Agricultural Policy', sets out 'what a sustainable model of European agriculture might look like'. This includes the ability to be internationally competitive without reliance on subsidy or protection, and being rewarded by the market for its outputs and by the taxpayer 'only for producing societal benefits that the market cannot deliver'. Sustainability from this perspective includes the outcomes of a reduction in import tariffs to align them with the levels seen in other sectors of the economy and 'no price support, export refunds or other production or consumption subsidies'.

[9] Sustainable Farming and Food: Forward Look. Defra, 2006

Defra's Five Year Strategy states that 'A competitive, profitable and sustainable farming industry also has a crucial role in enhancing biodiversity and protecting soils, water and other natural resources on 70% of England's land area', whilst A Vision for the Common Agricultural Policy states 'Our vision for agriculture within the next 10 to 15 years is for an industry which is fundamentally sustainable and an integral part of the European economy'. That is, the existence of a farming industry is seen as important insomuch as it helps to achieve policy objectives. However, there is no policy direction as to the structure of the agricultural industry, which is not of direct relevance except where it is seen to impact on achieving these objectives.

Other strategy documents are less explicit about the meaning of economic sustainability. For example, the Food Industry Sustainability Strategy does not define what economic sustainability means – for policy or for the industry – but refers instead to factors which may impact upon the economic *success* of the food industry (workforce skills, retain crime and science-based innovation). Given that the food industry survives in the market, without subsidy, this is perhaps unsurprising. The Non Food Crops Strategy – a joint DTI / Defra publication, lists economic factors within its 'sustainability criteria' for non-food crops. Again these are, in general, indicators of the success of the strategy and include amongst others 'a positive balance of trade', 'security of supply' and 'diversification of rural enterprises'.

4.2 Social sustainability

Social sustainability is used variously in reference to the *acceptability,* for example with respect to standards of animal welfare[10], equal opportunities, or health and safety[11], and in reference to wider social goals – such as ensuring access to public services for all, or tackling local inequalities[12]. There is no general, high level statement for social sustainability within Defra strategy documents in the manner that there is for economic sustainability (succeeding in the market place) or for environmental sustainability (making a positive net contribution to the environment).

Animal health and welfare is included within recent strategy documents as a key element of sustainability. This is based in part on the assumptions that increasing levels of animal health and welfare necessarily lead to improved economic returns and environmental management from farming. Whilst the social acceptability of animal health and welfare is undoubtedly important, assumptions on the positive economic and environmental benefits of animal health and welfare are more difficult to justify. For example, economic pressures have in the past led to many abuses of animal welfare, and routine medicines such as anthelmintics undoubtedly improve the welfare of ruminants, but may result in environmental damage. The ethical dimensions of animal health and welfare, together with the possible trade-offs between animal welfare and the economic and environmental dimensions of sustainable development mean that it is perhaps more sensible to consider animal health and welfare as an issue in its own right.

Human health is referred to within the Sustainable Farming and Food Forward Look and within the Food Industry Sustainability Strategy as the link between nutrition and health. Better public health 'through improved nutrition' is a stated strategic outcome of the first of these documents. In effect this addresses the opportunities available to the farming and food sectors to exploit the growing public demand for products with health claims attached to them, and highlights the potential economic benefits that the food and farming sectors might gain from these.

Rural Communities form the third element of the Sustainable Farming and Food Forward Look strategy paper. Farming is recognised in this as contributing to economic activity in particular in areas which are lagging economically and the strategy aim of sustaining rural communities, and in particular sustaining or improving the employment and economic performance of these lagging communities, is of particular relevance to Defra's PSA targets.

4.3 Environmental sustainability

'Improving environmental performance of farming' is the term used within Defra's Sustainable Farming and Food Forward Look to cover the areas of environmental protection, resource management and pollution control. The direction in which Defra interprets environmental sustainability is evidenced in phrases such as farming 'maximising its role in the renewal of the natural environment' and 'making a positive net contribution to the environment'.

Environmental 'objectives' for Defra include;

- landscape
- biodiversity
- soil
- air quality
- water quality
- waste management

[10] Sustainable Farming and Food: Forward Look, Defra 2006
[11] Food Industry Sustainability Strategy, Defra 2006
[12] Securing the Future. The UK Government Sustainable Development Strategy, HM Government 2005

Countryside access is cited as an environmental objective, although it may be more accurately interpreted as a social objective (as might 'landscape'). There is a wide range of policy, regulation and initiatives relating to Defra's environmental objectives, as well as the influence of economic incentives within the CAP. Issues are diverse; they can impact upon the economic performance of farming (e.g. if not coordinated across the whole market) and can impact upon sectors other than food and farming such as tourism and health. Given the overarching importance given to 'environment' within strategy documents relating to sustainable development, a key issue to be addressed may be how to prioritise *within* environmental sustainability objectives.

In an attempt to place a value on these environmental assets, Defra is adopting the approach of considering 'ecosystem services'[13]. The approach is based on the Millennium Ecosystem Assessment[14], a global study, and applies this at the UK level. Ecosystem services are 'the benefits that people gain from ecosystems' and the valuation is used as a means of comparing alternative courses of action. This is a recent development within Defra which attempts to create a 'strategic vision for the natural environment' as an aid to prioritising and communicating policy. However, whilst the concept of ecosystem services is relatively new, its adoption and application across Defra remains to be seen.

'Climate change and agriculture' is treated as a separate entity, and addresses three separate issues;

i) Mitigating the effects of climate change upon agriculture
ii) Mitigating the effects of agriculture upon climate change
iii) Opportunities for land management arising from climate change

Climate change is a major driver of government environmental policy. The contribution of agriculture to greenhouse gas emissions, and in particular to methane and nitrous oxide, is significant and mitigating the effects of effects of agriculture on climate change is therefore a central aim of Defra policy. Further to this, the Sustainable Farming and Food Forward Look highlights that climate change may bring economic opportunities to farmers to grow new crops, to expand into energy and to grow non-food crops for example. Here the impacts of such new crops and altered land-use upon Defra's policy objectives (e.g. as regards biodiversity) may be significant.

Various papers have inferred that Defra would benefit from, for example, the 'identification of crops, including non-food crops, which would flourish under changed climatic conditions' and the 'development of crop breeding programmes based on identifying ecologically adaptive populations'[15], elements of research that may be interpreted as mitigating the effects of climate change upon agriculture. However, the effects of climate change may not be confined to agricultural production and a broader question must therefore be asked, which is whether the effects of climate change upon agriculture will mean that policies relating to farming and food will need to be adapted in order to achieve the government's environmental, social or economic objectives?

5. Conclusions

Interpreting sustainability as it has been applied to farming and food requires that the economic, social and environmental elements of sustainable development are examined separately, as follows;

- Economic sustainability may be interpreted as 'the commercial efficiency of the farming industry being driven by the market'.
- Social sustainability may be interpreted as 'overall human welfare'.
- Environmental sustainability may be interpreted as 'improving environmental performance' and may be considered a policy priority. However, environmental sustainability remains the most complex element in the context of farming and food, because of the possible trade-offs between separate environmental objectives.

Where 'sustainable development' as a concept bringing together the environmental, social and economic elements becomes of use (with regard to research and evidence) is in the framing of questions relating to policy development and delivery. So, for example, questions may be asked as follows;

e.g. Do we understand sufficiently the interactions between economic (or social) drivers and environmental impacts (e.g. for a particular farming method) to put in place a policy that will have the desired outcome?

e.g. Do we have enough reliable evidence of the technicalities of environmental impacts / interactions between impacts, to justify policies aimed at mitigating these?

e.g. How do policy options compare against each other in terms of environmental, social and economic impact?

[13] Vaze, P., Dunn, H. & Price, R. 2006 Quantifying and Valuing Ecosystem Services. A note for discussion. Defra; A new vision for the natural environment: towards and ecosystem approach. Defra, December 2006
[14] Reference Millennium Ecosystem Assessment website
[15] The First Report of the Sustainable Farming and Food Research Priorities Group. Also see the Sustainable Farming and Food Forward Look, p40, paragraph 5.18

Appendix 2. A review of decision processes used within other organisations to target funding for scientific research

Defra is not alone in commissioning research of different sorts and across a diverse range of subject areas and so prior to developing the framework it was prudent to investigate the mechanisms used by other organisations to prioritise and target research funding. Organisations were selected as holding a similar remit to Defra as regards the commissioning of research and data was collected through internet search, email and telephone communication.

1. Scope

Allocation of funding to science programmes was studied in the following organisations:

UK	Scottish Executive Environment and Rural Affairs Department Department for Agriculture and Rural Development, Northern Ireland Sustainable Development Directorate, Department of Trade and Industry Food Standards Agency Ministry of Defence BBSRC NERC Royal Society Wellcome Trust
EU	Research Directorate, European Commission INRA, France Ministry of Agriculture, Nature and Food Quality, Netherlands
North America	United States Department of Agriculture [*including Sustainable Agriculture Research & Education, National Research Initiative and the Cooperative State Research, Education & Extension Service*] Agriculture & Agri-Food Canada
Australasia	Rural Industries R&D Corporation, Australian Government Foundation for Research, Science & Technology, New Zealand

2. Overview

In this section, the features common to procedures will be considered and examples given of types of funding allocation systems. A detailed overview of each of the organisations and the procedures they apply is given in Table 1.

3. Rationales for funding research

Government and other public organisations fund research programmes for three main reasons:

3.1 The science provides evidence for governments to develop and implement policy, including Defra, FSA, Ministry of Defence, and INRA, France

3.2 The science is aimed at promoting a 'sustainable' national agricultural industry and is often linked to education and extension services, including SEERAD, DARDNI, USDA, AAFC, RIRDC, FRST, the Netherlands, Germany and the EU Framework Programmes. Sustainability is interpreted variously to prioritise economic, environmental or social factors[16].

3.3 The science is to increase knowledge and support the science base, and is selected for its quality rather than its outcome, including the BBSRC, the NERC, the Royal Society, and the Wellcome Trust

4. Budget allocation processes

In most cases the processes for allocating funding follow a similar route, regardless of the rationale for funding:

4.1 The organisation identifies its policy and strategy priorities.

4.2 If the range of policies and strategies is wide, then separate strategy panels are established for each.

4.3 Expert groups are consulted for advice on what research is required to help meet these priorities. In most cases, research requirements are set by the funding organisation following input from external advisory panels comprised of experts from relevant fields of science, technology and industry.

[16] The UK levy bodies are in this class. The research priorities of each body are focused on the profitability of the levy payer and on one or two sectors of the industry, making decision making significantly simpler. The amount of funding available for new projects in each year is relatively low and there is a strong incentive to co-fund with others, including the LINK programmes managed by Defra.

4.4 A higher management committee, with input from the strategy panels, agrees and establishes the programmes that require scientific evidence. This decision making is usually reached by *discussion on the likelihood of the programme delivering the evidence needed to meet the priorities set out in the published strategy*, rather than by a formal assessment mechanism.

4.5 Budgets are allocated to each research programme by the management committee.

4.6 The organisation then issues calls for tenders in the areas identified by the expert panels and agreed by the management committee.

4.7 On receipt of tenders, review panels assess their suitability for funding. The review panels may consist of small teams from within the organisation or larger team incorporating external experts. Their make-up is often similar to (but independent from) the expert group involved at stage 4.3.

4.8 The research is completed and the findings are communicated to policy makers, user communities or the wider public, depending on the remit of the funding organisation. Some organisations have an education and extension service to ensure that the findings get taken up by the target group.

4.9 The outcome of the research feeds into the policy and strategy and is used to guide decisions on future programmes of research

The outputs of stages 4.1 – 4.4 and 4.6 – 4.9 are well publicised by the organisations studied and set out in the publicly available documentation.

Stage 4.5 is less transparent. The information that is not usually publicly available is the decision making process whereby organisations allocate funding between programmes. The results from this enquiry suggests that in most cases this decision is taken by a senior management team within the organisation and is reviewed on an annual basis to check for:

- continuing relevance
- assessment of impact
- availability of funding,
- emergence of new priorities.

There is little evidence that a formal framework structure is used to assist this decision making except in a few cases.

5. Published frameworks

Frameworks are in place in some organisations to help them to identify their priorities (stage 4.1, above). Examples include the National Framework for Environmental Management Systems in Agriculture in Australia, and the Strategic Planning and Accountability Framework from Agriculture and Agri-Food Canada.

5.1 The National Framework for Environmental Management Systems (EMS) in Agriculture is published by the Rural Industries R&D Corporation, an Australian Government organisation. This provides guidelines for Australian farmers to assess whether they are managing their land in the most appropriate way to protect their environment, and scientific research is commissioned to help improve the data and procedures available for their use. The main thrust of this is to maintain a competitive industry in the face of the environmental challenges that face Australian farming, such as drought and salinity. The framework sets a number of targets that the EMS should aim to achieve, and research proposals are judged on their ability to deliver against these with questions including:

"Magnitude of potential economic, environmental and broader community benefits forgone if project is not undertaken",

"Appropriateness, clarity and feasibility of research objectives, project design and methods, including management of risks" and

"Environmental sustainability of the project's outcomes and their potential impact on biodiversity".

5.2 The Strategic Planning and Accountability Framework, issued by Agriculture and Agri-Food Canada in collaboration with their Science & Innovation Strategy, is an attempt to improve the financial management of this government department which was recently restructured. All budgets, including those for research, are approved by the Executive Council, using a results-based planning and reporting process that incorporates performance indicators, with justification for each research activity being linked across divisions and programmes with the expected results, the 'Program Activity Architecture'. The key drivers are for research are the *expected impacts* that the programs are percieved to have on Canadian Agriculture and on the lives of Canadians. .

Although these frameworks help managers to identify research areas of high priority, the decision to allocate levels of funding follows the procedure used by MAFF in its annual Blue Book exercise, which ran until 2001. Every year, the R&D budgets for the coming financial year were appraised by senior management to identify where changes should be made. Each budget holder - i.e. the policy group and the science unit who managed their R&D – was required to spell out the consequences to their research programmes (and therefore to MAFF) of a cut of 5% and of 10% in each of their financial programmes, and what they would introduce if they were given an extra 5%.

Within each financial programme, funding was allocated to assessment units justified by ROAME statements and with specific time-limited objectives of what the R&D would achieve. This is comparable to the current allocation to the programme areas of Agriculture & Climate Change / Water Quality & Conservation / Biodiversity & Landscape / Food chain, and the subdivisions into Assessment Units within each of those, e.g. WQ1 – Water Quality and WU1 – Water Use.

As problems were solved or policy changed, research programmes would change to reflect this. Old programmes would end and new programmes would start. So, if a new priority emerged, such as Salmonella, BSE or TB, the 5% or 10% reductions would be taken from each budget holder and used to fund the new research needed. The redistribution of funding in the Blue Book exercise was across many areas including agriculture, including livestock production, arable crops, horticulture, food technology, agri-environment, animal health and welfare, fisheries, and flood control.

6. Other mechanisms

6.1 The use of Life Cycle Assessment (LCA) was introduced by the Dutch Ministry of Housing, Planning and Environment but has been adopted more widely, including the Dutch Ministry of Agriculture, Nature and Food Quality and in recent studies commissioned by Defra's Sustainable Consumption and Production Division. LCA helps to identify and formally present the processes within the production and consumption of a particular good which have greatest environmental impact. This allows research requirements to focus on those areas where changes in procedure are likely to have the greatest impact. Since LCA focuses on outcomes it presents good opportunities to identify cross-cutting research. However, the impacts measured within an LCA study are limited to a specific set of environmental criteria, and do not address the wider social, economic or additional environmental factors that policy makers must address.

6.2 The Food Standards Agency has recently developed a new framework to assist in prioritising research requirements. Earlier tools to assist in decision-making for research funding allocation, using pair-wise comparison methods, were found to be too complex for use at all levels within the Agency. The new support tool, which is expected to be put into place in the business planning round that starts in September/October 2007, will incorporate bids for new research into future business planning and requires the Agency staff, at the Division and Group level, who are proposing each of the research competitions to score the value of the research proposal using a matrix of 8 criteria.

These criteria are:

i. The size of the target issue, e.g. the size of the population at risk

ii. The reduction in the problem if the research findings are implemented

iii. An intervention factor, i.e. difficulty of implementing the change

iv. Timescale

v. Probability of success, i.e. will the research produce what is required?

vi. Probability of others doing the research

vii. Public concern / level of anxiety

viii. Public or other commitment, i.e. how likely is it that the required changes will be taken up?

The scores for each of these criteria are used to generate a priority ranking between 1 and 4, and this is then used in the business planning process to decide whether it should be funded. This process is new and is expected to evolve over time.

6.3 There are funding mechanisms where decisions on prioritisation and allocation are not made within the funding body. These include the 'response mode' funding from BBSRC and NERC. Funding allocation for research proposals received by BBSRC and NERC in their response mode programmes is based on scientific excellence. Although BBSRC has several thematic areas, each with its own Strategy Panel and Research Committee, while NERC does not differentiate its themes, the principle used to allocate funding is the same for both. Research tenders received following calls in response mode are assessed by panels of experts and scored against standards agreed across all the Research Committees. Funding is then

allocated to projects starting with those having the highest scores and moving down the list until all the funding is allocated. There is no differential allocation between thematic areas. Whilst this mode of funding allocation avoids the problems encountered when trying to compare the relative importance of two or more high level priorities, it does not ensure that specific research objectives are achieved.

7. Conclusions

The broad conclusions that might be drawn from this study of other organisations that manage a wide base of strategies are:

- The lack of a formal framework to assist in prioritising research funding is not unique to Defra
- All funding organisations studied have a well established formal procedure for identifying, in mainly qualitative terms, the broad priorities appropriate to their policies and strategies.
- The mechanisms for partitioning available budgets across those priorities are less well established.
- Advisory groups, involving internal and external stakeholders, are in place in many organisations to assist in prioritising research requirements. Like the recent Defra Research Priorities Group, however, these bodies do not allocate budgets.
- Decisions on budget allocations across priorities are usually taken by senior management.
- Organisations that have the financial success of their agriculture and food industries as their prime objective use the needs of their farmers and food producers to help decide budget allocations.
- Organisations that have knowledge acquisition as their main driver do not differentially partition budgets across priorities.
- Framework documents, providing a set of actions and criteria to be used in the decision making, exist in some organisations and these tools can help senior management with business planning. However, formalised frameworks are scarce and there is none that Defra could easily adapt for its own use

Table 1. Basis for prioritising research and allocating funding

Organisation	Areas of relevance	Basis for decision making on research priorities	Basis for allocation of funding across programmes
Defra, UK	Sustainable farming & food Sustainable consumption & production	1. High level policy objectives, Sustainable Farming & Food Strategy / Food Industry Sustainability Strategy 2. Policy Division objectives 3. ROAME statements supporting need for research 4. Publication of Research requirement programmes	1. Ministers and management Board 2. Policy Directors and Heads of Division
Food Standards Agency, UK	Food safety	FSA Strategic Plan and the Science Strategy inform the annual business plans	Proposals for research competitions are scored for their priority, using a Prioritisation Matrix incorporating 8 criteria, before they can be included in business plans
SEERAD, UK	Sustainable agriculture	1. Minister for Environment & Rural Development and the Agricultural Strategy Group. 2. Strategy for Scottish Agriculture 2006 3. External peer review 4. Chief Scientific Advisor	Support for Scottish Agricultural Research Institutes continuing at previous level, although research programmes are policy-based and overseen by an independent Advisory Group. By 2010, all research funding put to open tender. Additional funding for contract research decided by SEERAD policy personnel plus an independent assessor.
DARDNI, UK	Sustainable agriculture	1. Strategic Plan 2006-2011 2. R&D Strategy 2007-2015 (under development in consultation with the Research & Education Advisory Panel, Universities and AFBI)	1. Policy Divisions 2. DARD Strategy Board for approval (Chief Scientific Adviser being appointed)
BBSRC, UK	Sustainable agriculture and underpinning biological science	1. Senior management informed by OSI strategy 2. Establishment of Programme boards	20% of funding retained to support Institutes and capacity building. Remaining 80% in response mode, partitioned evenly across the top scoring project proposals in each Strategy Research committee
NERC, UK	Environmental protection and conservation	1. Senior management informed by OSI strategy 2. Establishment of Programme boards	Funding divided between support for NERC institutes and response mode funding. Single research committee with funding allocated only by scientific excellence
Royal Society, UK	Fellowships for scientific excellence	Quality of applicants with some selection for under-represented areas	Fellows and external peer review as required
Wellcome Trust, UK	Biomedical research	1. Board of Governors and Executive Board with input from 8 Strategy Committees 2. Strategic Plan 2005-2010 'Making a Difference' 3. Highlight areas published on web site	1. Strategy Committees with additional peer review for excellence of science 2. Strategic Awards Committee

European Commission	Sustainable agriculture	1. Framework Programmes informed by internal data collection & analysis and by consultation with members states. 2. Technology Platforms charged with developing research strategies to help meet an agreed long-term vision.	Themes and budgets for the Framework Programmes set by EC following extensive input from member states. Although frameworks exist, such as the 'Framework for indicators for the economic and social dimensions of sustainable agriculture and rural development', which inform decision making, there is no formal framework used to allocate funding across programmes.
INRA, France	Sustainable agriculture	"INRA orientations for the period 2006-2009", derived from consultation with stakeholders, development of previous priorities and proposals from research centres	INRA Management Board decision based on thematic priorities and the resource needs of the INRA infrastructure
Ministry of Agriculture, Nature & Food Quality, Netherlands	Sustainable agriculture	Department of Knowledge, MANFQ. Use of Life Cycle Assessment to identify key issues	All research conducted by EDLO Foundation, within the Wageningen University & Research Centre
Australian Government, Rural Industries Research & Development Corporation	Sustainable agriculture	1. Rural Industries R&D Corporation --> National Framework for Environmental Management Systems in Agriculture 2. Publication of research requirements prospectus and call for bids	Research Committees within the Rural Industries R&D Corporation plus peer review, based on match with priorities, sustainability potential of outcomes, benefits missed if not supported, plus 5 other desirable qualities including scientific quality, value for money & track record of research team.
Foundation for Research, Science & Technology, New Zealand	Sustainable production	High level priorities set at Cabinet level with input from the Ministry of RS&T.	Funds allocated to FRST from Vote RS&T. FRST then allocate to 18 portfolios, based on the high level priorities, and this allocation endorsed by an independent Board who advise FRST
United States Department of Agriculture	Sustainable agriculture, Forestry, Entrepreneurship, Conservation, Community development	Published prospecti and calls for research from a range of USDA funding organisations, including National Research Initiative (NRI) Competitive Grants Program [addressing specific scientific or technological agricultural problems], the Sustainable Agriculture Research & Education (SARE) Program [developing improved farm and ranch systems] and the Cooperative State Research Education & Extension Service (CSREES) [focusing on knowledge transfer]	USDA uses a comprehensive budget and performance integration process that aligns funding and performance with the Department's strategic goals. The process involves an in-depth review of agency goals, objectives and performance measures as they relate to the Department's strategic goals and objectives. The results of this review form the basis for development of specific budget proposals.
Agriculture and Agri-Food Canada	Sustainable development including sustainable agricultural production	AAFC Sustainable Development Strategy 2003 "Sustainable Agriculture: Our Path Forward" & Sustainable Development Strategy 2007-2009 "Making Progress Together", "Strategic Planning and Accountability Framework" and "Science & Innovation Strategy 2006"	Funding priorities are identified by consultation with stakeholders and are aimed at solving the Canadian industry's most meaningful challenges and opportunities.