



Evidence & Innovation Strategy 2009-2013



Department of
**Agriculture and
Rural Development**

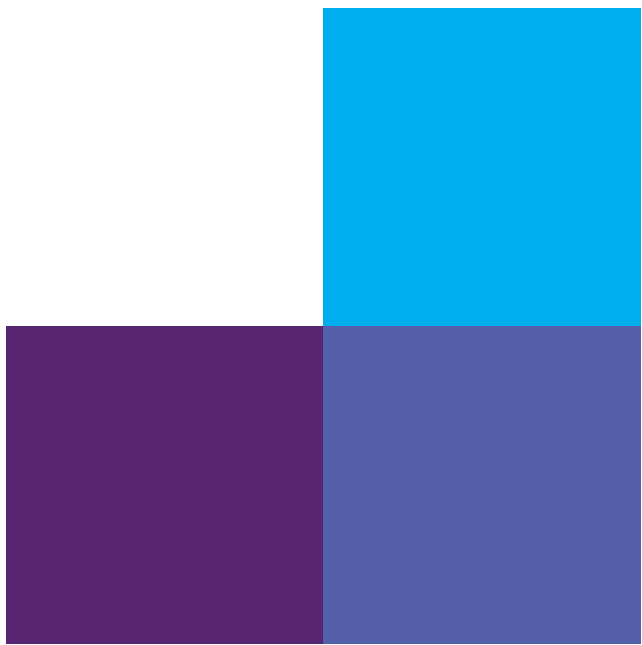
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AN ROINN

**Talmhaíochta agus
Forbartha Tuaithe**

MÁNNYSTRIE O

**Fairms an
Kintra Fordèrin**



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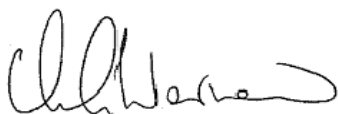
Ministerial Foreword

A thriving and sustainable rural community and environment in the North is the Vision that guides the work of DARD. As we strive to achieve this Vision, we will have to address difficult challenges in a fast moving and increasingly complex world. Now, perhaps more than ever, we need to have access to robust evidence to ensure that our policies are designed and delivered to achieve the best possible outcomes for the rural communities that we serve. At the same time, our local rural businesses must be able to harness the latest ideas, working methods and technologies if they are to achieve success in an increasingly competitive marketplace.

I am, therefore, pleased to launch this, our first research strategy since the implementation of the O'Hare review of our arrangements for agri-food education and research and development (R&D). It seeks to underpin the Vision and Goals of the DARD Strategic Plan 2006-11 and provide an over-arching framework for all DARD-funded R&D for the next 5-10 years.

It identifies the strategic research areas required to generate the evidence base for policy development and delivery in DARD and represents my Department's contribution to promoting innovation in the North, in line with the objectives of the Regional Innovation Strategy Action Plan (RISAP) 2008-2011.

In developing the Strategy, we have benefitted from the input of a wide range of stakeholders. I would like to thank those involved for their positive contributions and I hope you will all continue to work with us in implementing, and refining, the Strategy in the coming years.



Michelle Gildernew MP MLA
Minister of Agriculture and Rural Development

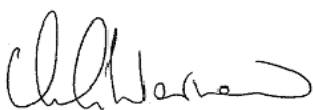
Focal ón Aire

Pobal tuaithe agus timpeallacht rafar agus inbhuanaithe i dTuaisceart Éireann; sin an Fhís a threoraíonn obair RTFT. Agus muid ag streachailt chun an Fhís sin a bhaint amach, beidh orainn aghaidh a thabhairt ar dhúshláin éagsúla fad is go bhfuil an saol ag éirí níos gasta agus níos casta. Anois, níos mó ná riamh b'fhéidir, caithfidimid rochtain a bheith againn ar fhianaise láidir lena chinntiú go ndearfar agus go seachadfar ár bpolasaithe chun na torthaí is fearr agus is féidir a bhaint amach do na pobail tuaithe a ndéanaimid freastal orthu. Ag an am chéanna, caithfidh ár ngnónna áitiúla tuaithe bheith ábalta úsáid a bhaint as na smaointe, na modhanna oibre agus na teicneolaíochtaí is déanaí má tá siad ag dul rath a bhaint amach in áit mhargaidh atá ag éirí níos iomaíche an t-am ar fad.

Dá thairbhe sin, tá lúcháir orm ár gcéad straitéis taighde a sheoladh ó cuireadh i bhfeidhm athbhreithniú Ó'Hare ar shocruithe s'againne d'oideachas agrairbhia agus taighde agus forbairt (T&F). Féachann sí le taca a chur faoi Fhís agus Spriocanna Plean Straitéiseach RTFT 2006-11 agus creat uileghabhálach a sholáthar do gach T&F arna maoiniú ag RTFT do na céad 5-10 de bhlianta eile.

Sainaithníonn sí na réimsí straitéiseacha taighde atá de dhíth le bonn fianaise a chruthú chun polasaí a fhorbairt agus a sheachadadh sa RTFT agus sin an méid atá Roinn s'agamsa a dhéanamh le nuálaíocht a chur chun cinn i dTuaisceart Éireann, de réir chuspóirí an Phlean Ghníomhaíochta um Straitéis Réigiúnach Nuálaíochta (PGSRN) 2008-2011.

Agus an Straitéis á forbairt againn, bhaineamar tairbhe as an obair a rinne réimse leathan páirtithe leasmhara. Ba mhaith liom buíochas a ghabháil leo siúd a bhí páirteach ann as an obair dhearfach a rinne siad agus tá súil agam go leanfaidh sibh ar aghaidh ag comhoibriú linn chun an Straitéis a chur i bhfeidhm, agus a scagadh sna blianta amach romhainn.



Michelle Gildernew MP CTR
Aire Talmhaíochta agus Forbartha Tuaithe

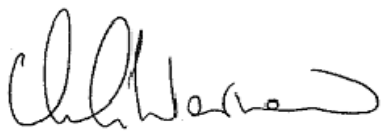
Meenester's Forrit

A weel daein an' oangaein kintra community an' environment i the Noarth bes the veesion at steers the waark o' DARD. Es we ettle tae bring thon veesion intae bein', we wul hae tae owrecum hannlins i a quaaq movin' an' mair an' mair complex worl'. Noo, aiblins mair nor iver, we hae need tae bae fit tae get aa strang evidence tae mak' siccar at oor policies ir wrocht oot an pit intae prattick tae get the bes' ootcums at ir fit tae bae gat fer the kintra communities at we sairve. Aa the saime tim', oor locail kintra consairns maun bae fit tae harness the maist new mintit notions, wies o' waarkin an' technologies gif they ir tae hae guid ootcums i a mair an' mair competitive meercetplace.

Thons fer wie A'hm sarious gled tae launch this, oor furst research strategy sine the O'Hare review o' oor set ap fer agri-food education, research an' forderin wus brocht in. Hit leuks tae unnerpin the Veesion an' Goals o' the DARD Strategic Plan 2006 – 11 an' gie an owreairchin framewaark fer aa DARD peyed fer Research an' Forderin fer the cummin 5 – 10 yeirs.

Hit shews the strategic research airts at ir needfu' tae generate the evidence base fer policie forderin an' delivery i DARD an' bes mae Depairtment's inpit tae heftin' innovation i the Noarth, gaein alang wi' the objectives o' the Locail Innovation Strategy Ection Plan 2008 – 2011.

I forderin the strategy, we hae hed the guid o' the inpit o' a clatter o' differ stakehoulders. A'hd laike tae thank thaim involved fer thair positive inpits an' A hope at ye wul cairry oan wrochtin alang wi' iz tae bring in an mak' betther the strategy i the yeirs tae cum.



Michelle Gildernew MP MLA

Meenester fer Fairmin an' Kintra Forderin

Executive Summary

The Department of Agriculture and Rural Development (DARD) has as its Strategic Vision a thriving and sustainable rural community and environment in Northern Ireland. To ensure that our policy and operational activities are appropriately designed and targeted to achieve this Vision, we need sound scientific evidence across the full range of our responsibilities. At the same time, we recognise the vital role of innovation in developing a sustainable and profitable regional economy.

This Strategy, therefore, describes the overarching framework for research and development to underpin evidence-based policy and delivery, and to promote innovation in agri-food, farming, forestry and other rural businesses. Since the twin drivers of the Strategy are evidence and innovation, we have called the Strategy the **DARD Evidence and Innovation Strategy**.

This Strategy underpins the Vision and Goals of the DARD Strategic Plan 2006-11 and will provide the over-arching framework for all DARD-funded research and development for the next 5-10 years. Our research will be policy led and determined by our Public Service Agreement Targets and other strategic objectives and commitments.

The precise detail of the research commissioned to deliver this Strategy will be set out in a series of underlying research programmes and sub-programmes, which will be developed during the early lifetime of the Strategy.

Stakeholders will play an important and on-going role in identifying and refining the research programmes and priorities and, where commercially relevant, we look to them to co-fund a proportion of the costs and will seek means to encourage this. Where appropriate, we will work with other government departments and/or other funders jointly to plan and fund research projects of common interest and will where possible seek to encourage similar collaboration among rural businesses and public sector research organisations. We will also maximise opportunities for collaboration and engagement with local, national and international research partners to avoid unnecessary duplication of research effort.

It is envisaged that a significant part of our research will be delivered by the Agri-food and Biosciences Institute. However, we will also invite competitive bids for some of our research work. Our decisions on research priorities and funding will be open and transparent.

The benefits of DARD-funded research will be harnessed through effective knowledge transfer to policy-makers and other stakeholders or through commercialisation.

A summary of DARD's strategic research framework is provided in Table 1 below.

DARD Evidence and Innovation Strategy 2009-13

Table 1. Framework for DARD Strategic Research

Research Need	DARD Strategic Goals				Cross Cutting Research Strands
	Goal 1	Goal 2	Goal 3	Goal 4	
	Performance in the market place <i>(Chapter 7)</i>	Social & economic infrastructure of rural areas <i>(Chapter 8)</i>	Animal, fish and plant health and animal welfare <i>(Chapter 9)</i>	Sustainable environment <i>(Chapter 10)</i>	
Evidence	Impact of policy changes	Addressing the needs of rural communities	Costs, benefits & risk profiles of animal & plant disease prevention & control strategies	Understanding and improving the environmental footprint of the agri-food industry	Socio-economic research Responding to climate change: adaptation and mitigation
	Education & life long learning		Improving detection & control of endemic animal diseases	Assessing & improving the impact of agri-environment programmes & activities	
			Developing Improved Traceability systems	Understanding the environmental impact of changes in agricultural land use patterns and intensity	
			Animal welfare	Sustainable forestry	
			Aquaculture & fish health	Sustainable waste and manure management	
			Plant health	Sustainable fisheries and aquaculture	
			Disease horizon scanning – emerging risks	Flood risk management	
Innovation	Sustainable and competitive production	Sustainable rural communities – the social economy	New techniques /approaches to disease prevention and control	Novel & innovative approaches to nutrient management.	
	Novel & innovative products and processes				
	Renewable energy – opportunities for land-based industries				
	Sustainable forestry				
	Sustainable fisheries & aquaculture				

1. Introduction

DARD (and its predecessors) has a long history of funding and carrying out research within the areas of agriculture, fisheries, forestry and food. Much of this research has found its way into practical applications on farm, food processing and other rural businesses. It has also helped shape government policy on agri-food issues and has represented a considerable investment of government funds in the development of this important sector.

With the creation of the Agri-Food and Biosciences Institute (AFBI) in April 2006 (amalgamating the former DARD Science Service and the Agricultural Research Institute for Northern Ireland), our role in agri-food research changed from being a provider of research to being a funder and customer of research.

In that same year, we published our first multi-annual business plan – the Strategic Plan 2006-2011¹. In this plan, we defined our four Strategic Goals:

- to improve performance in the market place;
- to strengthen the social and economic infrastructure of rural areas;
- to enhance animal, fish and plant health and animal welfare; and
- to develop a more sustainable environment.

Research was identified as having a key role to play in helping us achieve all of these Goals.

This Strategy represents our first attempt to define a strategic framework to direct our future investment in research and development. It establishes some key guiding principles, defines the purpose of DARD commissioned research, describes the areas of strategic research interest across our Goals and indicates how we will deliver the Strategy.

The Strategy has been developed drawing on significant stakeholder input, as well as expert advice from the Research and Education Advisory Panel. Due regard has been given to broader strategic initiatives and documents, both locally and further afield. This has been to try and ensure both a proper fit for the Strategy within a broader strategic framework and its relevance to our needs and those of our stakeholders.

¹ <http://www.dardni.gov.uk/dard-strategic-plan-2006-2011.pdf>

2. Key Principles Underpinning Our Approach to Research

In developing this Strategy, we have established the following guiding principles.

1. Our research will be policy led and our requirements determined by our Public Service Agreement Targets and our other strategic objectives and commitments.
2. Our strategic research priorities and subsequent research programme development and evaluation will be under-pinned by sound scientific principles and advice.
3. Stakeholders will play an important and on-going role in identifying and refining research priorities and, where commercially relevant, we will look to them to co-fund a proportion of the costs.
4. DARD-funded research will be high quality, fit for purpose and value for money.
5. The benefits of DARD-funded research will be harnessed through effective knowledge transfer to policy-makers and other stakeholders, or through commercialisation.
6. Where appropriate, our research requirements will be met through a competitive tendering process.
7. We will pursue opportunities for collaboration and engagement with local, national and international research partners and will avoid unnecessary duplication of research effort¹. We will seek to encourage similar collaboration among rural businesses and public sector research organisations where we can.
8. Our decisions on research priorities and funding will be open and transparent.

¹ In some instances, similar research may be undertaken where this is justified because of specific social, economic or environmental conditions in Northern Ireland.

3. The Scientific and Research Boundaries of this Strategy

At the outset, it is important that we clearly establish the scientific boundaries of this Strategy and the nature of the research that we will fund (in full or in part).

Research and experimental development (R&D) may be defined as:

'creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications'.

It excludes routine scientific and technological activities, such as the provision of education and training, the provision of information, general purpose data collection, patent and licence development, routine software development and feasibility studies. It also excludes economic appraisals and project evaluations, although evidence obtained from research will often inform these¹.

This Strategy relates to DARD's research and development agenda only. It does not encompass the wide range of scientific diagnostic and analytical testing and surveillance work currently funded by DARD in support of its EU and national obligations, disease control programmes, law enforcement, etc. The commissioning by DARD of these latter scientific services will continue to be driven by ongoing business needs determined independently of this Strategy (although it is recognised that research has an important role in informing and improving our delivery of these functions).

3.1 Types of Research

Three types of R&D may be distinguished²:

(i) Basic Research

Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

(ii) Applied Research

Applied research is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

(iii) Experimental Development

Experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience which is directed to producing new materials, products and devices; to installing

¹ Frascati Manual, OECD, 2002.

² Frascati Manual, OECD, 2002

new processes, systems and services; or to improving substantially those already produced or installed.

DARD research funding will be concentrated primarily on applied and experimental development research activities. This is in recognition of the relatively modest research funding (in a national and international context) at our disposal and, therefore, the need to deliver maximum impact within a reasonable timeframe to meet our strategic policy objectives. This will not preclude absolutely the undertaking of broader, more basic R&D, if there is a sound argument for doing so and a local benefit can be identified.

We also recognise that with the modest research monies at our disposal, we cannot fund research across all of the research interests identified in this Strategy, nor should we necessarily seek to. We envisage that in many instances, our interests can be adequately addressed through the desk based collation and interpretation of findings from research undertaken elsewhere, and that the capture and use of results from such research will meet our needs and those of our stakeholders.

4. The Role of DARD Commissioned Research

The DARD Strategic Plan sets out in broad terms our strategic priorities over the period 2006 to 2011. The specific detail of our associated policies and delivery plans is contained in more focused strategic documents and programmes. Examples of these include the Rural Strategy¹, the Forestry Strategy², the Animal Health and Welfare Strategy³, the Renewable Energy Action Plan⁴, and the Northern Ireland Rural Development Programme⁵. Together, these documents and programmes describe the detailed actions necessary to achieve our key strategic priorities and represent our response to the challenges and opportunities that we and our stakeholders face.

Research, development and technology transfer are some of the tools we will use to help us achieve our strategic goals. However, investment in research and the expansion of knowledge as an end in itself is not a priority for DARD. Consequently, this Strategy has no free standing or autonomous existence – **it exists to serve the strategic policy objectives already established or to be established**. From the limited resources at our disposal, we will ensure that, as far as possible, research is commissioned with a specific, policy-relevant goal in mind.

In keeping with this approach, all research needs identified in this Strategy will seek either to:

- Provide robust high quality and relevant **evidence** to improve policy making, review and delivery in DARD;
- or
- Identify product, process and organisational **innovations** that will support the sustainable development of the agri-food industry and broader rural economy in line with our policy objectives.

Hence, we have termed this the **DARD Evidence and Innovation Strategy**.

4.1 Evidence

DARD is committed to an evidence-based approach to policy development and implementation⁶. Therefore, our primary need for research is to obtain robust, high quality and relevant evidence to underpin the development,

¹ <http://www.dardni.gov.uk/dard-rural-strategy.doc>

² <http://www.dardni.gov.uk/strategy-for-sustainability-growth.pdf>

³ <http://www.dardni.gov.uk/animal-health-and-welfare-strategy.pdf>

⁴ <http://www.dardni.gov.uk/renewable-energy-action-plan-2.pdf>

⁵ <http://www.dardni.gov.uk/index/rural-development/nirdp2007-2013.htm>

⁶ Evidence-based policy has been defined as 'the integration of experience, judgment and expertise with the best available external evidence from systematic research' (Davies, 1991). This involves a balance between professional judgement and expertise on the one hand and the use of valid, reliable and relevant research evidence on the other.

delivery and evaluation of our policies across our full remit, as broadly described in the DARD Strategic Plan.

This includes having the right information available to ensure that our legislation and regulatory practices are appropriately targeted, effective and impose the minimum necessary administrative and compliance cost.

Therefore, in funding research to meet our evidence needs, we will seek to ensure that policy leads within DARD assume ownership of the research agenda, are the internal customers of this research and are fully engaged in defining the research needs.

4.2 Innovation

Innovation is the successful exploitation of new and existing ideas. Increased investment in innovation and R&D is identified as one of the four key drivers in achieving the Economic Vision for Northern Ireland *"as a high value added, highly skilled, innovative and enterprising economy which enables us to compete globally, leading to greater wealth-creation and better employment opportunities for all"*¹.

In an increasingly open and competitive global economy, Northern Ireland simply cannot compete on low wages and costs. This is particularly true in the agri-food sector, where Northern Ireland enjoys neither the scale nor the natural advantages to compete with many of the major global agricultural commodity suppliers. However, through innovation and the exploitation of research, rural businesses can boost productivity and achieve competitive advantage.

The vital role of innovation in the growth of the Northern Ireland economy is reiterated in the Northern Ireland Regional Innovation Strategy (RIS), which has a vision to *"create a culture and environment within which Northern Ireland will prosper by using its skills, knowledge and capacity to innovate"*².

Introducing innovation is, however, a complex process requiring the co-ordination of multiple inputs. There is a significant body of evidence to suggest that inter-firm collaboration (including with customers and suppliers), or collaboration between firms and universities/public sector research establishments, can increase levels of innovation. In 2007, 11% of innovation active Northern Ireland enterprises co-operated on innovation activities³. Suppliers and clients were the most common innovation partners. The least likely co-operation arrangement was with government or public research organisations.

Within primary agricultural production in particular (which consists predominantly of sole traders and micro enterprises), issues of cost and risk act as major barriers to investment in research and innovation. In addition,

¹ <http://www.detini.gov.uk/cgi-bin/downutildoc?id=936>

² <http://www.detini.gov.uk/cgi-bin/downutildoc?id=9>

³ UK Innovation Survey 2007: NI Results. <http://www.detini.gov.uk/cgi-bin/downutildoc?id=3742>

businesses may not have the resources or skills to take on board and apply such knowledge.

Government intervention to support and promote innovation in the rural economy must be founded on the principle of addressing market failure. Underinvestment in research and innovation is a recognised form of market failure, and the fragmented structure of the agri-food sector and rural businesses, as well as low and/or variable levels of profitability, will exacerbate this problem of underinvestment. Government intervention to correct this market failure can take a number of forms, such as smart procurement, advice and guidance and promoting knowledge transfer. Government funded and government assisted research also has a key role to play.

However, if government is funding research with a view to promoting innovation and economic growth, it is essential that there is close engagement with industry in shaping the research agenda, otherwise there is a significant risk that the research will not be translated into subsequent economic activity and growth.

Therefore, through this Evidence and Innovation Strategy, we will support and encourage industry and rural enterprises to become more involved in research and innovation and play our role in delivering on the RIS and the associated Action Plan¹. This will be achieved by:

- Funding and part-funding relevant R&D on behalf of the industry, where appropriate and justified;
- Engaging with industry and rural enterprises in the setting of the detailed research programmes that will flow from this Strategy;
- Levering private sector funding for research with a commercial application by offering suitable financial support, thereby encouraging industry to take a direct lead in directing research;
- Encouraging the uptake and exploitation of publicly-funded research;
- Ensuring that we and our delivery partners, including the Agri-Food and Biosciences Institute, work with science institutions locally, nationally and internationally to develop collaborative research where appropriate, and with local stakeholders to shape and disseminate that research;
- Working with government departments and other relevant partners to support implementation of the first report of MATRIX², the Northern Ireland Science Industry Panel.

¹ <http://www.detini.gov.uk/cgi-bin/downutildoc?id=2172>

² http://www.matrix-ni.org/downloads/matrix_vol1_report.pdf

5. Stakeholder Involvement in the Development of this Strategy

In the past, concerns have been raised about the lack of transparency in our decision-making in relation to R&D activities. Concerns have also been expressed by stakeholders about their ability to influence this decision-making process. Meaningful, early and effective consultation is, of course, also an essential part of good policy-making.

This Strategy has been drawn up in an open and inclusive process involving DARD policy development and delivery staff, other Northern Ireland departments, science delivery bodies, representatives of the agri-food industry and other rural stakeholders.

From November 2006 to February 2007, we hosted a series of meetings with key stakeholders, most of which were organised around specific sectoral groupings, to discuss their views on the content of the Strategy. A summary of these group discussions may be found on the DARD website¹. We also met with other Northern Ireland departments and a range of research funders and providers, including the two local universities and the Agri-Food and Biosciences Institute.

In the summer of 2008, we held a public consultation on the draft Strategy. We received comments from 24 organisations/individuals. A summary of those comments and our response to them is also available on the DARD website².

A full list of all those who have contributed to the development of the Strategy is attached at Annex A.

¹ http://www.dardni.gov.uk/index/publications/pubs-dard-strategies-reports-and-accounts/publications_strategies_newpage-2/publications-dard-research-and-development-strategy-pre-consultation-responses.htm

² To be inserted when available.

6. DARD Strategic Research Framework

6.1 The Strategic Scope of DARD's R&D Interest

The overarching policy context for the preparation of this Evidence and Innovation Strategy is the DARD Strategic Plan 2006–11. The Plan confirms that sustainable development is the key driver for the Department.

The Plan identifies the Department's Vision as:

'A thriving and sustainable rural community and environment in Northern Ireland'

This, therefore, serves as the vision for our Evidence and Innovation Strategy.

The Strategic Plan outlines five Strategic Goals to achieve this Vision. These are:

1. To improve performance in the market place;
2. To strengthen the social and economic infrastructure of rural areas;
3. To enhance animal, fish and plant health and animal welfare;
4. To develop a more sustainable environment; and
5. To deliver effectively our services to customers.

The Evidence and Innovation Strategy is focussed on creating a research framework that will assist DARD in delivering against the first four of these Goals (the fifth is essentially about process – how we deliver rather than what we deliver).

The balance of research effort between evidence and innovation (as defined in Sections 4.1 and 4.2 above) will vary across these four Goals. Research under Goal 1 will be driven largely by innovation objectives, with research Goals 2, 3 and 4 driven primarily by the need for evidence to underpin policy.

The strategic research interests under each of these Strategic Goals are set out in detail in Chapters 7-10. Inevitably, there is a degree of overlap, particularly in relation to:

- socio-economic research, and
- research relating to climate change adaptation and mitigation.

Therefore, these latter two areas are dealt with separately in Chapter 11 as Cross-Cutting Research Strands.

6.2 Time Horizon for the Strategy

We acknowledge the timescales involved in research and, in particular, the time lag between the commissioning of research and the eventual realisation of benefits. This means that research commissioned under this Strategy will extend beyond the remaining lifetime of the current DARD Strategic Plan. Nevertheless, although the balance of emphasis and detailed actions may evolve in response to changing circumstances, the Strategic Goals of this Department are not expected to alter fundamentally in the foreseeable future.

Therefore, they are likely to remain a valid basis for underpinning the Evidence and Innovation Strategy (though we recognise the need for suitable review mechanisms – see Chapter 13).

6.3 Flexibility

The Evidence and Innovation Strategy aims to establish the broad framework and principles to guide our investment in research. The detailed research content will be set in a series of underlying research programmes – see Chapter 12 for further details. These will be developed with a strong policy lead to ensure coherence with our strategic policy objectives, and with stakeholder involvement to ensure openness, engagement and, in the context of innovation, market focus and eventual uptake.

Although the broad thrust of DARD's strategic policy is likely to remain reasonably stable over the next number of years, we recognise that there will need to be a process of fine tuning and refocusing of the research agenda as new issues emerge. This will be addressed through the active management of the individual research programmes to reflect the evolving policy context.

7. DARD Strategic Goal 1: To Improve Performance In The Market Place

7.1 Rationale

Our main focus under this Goal is on research to support the sustainable economic development of the local agri-food, fisheries and forestry industries.

A changing trading environment, with increased international competition and an evolving system of EU support, means that firms and farms must continually adapt their business practices and products if they are to remain viable. A key message from stakeholders was the need proactively to seek to exploit new market opportunities, balancing environmental and social sustainability with the requirement for accelerated economic development.

As the focus of this Goal is largely on creating and sustaining economic advantage, there needs to be strong industry engagement in the development of the detailed research effort, particularly in respect of innovation research, as well as a clear focus on subsequent technology transfer.

Therefore, where possible, we will seek to lever industry funding for research with an expected commercial application, thereby ensuring that industry effectively takes a lead in setting the research agenda. One way of achieving this will be the development of a **Research Challenge Fund** - see Chapter 12 for further details.

Where the research has less of an immediate or obvious commercial application, or where the research is to inform policy, we will still seek to involve industry stakeholders in developing the detailed research programmes so that they remain firmly rooted in delivering an economic outcome.

7.2 Strategic Policy Drivers

- Continuing CAP reform, including the 2003 Luxembourg Agreement, the 2008 Health Check and post-2013 developments;
- Review of the Common Fisheries Policy;
- WTO negotiations and trade liberalisation;
- Northern Ireland Programme for Government 2008-11;
- A Sustainable Development Strategy for Northern Ireland 2006;
- Economic Vision for Northern Ireland 2005, and emerging Regional Economic Strategy;
- Regional Development Strategy for Northern Ireland 2025;
- Regional Innovation Strategy for Northern Ireland 2003, and Action Plan 2008-2011;
- Fit for Market – The Report of the Food Strategy Group 2004;
- Vision twenty/twenty – Report of the Foresight Leadership Group, Food Strategy Implementation Partnership 2006;
- The First Report of MATRIX: The Northern Ireland Science Industry Panel 2008, and emerging Implementation Plans;
- Food Matters – Towards a Strategy for the 21st Century 2008;

- Organic Action Plan Group for Northern Ireland: Action Plan 2006;
- Red Meat Taskforce Report 2007;
- Securing the Benefits – Joint UK Response to the Prime Minister’s Strategy Unit Net Benefits Report on the Future of the Fishing Industry in the UK 2005;
- Review of Inshore Fisheries Management in Northern Ireland 2007;
- Building a Sustainable Future for Aquaculture – A new impetus for the Strategy of the Sustainable Development of European Aquaculture 2009;
- Northern Ireland Forestry - A Strategy for Sustainability and Growth 2006;
- Strategy for the Equine Industry in Northern Ireland 2007;
- Fit Futures: Focus on Food Activity and Young People 2007;
- Investing for Health 2002;
- Government’s Response to the UK Biomass Taskforce Report 2006;
- Renewable Energy Action Plan 2007;
- UK Climate Change Act 2008; and
- EU Climate and Energy Package 2008.

7.3 Evidence Research Needs

7.3.1 Impact of Policy Changes

In order to inform policy development and delivery, we need to ensure that we have a sound understanding of the complex social, political and economic interactions which shape the operating environment in which the agri-food, fisheries and forestry industries function. This includes the impact of policy changes at EU and WTO level, central to which is the influence of the Common Agricultural Policy (CAP) and the Common Fisheries Policy (CFP).

Adjusting to the decoupling of CAP support from production continues to pose significant challenges to the agricultural industry. The continued evolution of the CAP under the 2008 Health Check and likelihood of further reform post-2013, together with trade liberalisation under a possible WTO agreement, will drive structural and technological change within the agri-food sector, with knock-on effects for the wider rural economy.

The growing significance of broader rural development within the CAP (which includes environmental, forestry and socio-economic strands) will continue to alter the way in which the CAP impacts the agri-food food industry and the broader rural economy. We need to understand the implications of emerging policy proposals so that we can seek to influence and respond to them, including by the development of appropriate sectoral and rural strategies. The economic modelling work of the Food and Agricultural Policy Research Institute (FAPRI) - UK Partnership operating within AFBI¹ will form a key element of this strand of strategic research. But we must also extend and deepen our understanding of the broader rural economy and the impact of EU policy upon it.

¹ <http://www.afbini.gov.uk/index/research/hp-work-area-economics/economics-p19960035.htm>

Research is similarly needed to inform Northern Ireland's position in the UK's negotiations with Europe on the CFP. For example, science has a key role to play in informing annual negotiations on Total Allowable Catches and days at sea for the sea fishing industry, helping to ensure sustainable fish stock management under an evolving Common Fisheries Policy.

Key research interests in this area are:

- Economic modelling of the agri-food and rural sectors to enable assessment of policy options, notably under CAP reform (including the future of CAP post-2013) and WTO trade liberalisation;
- Fish stock levels assessment and controls; and
- Sustainable fisheries management under CFP reform.

Work in support of the two Cross-Cutting Research Strands (i.e. socio-economic research and climate change research – see Chapter 11) is clearly also relevant here. For example, research is needed to evaluate the potential impact of EU and UK climate change legislation and policy options on the local agri-food sector.

7.3.2 Education and Life Long Learning

A highly-skilled workforce is widely regarded as one of the key drivers for economic growth and prosperity in Northern Ireland (as identified in the Economic Vision for Northern Ireland). DARD has a long history of supporting skills development in the agri-food sector and, more recently, rural development, both for new entrants and those already employed in the rural economy. At present, we deliver a range of further and higher education programmes and specialist short courses at the College of Agriculture, Food and Rural Enterprise (CAFRE). We also fund undergraduate and/or post-graduate programmes at the two Northern Ireland universities and the Rural College, Draperstown. In addition, each year we fund a number of post-graduate studentships at universities in the UK and Ireland.

We have initiated work on a DARD education strategy which will guide our approach to helping equip rural enterprises with the skills they need to become more competitive and sustainable and to deliver DARD's strategic policy objectives. A robust evidence base is needed to inform the development, subsequent implementation and eventual review of the strategy. The Department for Employment and Learning (DEL) already gathers a range of Labour Market Information and other data to inform the development, outworking and review of the Skills Strategy for Northern Ireland¹. In addition, good preliminary work has already been completed by Lantra² and Improve³, the relevant Sector Skills Councils for the land based and food and drinks industries, to inform development of their respective Sector Skills Agreements. However, further research and analysis is needed on the specific skills needs

¹ http://www.delni.gov.uk/skills_strategy_for_northern_ireland-2.pdf

² <http://www.lantra.co.uk/businesses/northern-ireland/>

³ <http://www.fdtc.co.uk/news.asp>

of the agri-food and wider rural sectors, both now and for the foreseeable future. An assessment also needs to be made of the impact of existing provision, as well as any gaps which need to be addressed, taking into account other key strategies and policy developments, such as the UK-wide Leitch Review of Skills¹, the Skills Strategy for Northern Ireland and the STEM Review².

Key research interests in this area are:

- Identifying the specific knowledge and skills needs of those in the agri-food and rural sectors;
- Assessing the impact of expected changes in industry structure and skills needs, as well as technological developments, in planning for future provision; and
- Evaluating the impact of current provision and identifying gaps and barriers in delivery

7.4 Innovation Research Needs

7.4.1 Sustainable and Competitive Production

DARD wishes to see a competitive and profitable agricultural industry which can respond to market opportunities and deliver high quality, safe products whilst protecting and enhancing our rich natural environment and heritage. To do this, farms need to become knowledge-based businesses which have access to, and can exploit, new ideas and technologies and be able to operate at high levels of technical efficiency. Given the direction of EU agricultural policy and the increasing challenge from global competitors, farms which do not embrace business and technological advances will suffer falling commercial viability and require greater access to off-farm sources of income (if they are to survive as production units).

However, while exposure to global competitive forces is increasing, global opportunities are also emerging. The world's human population continues to expand, with growth of up to 50% projected by 2050. Most of this growth is expected to be in the 50 least developed countries (UN 2007). This is coinciding with a shift to an increasingly urbanised population, and together with rising prosperity, a change in food consumption patterns. It has been estimated that there could be more than a 70% increase in demand for food and other agricultural products by 2050 (FAO 2006), whilst the impacts of climate change and other environmental threats (such as water availability) may limit capacity for food production in certain regions. All of this creates long term opportunities for market-led, efficient and sustainable agricultural production and processing in areas such as Northern Ireland.

Key research interests in this area are:

¹ http://www.hm-treasury.gov.uk/leitch_review_index.htm

² <http://www.delni.gov.uk/index/successthroughskills/stem-rev.htm>

- Assessing the scale of opportunities available in international markets and the costs, risks, barriers and benefits involved;
- Benchmarking the competitiveness of local production against international best practice;
- Identifying optimal sustainable production systems for different farm enterprises and structures;
- Evaluating the effect of adoption of new technologies on efficiency, including the potential use of genomics in improving productivity, disease control, animal welfare, traceability and breeding quality;
- Exploring the linkages between agricultural production systems and technologies and food attributes, such as food safety and eating quality;

Resource use efficiency will also be key to sustainable and efficient agriculture. Modern agriculture is highly dependant on fossil fuels, both in terms of its direct use on farm and embedded within inputs such as chemical fertilisers. The spike in the prices of these inputs during 2008 perhaps provides a preview of the future challenges that rising energy costs will pose in an era of growing global energy demand and finite fossil fuel reserves. Yet there is considerable scope to reduce reliance on both of these expensive inputs. Energy efficient production systems and on-farm energy production have the potential to reduce costs and lessen agriculture's expose to energy price inflation.

Considerable savings on chemical fertilisers could be made through more efficient use of animal manures and a rediscovery of the potential of legumes, such as clovers, to fix nitrogen in the soil within modern production systems

To underpin this, research will be required on resource use efficiency, particularly of embedded energy (from both a cost and carbon footprint perspective), but also labour, water and soil.

Key research interests in this area are:

- Improving efficiency of resource use, with particular focus on embedded energy, but also labour, water and soil;
- New technologies to improve efficiency of use of animal manures as a fertiliser;
- Developments in plant breeding to produce compatible grass/clover mixtures;
- Evaluation of potential of alternative forage legumes to reduce reliance on nitrogen fertiliser input; and
- Opportunities to reduce dependence on fossil fuels through the development of appropriate and cost effective farm level renewable energy technologies.

7.4.2 Novel and Innovative Products and Processes

A clear message emerging from the consultation to inform the development of this Strategy was that, in today's global market, Northern Ireland cannot compete simply on price. Lower labour costs and economies of scale in other

nations are generating increasing competitive pressures for Northern Ireland's producers and processors. It is evident that, to succeed in the future, new approaches are required which will give Northern Ireland products distinctive and marketable attributes. In many instances, these attributes will be created by post farm gate processes.

The increased focus on the impact of food and food ingredients on human health and wellbeing present significant opportunities for the agri-food industry. By capitalising on such opportunities, the Northern Ireland agri-food can reposition itself away from a vulnerable reliance on commodity or near commodity products and seek to capture greater value from the supply chain.

Growing opportunities also exist in the development of non-food products from crops. Northern Ireland enjoys a particular natural advantage in the growing of grass, which accounts for 78% (excluding rough grazing) of the utilised agricultural area. Monitoring and exploring emerging options for the potential use of this crop other than as animal feed could pay dividends.

Key research interests in this area are:

- Improving food quality, product attributes and system efficiency through process innovation;
- Exploiting functional foods and food ingredients for human health and wellbeing;
- The potential exploitation of non-food crops for biocompounds and biopolymers, e.g. packaging, cosmetics, textiles; and
- Assessing the potential of the grass crop as a substrate for non-animal feed uses.

7.4.3 Renewable Energy - Opportunities for Land-based Industries

Renewable energy resources will help form part of a portfolio of technologies that will provide the means of responding to the challenges of climate change and rising fossil fuel costs. Identifying and exploiting such opportunities will not only help the UK to deliver its renewable energy targets, renewable crops and technologies will also open up new income streams for the agriculture and forestry sectors, so broadening their economic base. The latter is a particular policy focus of DARD. Therefore, research in this area must have a strong focus on securing the economic benefits of renewable energy for the land based sectors and the broader rural economy.

Forestry by-products have significant potential as a source of renewable energy if they can be used efficiently. Anaerobic digestion of animal manures and other agri-food waste streams also offers considerable potential as a means of both generating renewable energy and managing waste streams in a sustainable manner. Anaerobic digestion may also offer possibilities in terms of generating energy from crops (including grass).

Parallel to work on encouraging renewable energy opportunities, it will also be important to conduct research which assesses the potential impact of

renewable energy crops and technologies on the environment. (Also see Chapter 10.)

Key research interests in this area are:

- Profitable energy from biomass;
- Profitable energy from forestry and forestry by-products; and
- Profitable energy from agricultural and food waste streams.

Research will also be needed to explore the potential of new energy crops whose growth is made feasible by advances in genetics which extend their geographic range, or by anticipated changes in growing conditions brought about by climate change.

7.4.4 Sustainable Forestry

DARD's Forest Service aims to support the planting of 1,650 hectares (at a rate of 550 hectares per year) of forest and woodland by 2011, with a view to doubling the area of forest cover in Northern Ireland in the longer term. To achieve this, more land needs to be converted from agriculture to forestry, mainly by private landowners. Landowners are likely only to invest in this activity if the financial rewards make it worthwhile. Research is needed to provide a better understanding of the returns from forestry, taking account of the social, economic and environmental issues, and, crucially, the barriers which prevent private landowners converting agricultural land to forestry.

The draft Strategy to Develop the Recreational and Social Use of Forest Service Forests, due to be finalised in mid 2009, outlines plans to promote and facilitate the use of forests for recreation and other social purposes. This will require a better understanding of the costs and benefits of the opportunities available, the challenges of managing the needs of different users, and also the likely impact of recreational activities on the forest environment.

Key research interests in this area are:

- The economics of timber production, taking account of the multiple functions of forests;
- Improving supply chain management and markets for forest products and services;
- Research on recreation and social forest users and cost effective delivery of expectations, including opportunities for building partnerships for forest recreation; and
- Protection of forests from disease and pests.

7.4.5 Sustainable Fisheries and Aquaculture

Commercial sea fishing makes an important contribution to the economy of a number of our coastal communities. However, the local industry has come under huge pressure in recent years as a result of reduced fish quotas and

days at sea allowances. To ensure a sustainable and profitable industry for the future, information is needed on fish stock levels and sustainable fisheries management practices, including stock enhancement and suitable harvesting plans, as well as the economics of fishing. One of the most significant issues is the high level of discards of whitefish by-catches associated with shellfish fishing rigs. Research is, therefore, required on minimising discards through selectivity trials on fishing gear.

A recent EU Foresight exercise¹ identified aquaculture as a potential means of helping to feed the world's growing population. The projected increase in demand for seafood opens up potential opportunities for Northern Ireland. Rising sea surface temperatures as a result of climate change may allow some shellfish cultures to colonise new waters, creating the potential for alternative commercial opportunities. The Review of Inshore Fisheries Management in Northern Ireland² also identified opportunities for sustainable growth in aquaculture and mariculture, including diversification into new species of shellfish and seaweed, as well as potential for development of crab and lobster fisheries. It is important that the shellfish aquaculture industry develops in a sustainable manner and with an acceptable environmental impact (see also Chapter 10).

Key research interests in this area are:

- Sustainable sea fisheries management;
- Economics of sea fishing, including vessel and labour efficiency;
- Fishing gear selectivity trials;
- Commercial opportunities for aquaculture and mariculture;
- Potential for expansion of crab and lobster fisheries; and
- Environmental impact of aquaculture activities.

¹ http://ec.europa.eu/research/agriculture/scar/pdf/foresighting_food_rural_and_agri_futures.pdf

² <http://www.dardni.gov.uk/fisheries-inshore-review>

8. DARD Strategic Goal 2: To Strengthen the Social and Economic Infrastructure of Rural Areas

8.1 Rationale

The concept of 'rural' and its role in the overall Northern Ireland economy has changed dramatically over the past 10 to 15 years (not least as a result of changes in agriculture) and, with this, the needs of rural communities. DARD's Rural Strategy, published in October 2006, provides a strategic direction and framework for rural development policy in Northern Ireland. It aims to facilitate a coordinated and cooperative approach to rural development over the period 2007-13. A key element of the Rural Strategy is the commitment that DARD will create and develop the role of champion for the rural community in relation to access to public services and in the reflection of rural needs within broader government policy initiatives.

DARD has, therefore, secured a mandate from the Northern Ireland Executive to develop a Rural White Paper with the aim of strengthening the cross-departmental approach to tackling the problems (and capitalising on the opportunities) that exist in rural areas. To inform this role, we will need to have a robust understanding of the social and economic characteristics of rural areas, with a particular focus on identifying disadvantaged groups and their specific needs. We need to understand how these characteristics and needs vary between rural communities and how they compare with urban counterparts. We also need to develop a more sophisticated understanding of what this means for the development and equitable delivery of the broad remit of government policy for both the farm and non-farm sector.

It is anticipated that the monitoring and assessment of activities delivered through previous, and the current, Rural Development Programmes and other routes can provide some of the knowledge base needed in this area to help develop a **Rural Evidence Hub**. However, we must also seek opportunities to gather relevant information across other departments and this Hub will, in future, become a valuable shared resource and will help enhance the process of rural proofing.

A vital first step in developing our rural research programme is, therefore, a comprehensive literature review to gather and analyse the existing evidence base. This will also seek to identify knowledge gaps and the need for further socio-economic research, including possible longitudinal studies, to address policy questions relating to rural regeneration.

Rural regeneration requires a vibrant socio-economic structure and this has been a key focus of successive Rural Development Programmes. We will need a robust evidence base to assess the impact and effectiveness of the Northern Ireland Rural Development Programme 2007-13 and development of future policies and programmes.

8.2 Strategic Policy Drivers

- Continuing CAP Reform, including 2003 Luxembourg Agreement, the 2008 Health Check and post-2013 developments;
- EU Rural Development Regulation 2007-13;
- Northern Ireland Programme for Government 2008-11;
- Economic Vision for Northern Ireland 2005, and emerging Regional Economic Strategy;
- Regional Development Strategy for Northern Ireland 2025;
- DARD Rural Strategy 2007-2013;
- Northern Ireland Rural Development Programme 2007-13;
- DARD draft Rural Anti-Poverty and Social Inclusion Framework;
- DARD Renewable Energy Action Plan 2007;
- Planning reform, including PPS 21 (draft): Sustainable Development in the Countryside 2008;
- Northern Ireland Act 1998; and
- Strategy for the Equine Industry in Northern Ireland 2007.

8.3 Evidence Research Needs

8.3.1 Addressing the Needs of Rural Communities

DARD's Rural Strategy has an overall theme of '*diversifying the rural economy, protecting the rural environment and sustaining rural communities*'. To inform the delivery of this strategy, as well as the role of Rural Champion and the proposed Rural White Paper, we need a better understanding of the characteristics, needs and expectations of those who live and work in rural and coastal communities. Research will, therefore, focus in the first instance on the specific status, problems and opportunities of rural communities, with a particular focus on the needs of disadvantaged groups.

Changing market forces and environmental pressures are expected to continue to drive restructuring of traditional rural industries, such as farming and fishing. This points to the need for alternative economic enterprises. Government has a key role in assisting rural communities to take advantage of new opportunities. Initially, however, we need a better understanding of which diversification activities represent the most viable options for rural dwellers, as well as their potential impact on sustainable communities and the natural environment. Part of this must be an assessment of the barriers that slow the rate of rural regeneration and an analysis of the most appropriate policy options to overcome these obstacles.

Key research interests in this area are:

- Baseline and trend data on the socio-economic characteristics of different types of rural areas to populate a Rural Evidence Hub;
- Levels of access to government and other services in rural areas such as transport, housing, education, health, social services, information, child care, elder care;

- An assessment of appropriate policy responses to address barriers to access;
- Evaluation of existing and planned DARD rural development interventions, including the role and value of diversification activities;
- Appropriate policy initiatives to promote equality of opportunity and tackle poverty and social exclusion in rural areas.
- The evolving role of agri-food, fishing and forestry in the rural economy;
- The role of the rural economy in the broader Northern Ireland economy; and
- Socio-economic linkages and interdependencies between rural and urban areas;

Where appropriate, we will commission qualitative or user-led research in support of these interests.

8.4 Innovation Research Needs

8.4.1 Sustainable Rural Communities – The Social Economy

Sustainable communities may be defined as those '*which integrate the social, economic and environmental components of the neighbourhood, meet the needs of existing and future generations and respect the needs of others*¹.

Given the on-going changes in the rural economy and society, there is need to identify new ways of reconnecting and regenerating rural and coastal towns and villages which engage all parts of the community. Social economy enterprises offer one such opportunity. These are enterprises which have a social, community or ethical purpose and operate using a commercial business model but on a not-for-personal-profit basis. Traditional agricultural co-operatives would have fallen within this definition, but more recently, social economy enterprises have had an important role in leading rural regeneration initiatives.

Key research interests in this area are:

- The role and potential of social economy enterprises in community development and regeneration; and
- The achievement and benefits of community engagement and animation.

¹ A Sustainable Development Strategy for Northern Ireland – First Steps Towards Sustainability. <http://www.ofmdfni.gov.uk/sustain-develop.pdf>

9. DARD Strategic Goal 3: To Enhance Animal Health and Welfare, Fish and Plant Health

9.1 Rationale

Animal health and welfare issues exert a very significant influence across a wide spectrum of our economic and social life and also, in some cases, on human health. The experience of BSE and foot and mouth disease over the past decade and more provides ample evidence of the potential cost to the taxpayer of major outbreaks of animal disease, the animal welfare consequences, the loss of public confidence in the livestock industry and the wider economic impact. This all points to the need for a strategic approach to protecting animal health and welfare, supported by sound scientific evidence.

Although animal health issues have achieved a high public profile in the UK over recent years (often in a very negative context), plant and fish health are also key strategic considerations for the future safety and security of the food chain and the broader rural economy. Vigilance against new and emerging threats in the face of an increasingly open international trading environment and a changing climate is clearly a prudent and necessary precaution.

9.2 Strategic Policy Drivers

- A New Animal Health Strategy for the European Union 2007-2013;
- Northern Ireland Programme for Government 2008-11 and associated Efficiency Delivery Plans ;
- Northern Ireland Animal Health and Welfare Strategy 2006;
- Draft All Island Animal Health and Welfare Strategy 2008;
- Northern Ireland Plant Health Strategy (under development);
- Invasive Species in Ireland Report, March 2004;
- Aquatic Animal Diseases Directive (Council Directive 2006/88/EC of 24 October 2006); and
- North Atlantic Salmon Conservation Organisation (NASCO).

9.3 Evidence Research Needs

9.3.1 Costs, Benefits and Risk Profiles of Animal and Plant Disease Prevention and Control Strategies

All government decisions on animal and plant health and animal welfare should be based on sound science and a clear understanding of the risks, costs and benefits of policy options and alternatives. Targeted research is, therefore, vital to support and underpin the development of animal and plant health and animal welfare policies in Northern Ireland and informing our discussions with Defra and EU.

Historically, DARD's animal and plant disease control strategies and interventions have been driven by an EU agenda. Often, with the exception of

data on disease incidence, little is known of the wider economic implications of our actions. Further information on these issues is required to evaluate existing animal and plant disease control strategies and to inform the direction of future policy. In particular, better tools to estimate the long term benefits and costs to the economy of disease control strategies should be developed.

Key research interests in this area are:

- Understanding the full costs, risks and benefits of animal, fish and plant disease control strategies, now and in the longer term; and
- Assessing attitudes to animal health and welfare within the supply chain and how these affect decision-making, including consumer behaviour.

9.3.2 Improving Detection and Control of Endemic¹ Animal Diseases

DARD spends large sums of money each year on the surveillance and diagnosis of animal diseases, notably bovine Tuberculosis (TB) and Brucellosis. Faster, more accurate and less costly detection of such diseases will ultimately assist in disease eradication programmes and the early detection and prevention of the spread of new diseases. This should help improve the overall health status of Northern Ireland's animal population and, ultimately, create a more competitive agri-food industry.

DARD aims to eradicate Brucellosis from the Northern Ireland herd within the next 5 years.

Although the overall trend in the incidence of bovine Tuberculosis in Northern Ireland has been downward over the past 5 years, it continues to be one of the most challenging and costly animal health problems both for the industry and for the taxpayer. It also has potential human health implications. Total bovine TB related expenditure by DARD in 2007/08, for example, was in excess of £21 million. Research into all aspects of TB control, including possible vaccines, the role of wildlife reservoirs, resistance to disease, etc. is required in order to gather the evidence required to shape our policy as we work towards the longer term target of eradication in a cost-effective way.

Key research interests in this area are:

- Epidemiology of TB, including molecular epidemiology (strain typing) and methods of controlling the spread of disease from cattle to cattle and between wildlife and cattle;
- TB vaccines for cattle/wildlife.
- Improved diagnostic tests (with particular emphasis of accuracy, timeliness and cost); and
- Improved disease surveillance methods;

¹ An endemic disease is one which is constantly present to a greater or less degree in any region.

9.3.3 Developing Improved Traceability Systems

DARD's animal traceability systems are at the heart of efforts to control the spread of animal diseases, as well as providing consumer reassurance and facilitating trade. Research to identify practical, low cost, robust methods of improving the integrity of traceability systems will underpin DARD's disease control strategies and the safeguard customer confidence in local produce.

Key research interests in this area are:

- DNA based traceability methods and their practical use; and
- Alternative identification systems.

9.3.4 Animal Welfare

Some market solutions currently exist for improving animal welfare in farmed animals, such as "Freedom Foods", the farm assurance and food labelling scheme established by the Royal Society for the Prevention of Cruelty to Animals (RSPCA) to improve the welfare of farm animals and offer consumers a higher welfare choice. However, animal welfare has many of the attributes of a public good, in which society's desire for high animal welfare standards is not accurately reflected through the market for farmed animals (and not at all in the case of non-farmed animals). Therefore, government action to correct this market failure is necessary, although the detailed evidence to guide that intervention is not always clear, or even available.

Nevertheless, society's interest and concern for the welfare of kept animals is a growing driver for strategic change. Concerned individuals and welfare groups lobby regularly for the highest possible welfare standards for animals. There is pressure to ensure that animal health and welfare policies do not simply ensure the absence of cruelty and disease, but also ensure, through education and awareness, that anyone who takes ownership of an animal for whatever purpose has a duty of care to meet acceptable animal health and welfare standards.

Key research interests in this area are:

- Understanding public perceptions and the benefits accruing to society from improved animal welfare relative to the costs;
- Assessing the current status of animal welfare in farming systems in Northern Ireland;
- Assessing the animal welfare impact of changing production practices in response to economic pressures, new technologies and new legislation; and
- Exploring the most efficient means of responding to demands for higher animal welfare standards.

9.3.5 Aquaculture and Fish Health

Although fish diseases are not communicable to humans, shellfish, in particular, can carry bacteria and biotoxins which are potentially injurious and

even fatal. While essentially a public health rather than a fish health matter, a significant incident could have disastrous consequences for the local industry.

Given the nature of the environment in which fish are farmed, aquaculture has the potential adversely to affect fish in the wild, not only by spreading disease, but also by interfering with the genetic make-up of wild stocks. The controlled environments in which wild fish species are farmed have potentially major implications on their welfare.

Under the current EU fish health regime, Northern Ireland is a disease free zone in respect of most exotic and non-exotic diseases and aims to maintain this status. To do so, it needs to be alert to the potential for new disease threats, including those arising from changes in sea temperatures (see also Section 9.3.7 Disease Horizon Scanning – Emerging Risks).

Key research interests in this area are:

- Understanding the risks and potential impact if aquaculture on the health and genetic make-up of wild fish stocks and the most appropriate mitigation policies;

9.3.6 Plant Health

An All Island strategic approach to plant health and pesticides is currently being developed.

It is anticipated that key research interests from a policy evidence perspective will centre around improved surveillance and diagnostic methods.

DARD also has an interest in the health of bees, particularly given their role in plant pollination, and will seek to tap into relevant work being carried out at Defra's Central Sciences Laboratory National Bee Unit, and at The Queen's University of Belfast, funded by the Department of the Environment.

The emerging DARD Contingency Plan for exotic pests and diseases of Honey Bees in Northern Ireland, together with the forthcoming Bee Health Strategy may also identify further areas for specific local research.

9.3.7 Disease Horizon Scanning – Emerging Risks

Increased international travel and trade, as well as climate change, have the potential to impact significantly on the diseases affecting Northern Ireland animals, fish and plants. DARD needs to retain a capacity for the early detection of emerging threats so that appropriate action can be taken to protect the animal, plant and fish health status of Northern Ireland. This requires both the monitoring of pest and disease occurrences and the assessment of risk from new and emerging threats. This may give rise to the need for specific research projects (as in the case of bluetongue disease),

depending on the nature of the threat, the state of scientific knowledge and local circumstances.

9.4 Innovation Research Needs

9.4.1 New Techniques/Approaches to Disease Prevention and Control

The control of disease is of great significance to the efficiency and profitability of modern agriculture. The development of new tests and vaccines offers the potential for early diagnosis and control of disease whilst also providing an opportunity to stimulate innovative solutions from the private sector.

Developments in relation to genome sequencing offer the potential for genetic selection for disease resistance in plants, animals and fish. This could be a very important and cost effective long term control strategy for major endemic animal diseases. Similarly, changes in nutrition at key stages in the lifecycle (e.g. foetal programming in animals) can fundamentally alter mechanisms of disease resistance.

Key research interests in this area are:

- Improved diagnostic tests and vaccines for commercially significant animal and plant diseases;
- Nutritional strategies to reduce susceptibility to disease; and
- Use of genome selection to improve resistance to disease.

10. DARD Strategic Goal 4: To Develop a More Sustainable Environment

10.1 Rationale

Government is fully committed to the principles of sustainable development and to leading by example. The Sustainable Development Strategy for Northern Ireland and associated Implementation Plan, published in 2006, reflect this commitment and DARD, along with other Northern Ireland departments, will contribute to the achievement of its goals.

A generally accepted definition of sustainable development is: '*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*' (Report of the World Commission on Environment and Development: Our Common Future - also known as the Brundtland Report - 1987¹). Underpinning this is the need to address collectively and individually the environmental considerations which are major factors in public health and wellbeing. Examples of these include, tackling the causes of climate change, pollution, poor air quality and other consequences; ensuring good water quality; avoiding the loss of plant and animal species (biodiversity) essential to the food chain and cycle of life; understanding and managing the consequences of waste; and the enhancement and protection of landscape and natural resources.

The main focus of our research needs in this area is on gaining a better understanding of the interaction between land and marine based industries and the natural environment. This, together with an improved understanding of attitudes to regulatory compliance in these industries, will inform better policy making and regulation.

At the same time, concern for environmental sustainability, including the need to mitigate the impact of climate change, could open up new opportunities for the land-based sector, for example in renewable energy production. A better understanding of the value attached to sustainable land and marine management may also provide the opportunity to create and exploit market differentiation for the products of the agri-food sector.

10.2 Strategic Policy Drivers

- EU Directives, notably on Birds (79/409/EEC), Habitats (92/43/EEC), Nitrates (91/676/EEC), Water Framework (2000/60/EC) and Floods (2007/60/EC), and the European Landscape Convention 2000;
- The Office of Science and Technology Foresight Report on Future Flooding 2004;
- Northern Ireland Programme for Government 2008-11;
- A Sustainable Development Strategy for Northern Ireland 2006;
- Northern Ireland Nitrates Action Programme 2006;

¹ <http://www.un-documents.net/wced-ocf.htm>

- DARD Rural Strategy 2007-2013;
- Northern Ireland Waste Management Strategy 2006-2020;
- Northern Ireland Biodiversity Strategy 2002;
- Conserving Biodiversity - The UK Approach 2007;
- Northern Ireland Forestry - A Strategy for Sustainability and Growth 2006;
- Strategic Energy Framework for Northern Ireland 2004;
- DARD Renewable Energy Action Plan 2007;
- Securing the Benefits – Joint UK Response to the Prime Minister's Strategy Unit Net Benefits Report on the Future of the Fishing Industry in the UK 2005;
- Draft UK Marine and Coastal Access Bill;
- Charting progress: An integrated Assessment of the State of the UK Seas 2005;
- An Integrated Coastal Zone Management Strategy for Northern Ireland 2006-2026; and
- Living with Rivers and the Sea, 2008 (Government's response to the Northern Ireland Flood Management Policy Review).

10.3 Evidence Research Needs

10.3.1 Understanding and Improving the Environmental Footprint of the Agri-food Industries

Agriculture occupies around 75% of the Northern Ireland landmass¹. Therefore, it has a major role in determining the region's biodiversity/ecological status, the quality of its rivers and lakes and its distinctive landscape character. A significant government effort in terms of regulation and financial intervention is expended in protecting and enhancing these important environmental assets (e.g. in reducing nutrient enrichment of waterways). It is, therefore, essential that we have a clear understanding of the interaction between agriculture and the environment, and how, if necessary, this can best be influenced through the most appropriate use of education, regulation and incentivisation.

Efforts to reduce greenhouse gas (GHG) emissions, and the carbon economy more generally, are assuming ever greater significance for agriculture (see Chapter 11). The land-based sectors are probably unique in that they have the capability of sequestering carbon in soils and in biomass. However, agriculture is also a significant contributor to greenhouse gas emissions. If governments wish to exert a greater influence in this area, there needs to be greater understanding of the natural processes involved and how these can be managed at minimal cost or disruption to the industry.

Key research needs in this area are:

¹ Statistical Review of Northern Ireland Agriculture, DARD (2008) - http://www.dardni.gov.uk/the_statistical_review_of_northern_ireland_agriculture_2008.pdf

- Understanding the complex interrelationships between soils, water quality, plant nutrients and land management practices;
- Understanding and influencing the role of grazing animals in sustaining biodiversity and vegetation, particularly in the hills and uplands (where the majority of our priority habitats are located);
- Improving our understanding of the significance of species-rich grassland and field boundaries as wildlife reservoirs;
- Understanding how to minimise the environmental costs and maximise the environmental benefits of agricultural activities at minimal cost to farmers and taxpayers;
- Assessing the potential of grassland (and forestry) as carbon sinks and how this potential might be exploited; and
- Developing new technical solutions to reduce GHG emissions from agri-food production systems.

10.3.2 Assessing and Improving the Impact of Agri-environment Programmes and Activities

Northern Ireland aims to halt biodiversity loss by 2010 and reverse its decline by 2016¹. One of the key mechanisms by which DARD can contribute to the achievement of this goal is through its agri-environment programme. In 2007, some 448,000 hectares or 40 per cent of farmland was registered in an agri-environmental scheme in Northern Ireland. The current Programme for Government includes a target to increase this to 50% by 2013. DARD expenditure on agri-environment measures forms a major element of the Rural Development Programme 2007-2013. An evaluation of the impact of these measures and their further potential is essential to ensure that current and future intervention is targeted appropriately to deliver the desired outcomes (this is also an EU requirement). We also need to have a much better appreciation of the costs of agri-environment interventions relative to the benefits derived by wider society.

10.3.3 Understanding the Environmental Impact of Changes in Agricultural Land Use Patterns and Intensity

The decoupling of agricultural support, through introduction of the Single Farm Payment, and the resulting shift in the economics of agricultural production has the potential to lead to extensive changes in land use patterns across Northern Ireland. Greater exposure to global competition is placing increasing pressure on the profitability of traditional agricultural businesses. These influences will continue to drive changes in agricultural structures and activities. For example, the intensity of land use (in terms of cattle and sheep populations) has been falling steadily throughout this decade. However, there has been no discernable upturn to date in the rate of conversion of land to alternative uses, such as forestry. However, opportunities do exist for alternative land-using enterprises, and issues such the increasing emphasis

¹ A Sustainable Development Strategy for Northern Ireland, OFMDFM - <http://www.ofmdfmi.gov.uk/sustain-develop.pdf>

on renewable sources of energy may lead to a renewed focus on alternative land use options, such as biomass production.

A key research interest in this area is the assessment of the environmental impact, both positive and negative, of changing land use patterns, including the risks and consequences of land abandonment. This will inform the development of any policy responses that may be deemed necessary.

10.3.4 Sustainable Forestry

The level of forest and woodland cover in Northern Ireland at approximately 6% is much lower than the rest of the UK (12%) and well below the average in the rest of the EU27 (37%)¹. 'Northern Ireland Forestry - A Strategy for Sustainability and Growth' published in March 2006² identified the promotion of forest expansion as one of its key objectives, with a long term target of doubling forest cover over the next 50 years, largely through a transfer of land from agriculture to forestry. The promotion of the use of forests for public recreation was also identified as a key priority.

A better understanding is needed of the potential impact (and the means of maximising the potential positive effect) of these changes in land use in terms of air and water quality, biodiversity and landscape. We also need a better appreciation of the potential contribution of forests to off-setting carbon emissions, helping to mitigate flood risk/severity, as a renewable energy source and as a means of managing organic waste streams from the domestic and agricultural sectors.

A significant part of the justification for seeking to expand the area of forestry is the assumed level of public utility that can be created. A better understanding is necessary of the amenity value that is derived from public and private forestry. We also need to establish how this can be maximised by addressing issues such as location, species mix and access. An understanding of forestry's contribution to a broader economic agenda, such as recreation and tourism, is also essential.

Forestry is a long term commitment and climate change could have a significant effect on the growing of trees in Northern Ireland. Therefore, we need to consider the potential impact of specific climatic changes upon Northern Ireland's forest systems and how we might respond to challenges such as increased wind throw and attack from pests and diseases, the increase in fire risk and tree mortality through summer droughts and the potential for higher growth rates.

Key research interests are:

¹ Statistical Review of Northern Ireland Agriculture, DARD (2008) - http://www.dardni.gov.uk/the_statistical_review_of_northern_ireland_agriculture_2008.pdf
² <http://www.forestserviceni.gov.uk/index/publications/policy-and-standards/a-strategy-for-sustainability-and-growth.htm>

- The impact of forest expansion on biodiversity, landscape and other measures of environmental health;
- The potential role of forests in mitigating flood, climate change and dealing with organic wastes;
- Assessing and maximising the amenity value of forests; and
- The potential impact of climate change on forestry.

10.3.5 Sustainable Waste and Manure Management

Sustainable production and consumption is about achieving more with less. Like others, the agri-food sector needs to be more resource efficient, both in production and consumption, to reduce the amount of material used and wasted. The Department of the Environment (DOE) is the lead Northern Ireland department on waste management issues and works alongside InvestNI and other partners to promote research and demonstration projects on minimising waste. DARD will, therefore, focus its research efforts, at least in the short term, on the management of manure and other organic wastes from the agri-food sector.

The implementation of the EU Nitrates Directive¹, the Water Framework Directive², the Integrated Pollution Prevention and Control Directive³ and the Waste Management Regulations (Northern Ireland) 2006⁴ impose restrictions on the farming industry and the way it deals with manures and wastes. The Nitrates Directive Action Programme⁵, in particular, limits the amount of organic manure which can be spread on land and the timing of when it can be spread. This creates issues around the management of manures, which can be a particular challenge for intensive livestock holdings.

Research is needed in this area to underpin the implementation and evaluation of the Northern Ireland Nitrates Action Programme and compliance with the EU Derogation (permitting higher organic nitrogen applications on certain holdings)⁶.

Key research interests are:

- Minimising phosphorus and nitrogen losses to water from livestock systems;
- Better management of dirty water; and
- The effectiveness of individual elements of the Nitrates Action Programme.

Sustainable alternative uses for manure could provide agri-food businesses with a viable outlet for animal manures and organic wastes. To help inform DARD's actions to support renewable energy, further work is required to

¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0676:20081211:EN:PDF>

² <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0060:20090113:EN:PDF>

³ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1996L0061:20060224:EN:PDF>

⁴ <http://www.opsi.gov.uk/Sr/sr2006/20060280.htm>

⁵ http://www.doeni.gov.uk/index/protect_the_environment/water/nitrates_.htm

⁶ http://www.doeni.gov.uk/notification_pursuant.pdf

explore anaerobic digestion systems and their specific contribution to sustainable agri-food waste management (see also Section 7.4.3).

10.3.6 Sustainable Fisheries and Aquaculture

It is widely accepted that some key commercial sea fish stocks relevant to Northern Ireland have become seriously depleted. DARD is committed to supporting their recovery through an ecosystem approach to in-shore fisheries management. This can be achieved only with the benefit of a sound scientific understanding of these systems. However, climate change is expected to lead to changes in sea temperatures which will impact fish stocks and bring the threat of new pests and disease. A better insight is required of the potential effects of these influences on the Northern Ireland sea fishing industry and how current management regimes must evolve to ensure sustainability.

Proposals for the Reform of the EU Common Fisheries Policy are expected in 2010 and are likely to include different approaches to the control and enforcement of the regulation of fishing effort. We need a better analysis of how future regulatory requirements might be applied to the local fishing industry to effect positive change, as well as their impact on the sustainability of the industry.

DARD is committed to a sustainable local aquaculture industry and is already funding modelling work to establish sustainable levels and management strategies for shellfish cultivation in Northern Irish sea loughs.

Key research interests in this area are:

- Impact of human activity on commercial marine stocks;
- Potential impact of climate change on specific species and on fisheries in general;
- Sustainable management of commercial fish stocks, including best use of regulation;
- Potential for exploitation of new target species; and
- Sustainable carrying capacity for aquaculture in coastal areas.

10.3.7 Flood Risk Management

Flood events in Northern Ireland and England during the summer of 2007 and in Northern Ireland in August 2008 brought into sharp focus the impact of floods on society and the hardship caused to individuals. It is estimated that in an event with a 100 to 1 chance of occurrence in any one year, some 60,000 properties in Northern Ireland are at risk from flooding¹. With increasing land development and the predicted effects of climate change, the number of properties at risk is likely to increase.

¹ Living with Rivers and the Sea - Government's Response to the Independent Flood Management Policy Review, Northern Ireland Rivers Agency, 2008

The Office of Science and Technology Foresight Report on Future Flooding, issued in 2004¹, highlighted areas of inadequate knowledge and limitations in modelling capabilities. It recommended that '*we need first improve our ability to understand the functioning of various response measures, interventions, and policies and, second, reduce uncertainties concerning their efficacy and sustainability*'. The introduction of the EU Water Framework Directive and, more particularly, the Floods Directive² also has significant implications for future flood risk management. The latter allows for flexibility in implementation adapted to local circumstances.

As a result of changes in the drivers for flood risk management, DARD's Rivers Agency commissioned a review of Flood Management Policy. It highlighted issues such as communication of flood risk, coastal management and reservoir safety where the Agency could have an increased role. The Rivers Agency is currently collaborating in a major research group - the Flood Risk Management Research Consortium (FRMRC) - on a four year programme of research. The broad themes of the research are:

- Flood Inundation Modelling;
- Urban Flood Modelling;
- Real-time Weather Radar and Forecasting;
- Land Use Management;
- Infrastructure Management ;
- Whole Systems Modelling; and
- Integrating Methods for Evaluation of Flood Risk.

The research is substantially funded by the Engineering and Physical Sciences Research Council with the Environment Agency (England), Scottish Executive, Office of Public Works (ROI) make significant contributions. The Rivers Agency currently contributes £25,000 per annum. There is scope to undertake local plot projects as part of this programme.

10.4 Innovation Research Needs

10.4.1 Novel and Innovative Approaches to Nutrient Management

Technological innovation can make a major contribution to reducing the environmental impact of agriculture and contribute to the wider public good. Improved efficiency of nutrient use in farming systems represents a double benefit – the farmer benefits from reduced costs and the environment benefits from reduced nutrient loading. Recent research has led to a better understanding of the precise nutrient requirements of crops and animals, whilst rapid diagnostic tools are also available to assess accurately the nutritive value of feeds and fertilisers. This means that nutrient supply can now be more accurately targeted to meet crop or animal requirements precisely.

¹ <http://www.foresight.gov.uk/OurWork/CompletedProjects/Flood/index.asp>

² http://eur-lex.europa.eu/LexUriServ/site/en/oj/2007/l_288/l_28820071106en00270034.pdf

Recent advances in genomics also mean that genetic selection in plants and animals could, in the future, be targeted at improved nutrient efficiency.

Key research interests are:

- Improved information on nutrient requirements of crops and livestock under Northern Ireland conditions;
- Development of technologies to facilitate precision nutrient management in crops and animals; and
- Development of new methods, including use of genome selection, to increase nutrient utilisation in crops and animals

11. Cross-Cutting Research Strands

Although our research interests have been brigaded under DARD's four key Strategic Goals, there are two fields of research that cut across all of these Goals and have been mentioned in each. For the purposes of this Strategy, these have been classified as Cross-Cutting Research Strands.

11.1.1 Socio-Economic Research

Almost every aspect of our work requires a solid foundation of socio-economic evidence. This will inform policy development, implementation and review, as well as our position in future negotiations in Europe, all set within a context of the evolving global markets. In particular, we require analysis of the following to inform the design of appropriate policy interventions:

- The impact of EU policy changes, new legislation and market reforms on different agricultural sectors;
- The economics and impact of current and potential policy interventions such as the Rural Development Programme, agri-environment schemes and animal, plant and fish disease control strategies;
- Evaluating the optimal production systems for profitability and sustainability for the different agricultural sectors;
- The economics of emerging opportunities for alternative land use and diversification, e.g. renewable energy, biorefining of grass, non-food crops, equines, aquaculture, tourism;
- Assessing the environmental benefits and amenity value of farming, forestry and rural landscapes.
- Socio-economic studies of different types of rural areas, including needs, characteristics and expectations of rural people;
- Understanding the linkages between rural and urban areas, including the role of the rural economy;
- Understanding and exploiting consumer preferences and trends, such as food for health, concern for animal welfare and good environmental practice;
- Understanding factors influencing and barriers to innovation, enterprise and education, restructuring and regulatory compliance; and
- Gathering the evidence base for equality and rural proofing of government policy.

11.1.2 Responding to Climate Change: Adaptation and Mitigation

Climate change has been identified as one of the biggest challenges we face today and a raft of legislative and policy initiatives has been announced recently which attempts to address this issue.

The EU Climate and Energy Package, agreed in December 2008¹ requires a 20% reduction in EU green house gas emissions by 2020 (or a 30% reduction in the event of a global and comprehensive agreement²). Closer to home, the UK Climate Change Act³, passed in November 2008, requires an 80% reduction in green house gas emissions by 2050. In its first report, the UK Committee on Climate Change⁴ has recommended an interim target reduction in GHG of 34% by 2020 and an intended target of 42%. It also plans to deepen its analysis of the role of agriculture in climate change in subsequent reports. The Northern Ireland Executive has already committed to a 25% reduction in GHG by 2025.

The first report by the Committee on Climate Change estimates that agriculture accounts for 23% of GHG emissions in Northern Ireland, with the major components being carbon dioxide, methane (from enteric fermentation in livestock) and nitrous oxide (from soils). Therefore, meeting the challenging GHG targets referred to above could have very significant and costly implications for the local agri-food sector.

Whilst a range of technically feasible methods are available to reduce emissions from agriculture, information is needed on the relative cost effectiveness of these methods and potential implications of their adoption on the local industries. Some techniques even have the potential to reduce costs.

There are early signs that the climate of Northern Ireland is changing. Air temperature is rising and the number of hot days increasing; the proportion of summer rainfall is decreasing, while winters are slightly wetter⁵. These and other expected changes, such as increased flood risk and severe storms, are predicted to have significant implications across rural areas which, even within the small landmass of Northern Ireland, are not predicted to be uniform.

There are already signs of emerging challenges for the local agricultural industry, such as the spread of exotic cattle diseases in Europe. Global trade and transport is also facilitating the spread of non-native flora and fauna beyond their traditional habitat range.

This points to the need for environmental horizon scanning to give early warning and scientific capacity to respond to emerging threats (or the exploitation of new opportunities). The Scotland and Northern Ireland Forum for Environmental Research (SNIFFER) report 'Preparing for a Changing Climate in Northern Ireland'⁵ examines the potential opportunities and threats presented by the impacts of a changing climate across a broad range of sectors, including agriculture, forestry and fisheries. Areas for further

¹ http://ec.europa.eu/environment/climat/climate_action.htm

² World leaders will meet in December 2009 at the UN Climate Change Conference in Copenhagen to seek agreement on a new treaty to replace the Kyoto Protocol.

³ http://www.opsi.gov.uk/acts/acts2008/ukpga_20080027_en_1#Legislation-Preamble

⁴ <http://www.theccc.org.uk/reports/>

⁵ http://www.doeni.gov.uk/index/protect_the_environment/climate_change/climate_change_-_impacts_adaptation.htm

research are also suggested, such as more detailed assessment of risks to Northern Ireland agriculture on a sector-specific and geographic basis.

The Department of the Environment (DOE) is the lead government department with responsibility for environmental issues, including climate change in Northern Ireland. DARD will explore with DOE the potential to collaborate on research of direct relevance to the agriculture, fisheries and forestry industries and, in particular, technologies and management practices to reduce GHG emissions in line with local, national and international targets.

Climate change, of course, is not simply a challenge. It also creates potential opportunities. For example, grassland and forestry both offer considerable potential as a carbon sink. Investment in carbon offsetting in agriculture and forestry could be attractive for other industries, which may be prepared to invest in new technologies to reduce GHG emissions in food production as a more cost effective option than reducing emissions from their core businesses. There is also an opportunity for local agri-food to create market advantage by developing low carbon footprint food production systems.

Key research interests are:

- Developing the evidence base on GHG emissions from agri-food, fisheries and forestry in Northern Ireland;
- Assessing the potential impact of EU, UK and Northern Ireland climate change legislation on the local agri-food industry;
- Developing business efficient mitigation strategies to reduce GHG emissions, particularly from the ruminant livestock sector;
- Evaluating the role of grassland and forests as a carbon sink and opportunities to enhance and exploit this;
- Evaluating the risk of emerging plant, animal and fish diseases and pests arising from climate change;
- Evaluating opportunities arising from climate change, including for new crops or to increase the output of existing crops; and
- Carbon life-cycle analysis of different food production systems and the development of technical solutions to reduce greenhouse gas emissions in order to create product differentiation.

12. Delivering the Strategy

12.1 Commissioning Research – a Programme-based Approach

Over the next two years, we will develop a number of research programmes and sub-programmes flowing from the high level research needs identified in Chapters 7 to 11. It is in these programmes that the detailed research will be defined and delivered in line with this Strategy. There will, of course, be linkages between various programmes and sub-programmes.

Broadly speaking, all research projects funded by DARD over the period of this Strategy will be required to fall clearly within this framework and be managed on a programme or sub-programme basis. However, this does not preclude the possibility of our funding individual projects outside of the specified programmes where emerging and pressing need arise.

Each programme will have an overarching policy framework and specific policy objectives. Research providers will be invited to come forward with costed proposals for projects to address these needs.

It is envisaged that each programme will include a significant desk-based research element (literature review) which, as the first step in the delivery of the programme, will provide a **Research Digest** of relevant research material, in an appropriate publishable format. This will serve both to capture the benefit of research undertaken elsewhere and to inform the detailed specification of the research programme.

12.2 Identifying Priorities

Given the finite budget available to DARD for research, not all programmes or projects designed to deliver this Strategy will commence at the same time. Instead, we (in consultation with our stakeholders as appropriate) will seek to prioritise research needs on the basis of a number of criteria, to include the following:

- Policy need;
- Strategic importance of the sector/issue;
- Extent to which work is already being funded elsewhere (no duplication unless a proven need); and
- Degree of co-funding available from other parties.

Traditionally, the focus of DARD-funded research has been on agricultural production issues. However, current and future challenges, such as climate change and energy, halting biodiversity loss and underpinning rural communities, highlight the need for a much broader range of information across DARD's responsibilities. Early priorities in terms of new programme development, therefore, will address those areas where there are clear gaps in our current evidence base, namely under Goal 2 (Rural Development) and Goal 4 (Environment); as well as those areas where we have pressing

strategic policy commitments, such as sustainability of the red meat sector and TB prevention and control.

12.3 Delivery Partners and Contract Commissioning

In response to the O'Hare Review, the Department published an aspirational target to put 50% of its R&D out to competitive tender. Moving towards achievement of that aspiration will take some time, given the current commitment of our research monies within the core grant-in-aid for AFBI. Nevertheless, we will begin to progress this from 2009, with the design and introduction of robust and transparent contract commissioning procedures which comply with best practice in public procurement.

The remainder of our R&D work in pursuit of this Strategy will be undertaken by AFBI as part of its annually agreed work programme for DARD. Working with AFBI, we will work towards realigning funding with the priorities set out in this Strategy, thereby achieving a better balance of research funding across the Department's entire remit.

12.4 Funding and Private Sector Contributions

The consensus emerging from stakeholder consultation was that government should fully fund R&D in areas where there is a clear market failure argument or where government requires evidence to inform its policy development and evaluation. This includes environmental protection and compliance with regulation, rural development and, to some degree, animal health and welfare.

Where there is an expected commercial outcome which could be captured and exploited, the private sector should be prepared to contribute to research. We, therefore, propose to seek complementary funding from the private sector in those areas where there is the potential for direct commercial application of the research. These opportunities fall within the Innovation Research Needs identified under each Goal of this Strategy (particularly Goal 1). Where industry is contributing to funding research within DARD's strategic areas of interest, clearly it must take a significant level of responsibility for setting the direction of research (within the context of this Strategy) to meet precise industry needs.

We will be seeking to identify opportunities to secure additional monies for discrete blocks of new work and Ministerial priorities, such as TB control. We have already secured almost £7m under the Innovation Fund, announced by the DFP Minister in his 2008 Budget speech. This funding is ring-fenced and will be used over the period to 2010/11 for research and knowledge transfer activities in renewable energy technologies in the rural economy; the exploitation of natural products such as grass to produce novel products including fibre insulation, biocompounds and biopolymers; and demonstration of technological developments in food packaging.

We also plan to create a **Research Challenge Fund** to stimulate private sector investment in R&D by agri-food and rural enterprises. The latter will provide a mechanism for individuals, SMEs and micro-businesses, clusters and research providers to bid for a percentage of the funding needed to take forward research projects in their particular fields of interest. We will publish proposals for a scheme during 2009.

In tandem with a Research Challenge Fund, we will explore mechanisms for signposting agri-food and rural enterprises to the opportunities presented by InvestNI innovation support schemes, EU funding programmes and schemes such as the Defra LINK programme.

12.5 Increased Collaboration

Discussions with other government departments, as well as the examination of other local, national and international research strategies, have confirmed the potential for collaboration across a number of areas of mutual interest. For example, on a local basis, there is scope to work with the Department for Employment and Learning on education issues, with the Department of Social Development on rural needs, with the Department of Culture, Arts and Leisure on inland fisheries, with the Department of the Environment on biodiversity, climate change adaptation and waste management, and with the Department of Enterprise, Trade and Investment and InvestNI on stimulating innovation.

Likewise, given the similarity in soil and climatic conditions within the island of Ireland, it is reasonable to expect that much of the research carried out by the South will have application in the North. In addition, the island of Ireland is recognised as a distinct epidemiological unit with substantial cross-border movement and trade of animals/animal products and plant products. For that reason, plant health research is already one of the areas of cooperation under the Agriculture Sectoral arrangements for the North South Ministerial Council, as is animal health in general. As this Strategy develops, we will seek to develop the most appropriate mechanisms and specific areas for further collaboration with the Republic of Ireland.

Nationally and internationally, through its membership of a variety of research networks and funders' fora, such as the UK Animal Diseases Research Funders' Forum, opportunities will be identified for collaboration in commissioning new research and to share research findings for mutual benefit. As work progresses on the implementation of the Strategy, and particularly the development of its underpinning programmes and sub-programmes, we will pursue this potential further and, where appropriate, will examine the scope for joint planning and co-funding of new research to extract maximum benefit from the funding at our disposal.

12.6 Future Stakeholder Involvement

In drawing up this document, we benefited very much from the engagement of a wide range of rural stakeholders in a series of focus groups. In the course

of those discussions, stakeholders clearly expressed a wish to have the opportunity to provide ongoing input to the Strategy. To that end, we propose to maintain and build on that engagement by developing arrangements for research issues to be considered by existing and new stakeholder groups. Representatives from these groups will play an important role in the development of the research programmes to implement this Strategy and in the eventual review of the Strategy.

12.7 Governance

Over the course of the next 18 months, we will introduce a number of measures to strengthen our governance arrangements for research. These will include quality assurance measures to ensure compliance of DARD-funded programmes with appropriate quality standards, such as ISO 9002, the Joint Code of Practice for Research and the Universal Code of Ethics for Scientists. We will also explore the scope for an enhanced element of independent scrutiny of research projects and programmes through, for example, peer review.

We will introduce appropriate and effective systems for monitoring our research programmes to ensure that they remain cost effective and deliver on objectives. In addition, we will review and refine our arrangements for economic appraisal and project approval for research activities. In particular, before we fund research, we will wish to assess proposals in terms of:

- Policy relevance;
- Value for money;
- Scientific merit;
- Plans for dissemination and application; and
- Additionality.

It is envisaged that all research commissioned by DARD will have a nominated policy customer. The Departmental Scientific Advisor will support policy makers and enhance their skills and confidence in using an evidence-based approach and in challenging the value of research proposals.

12.8 Review of Existing DARD-funded Research

A review of our current research effort will be conducted to assess its relevance and fit with the priorities identified in this Strategy and to prepare a roadmap for realignment. This review will be led by the DARD Departmental Scientific Advisor in consultation with DARD senior policy officials and stakeholders as appropriate.

12.9 Knowledge and Technology Transfer

There is a compelling argument that there are greater benefits to be gained from the diffusion of existing research findings and new technology than from the commissioning of new research.

'The sustained commitment of a sizeable proportion of national and EU science budgets to the systematic transfer and uptake of the existing reservoir of research knowledge would make a more substantial contribution, in the immediate decade ahead, to the future competitiveness and sustainability of Europe's agri-food industries and rural economies than the new generation of new knowledge'.¹

Whilst new arrangements for knowledge and technology transfer (KTT) led by CAFRE were introduced following the O'Hare Review, there is scope for further improvement (particularly in subject areas that lie outside of CAFRE's immediate remit).

There is also a need to ensure that the outputs of existing and new research are put to effective use by policy-makers in DARD and other relevant Northern Ireland government departments (e.g. as part of the rural proofing process).

A strong theme emerging from stakeholder meetings was a view that, whilst there may be a large volume of relevant R&D being undertaken, the results of this work are not being communicated in a format or language which stakeholders can readily understand and exploit. As a result, the findings may not be put to effective use. This concern seems to be confirmed by the range and volume of research strategies already published, both here and abroad, of which most stakeholders remain unaware.

This all leads us to conclude that a sizeable proportion of our efforts must be directed towards achieving effective KTT, or at least in facilitating such activity.

We will, therefore, explore and put in place effective processes for research findings to be relayed to the relevant audience, either to inform government policy-making and regulation or to promote innovation by helping rural businesses develop new products, processes and services. To this end we will ensure that all DARD research programmes have a clearly identified knowledge and technology transfer delivery plan at the outset. This plan may include the use of KTT farms; the development and publication of a research digest and research briefing notes; KTT seminars; and KTT Partnerships or other KTT brokerage arrangements, drawing on best practice in Northern Ireland, UK and Europe. The publication of the Research Digest (Section 12.1) will also assist KTT.

¹ Dr Liam Downey, FFRAF Report: foresighting food, rural and agri-futures

13. Review and Evaluation

This is the first Evidence and Innovation Strategy developed by DARD under the post-O'Hare organisational arrangements. We regard it is a work in progress.

Circumstances for the rural economy will continue to evolve and develop; new knowledge will be uncovered (e.g. the impact of CAP reform and trade liberalisation on farming structures) and new challenges and opportunities will arise (e.g. from the impact of climate change). Therefore, we propose that the first formal review of the Strategy should take place by 2012 in preparation for the follow-on Strategy. The Review will examine the extent to which the objectives of this Strategy are being met, ensure the continued relevance and appropriateness of research priorities and identify any emerging requirements or changes that need to be taken on board.

Listed in Annex B, are a number of targets featured in the Strategy. These, together with a series of input, output and outcome based performance indicators, will be used to measure progress on the Strategy and evaluate its impact. We will publish this information periodically on the DARD website at www.dardni.gov.uk.

14. Comments and Feedback

This Strategy will be published on the DARD website at www.dardni.gov.uk.

We will also publish on the website:

- Each of the new DARD research programmes as they are developed;
- An overview of DARD's arrangements for quality assurance and contract commissioning (when developed);
- Proposals for a Research Challenge Fund (when developed); and
- On an annual basis, information on our progress against targets and performance indicators.

We are committed to improving the quality of our policy-making and delivery. We, therefore, welcome any feedback or comments on this document which we will take account of in reviewing this Strategy or in developing further work.

Comments should be sent to:

**Department of Agriculture and Rural Development for Northern Ireland
Research Policy Branch
Room 359, Dundonald House
Upper Newtownards Road
Belfast BT4 3SB**

ANNEX A

Stakeholder Involvement in the Development of this Strategy

The following list identifies all those stakeholders who contributed to development of this Strategy via the series of focus groups, one-to-one meetings and correspondence and formal public consultation.

Action Renewables
Agri-Food and Biosciences Institute
AgriSearch
Animal Welfare Federation Northern Ireland
Carbon Trust
Council for Nature Conservation and the Countryside (CNCC)
Cross Border Aquaculture Initiative Team
Dairy UK
Department of Culture, Arts and Leisure
Department of Education
Department for Employment and Learning
Department of Trade, Enterprise and Investment
Department of Finance and Personnel
Department of Health, Social Services and Public Safety for Northern Ireland
Department of Environment
Department for Regional Development
Department for Social Development
Office of the First Minister and Deputy First Minister
Northern Ireland Equine Strategy Group
Farming and Wildlife Advisory Group
Institute of Northern Ireland Beekeepers
InvestNI
Irish Thoroughbred Association -North Region
League against Cruel Sports
Livestock and Meat Commission
Moy Park Ltd
Mushroom Industry Association of Northern Ireland
National Sheep Association
Northern Ireland Assembly
Northern Ireland Council for the National Beef Association
Northern Ireland Food and Drinks Association
Northern Ireland Fruit Growers' Association
Northern Ireland Potato Industry Stakeholders' Forum
Northern Ireland Seafood
Northern Ireland Meat Exporters' Association
North of Ireland Veterinary Association
Queen's University Belfast
Rural Community Network
Royal Society for the Protection of Birds
Royal Ulster Agricultural Society
Ulster Farmers' Union
Ulster Arable Society

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Ulster Beekeepers' Association
Ulster Wildlife Trust
University of Ulster
World Wildlife Federation Northern Ireland
Young Farmers' Clubs of Ulster

In addition, some stakeholders contributed to the process via an on-line questionnaire or submitted written comments on the Strategy during the pre-consultation phase.

Alan Hunter
Aquaculture Initiative
Archie Murchie
Association of Veterinary Surgeons Practising in Northern Ireland
Mary McCormack
National Trust
Northern Ireland Environment Link
Northern Ireland Horse Board
Rural Development Council
Ulster Coarse Fishing Federation

ANNEX B

Key Targets and Indicators

Evidence

- By June 2009, finalise three research programmes to provide a strong evidence base for the Department's policy development and delivery activities in the areas of renewable energy, sustainability of the red meat sector and sustainable environment.
- By September 2009, introduce appropriate cost-effective quality assurance arrangements for DARD-funded R&D.
- By October 2009, introduce competitive contract commissioning arrangements for DARD-funded R&D.
- By March 2011, develop research programmes to underpin all of the research areas identified in this Strategy.

Innovation

- By September 2009, develop and introduce a Research Challenge Fund for agri-food and rural businesses.
- By October 2009, set up appropriate mechanisms for stakeholder engagement in R&D.
- By March 2010, establish the resources and mechanism(s) required for a research digest.
- By March 2010, review DARD's arrangements for knowledge transfer and deliver improvements.

Performance Indicators

Indicators will be based around those used for reporting on the Regional Innovation Strategy Action Plan 2008-2011 which include the following:

- Percentage of innovation-active rural businesses;
- Number of participants at DARD-funded knowledge transfer events;
- Number of hits on research material published on the DARD website and Research Digest (when available);
- Number of collaborative agreements between AFBI and other research providers.

ANNEX C

References and Further Reading:

General Background

Cabinet Office, 1999, *Modernising Government White Paper* (Cm4310), London.
<http://www.archive.official-documents.co.uk/document/cm43/4310/4310.htm>;

Department of Innovation, Universities and Skills (DIUS), 2008, *Implementing "The Race to the Top": Lord Sainsbury's Review of Government's Science and Innovation Policies*, London;

HM Treasury, DTI, DfES, 2004, *Science and Innovation Investment Framework 2004-2014*, London;

Lord Sainsbury of Turville, 2007, *The Race to the Top: A Review of Government's Science and Innovation Policies*, London;

Office of the First Minister and deputy First Minister (OFMdfM), 2003, *A Practical Guide to Policy-Making in Northern Ireland*, Belfast, <http://www.ofmdfmi.gov.uk/policylink-a-practical-guide-to-policy-making.htm>;

O'Hare, D, 2002, *Education and R&D in agriculture and food science in Northern Ireland: Report of Review Panel*, Belfast; <http://www.dardni.gov.uk/de/index/publications/pubs-dard-learning-and-education/pubs-dard-strategies-reports-and-accounts-education-and-r-and-d-in-agriculture-and-food-science.htm>.

Innovation

Abreu, M; Grinevich, V; Kitson, M; and Savona, M. for DIUS, (2008, March), *Absorptive Capacity and Regional Patterns of Innovation*;

Baker, J., 1999, *Creating knowledge creating wealth. Realising the economic potential of public sector research establishments*, A report to the Minister for Science and the Financial Secretary to the Treasury, London;

DETI, 2008, *Northern Ireland Research and Development Statistics 2007*, Belfast, <http://www.detini.gov.uk/cgi-bin/morenews?utilid=1136>;

DIUS, 2008, *Innovation Nation: Science and Innovation White Paper* (Cm7345), London, http://www.dius.gov.uk/reports_and_publications/~media/publications/S/ScienceInnovation_web;

European Commission, 2008, *The Integrated Guidelines For Growth And Jobs (2008-2010)*, Brussels, http://ec.europa.eu/growthandjobs/pdf/european-dimension-200712-annual-progress-report/200712-annual-report-integrated-guidelines_en.pdf;

Food Strategy Implementation Partnership, 2006, *Fit for Market Foresight Leadership Group Workshop: Developing Innovation Programmes Synthesis Report*, Belfast,

MATRIX: The Northern Ireland Science Industry Panel, 2008, *Technology and Capability Study*, http://www.matrix-ni.org/downloads/matrix_vol8_capability.pdf.

ANNEX C

Overarching Strategic Commitments

Department of Agriculture and Rural Development (DARD), 2006, *Strategic Plan 2006-11*, <http://www.dardni.gov.uk/dard-strategic-plan-2006-2011.pdf>;

Department for Regional Development (DRD), 2001, *Shaping our future: Regional Development Strategy for Northern Ireland – 2025*, <http://applications.drdni.gov.uk/publications/document.asp?docid=5567>;

DETI, 2005, *Economic Vision for Northern Ireland*, <http://www.detini.gov.uk/cgi-bin/downutildoc?id=936>;

DETI, 2003, *think/create/innovate: Regional Innovation Strategy for Northern Ireland*, <http://www.detini.gov.uk/cgi-bin/downutildoc?id=9>;

DETI, 2008, *Regional Innovation Strategy, Action Plan 2008-2011*, <http://www.detini.gov.uk/cgi-bin/downutildoc?id=2172>;

OFMdfM, 2008, *Programme for Government 2008-11*, <http://www.pfgbudgetni.gov.uk/finalpfg.pdf>;

OFMdfM, 2006, *A Sustainable Development Strategy for Northern Ireland, First Steps towards Sustainability*, <http://www.ofmdfmi.gov.uk/sustain-develop.pdf>;

OFMdfM 2005, *A Shared Future - Policy and Strategic Framework for Good Relations in Northern Ireland*, <http://www.asharedfutureni.gov.uk/policy-strategic.pdf>;

OFMdfM, 2006, *Lifetime Opportunities – Government’s Anti-poverty and Social Inclusion Strategy for Northern Ireland*, <http://www.ofmdfmi.gov.uk/antipovertynov06.pdf>.

Strategic Goal 1

Cabinet Office Strategy Unit, 2008, *Food Matters - Towards a Strategy for the 21st Century*, http://www.cabinetoffice.gov.uk/media/cabinetoffice/strategy/assets/food/food_matters1.pdf;

DARD, 2008, *Statistical Review of NI Agriculture 2008*, <http://www.dardni.gov.uk/index/publications/pubs-dard-statistics/statistical-review-of-northern-ireland-agriculture-2008.htm>;

DARD, 2008, *Northern Ireland Agri-Food Sector: Key Statistics June 2008*, http://www.dardni.gov.uk/key_statistics_for_2008.09.043_northern_ireland_agri-food_sector_key_statistics_june_08.pdf.pdf;

DARD, 2007, *Size and performance of the NI Food and Drinks Sector 2005 with provisional estimates for 2006*, , <http://www.dardni.gov.uk/index/publications/pubs-dard-statistics/size-and-performance-of-the-northern-ireland-food-and-drinks-processing-sector-2005-with-provisional-estimates-for-2006.htm>

DARD, 2007, *Review of Inshore Fisheries Management in Northern Ireland*, http://www.dardni.gov.uk/inshore_fish_review.pdf ;

DARD, *Strategy for the Equine Industry in Northern Ireland*, 2007, <http://www.dardni.gov.uk/publications-strategy-for-the-equine-industry-in-northern-ireland> ;

DARD, 2007, *Renewable Energy Action Plan*, <http://www.dardni.gov.uk/renewable-energy-action-plan-2.pdf> ;

ANNEX C

DARD Forest Service, 2006, *Northern Ireland Forestry - A Strategy for Sustainability and Growth*, <http://www.forestserviceni.gov.uk/strategy-for-sustainability-growth.pdf>;

DARD Forest Service, 2008, *Developing the Recreational and Social Use of Forest Service Forests*, Consultation Document, <http://www.forestserviceni.gov.uk/index/forest-service-northern-ireland-consultations/consultations-recreation-strategy-2008.htm>;

Department of Environment Food and Rural Affairs (DEFRA) et al., 2005, *Securing the Benefits – Joint UK Response to the Prime Minister's Strategy Unit Net Benefits Report on the Future of the Fishing Industry in the UK*, <http://www.defra.gov.uk/marine/pdf/fisheries/securingbenefits.pdf> ;

DEFRA, 2008, *Ensuring the UK's Food Security in a Changing World*, Discussion Paper, London;

DHSSPSNI, 2007, *Fit Futures: Focus on Food Activity and Young People*, <http://www.dhsspsni.gov.uk/fit-futures-implementation-plan.pdf>;

DHSSPSNI, 2002, *Investing for Health*, http://www.dhsspsni.gov.uk/show_publications?txtid=10415 ;

European Commission, 2009, *Building a Sustainable Future for Aquaculture – A new impetus for the Strategy of the Sustainable Development of European Aquaculture*, http://ec.europa.eu/fisheries/cfp/aquaculture_processing/pdf/com_2009_162_en.pdf;

European Commission, 2008, *The Health Check of the CAP reform Impact Assessment of alternative Policy Options, the 2008 Health Check*, http://ec.europa.eu/agriculture/healthcheck/index_en.htm

European Commission, 2003, *CAP Reform Summary*, http://ec.europa.eu/agriculture/capreform/sum_en.pdf ;

Food Strategy Group, 2004, *Fit for Market – The Report of the Food Strategy Group*, http://www.investni.com/fit_for_market_report.pdf ;

MATRIX, *The First Report of MATRIX: The Northern Ireland Science Industry Panel*, 2008, http://www.matrix-ni.org/downloads/matrix_vol1_report.pdf;

Northern Ireland Red Meat Industry Task Force, 2007, *Northern Ireland Red Meat Industry Task Force Strategy Review*, Volume 1 – Main Report, <http://www.niredmeattaskforce.co.uk/progress-report/> ;

Wik M., Pingali P. and Broca S., 2008, *Global Agricultural Performance: Past Trends and Future Prospects*, Background Paper for the World Development Report 2008, http://siteresources.worldbank.org/INTWDR2008/Resources/2795087-1191427986785/Pingali-Global_Agricultural_Performance.pdf

WTO negotiations and trade liberalisation, <http://www.wto.org/>.

Strategic Goal 2

DARD, 2006, *Rural Strategy 2007-2013*, <http://www.dardni.gov.uk/dard-rural-strategy.doc>

DARD, 2007, *Northern Ireland Rural Development Programme 2007-13*, http://www.dardni.gov.uk/nirdp_2007-13 ;

DARD, 2009, *Draft Rural Anti-Poverty/Social Inclusion Framework*, Consultation document, <http://www.dardni.gov.uk/apsiframeworkpdf.pdf>;

ANNEX C

Department of the Environment (DOE), 2008, *PPS 21 (draft): Sustainable Development in the Countryside*, http://www.planningni.gov.uk/index/policy/policy_publications/planning_statements/pps21.pdf;

European Commission, Council Regulation (EC) no 1698/2005, 2005, *Rural Development Regulation 2007-13*, http://www.dardni.gov.uk/eu_rural_development_reg.pdf.

Strategic Goal 3

European Commission, 2006, *Council Directive 2006/88/EC, Aquatic Animal Diseases Directive*, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:328:0014:0056:EN:PDF> ;

DARD, 2006, *Animal Health and Welfare Strategy*, Belfast, <http://www.dardni.gov.uk/animal-health-and-welfare-strategy.pdf> ;

European Commission, 2007, *A new Animal Health Strategy for the European Union (2007-2013) where 'Prevention is better than cure'*, http://ec.europa.eu/food/animal/diseases/strategy/docs/animal_health_strategy_en.pdf.

Strategic Goal 4

DARD Rivers Agency, 2008, *Living with Rivers and the Sea*, (Government's response to the Northern Ireland Flood Management Policy Review), http://www.riversagencyni.gov.uk/living-with-rivers-and-the-sea.09.097_rivers_agency_-_living_with_rivers_and_the_sea_report_-_published_august_2008.pdf.pdf.

DEFRA, 2005, *Charting progress: An integrated Assessment of the State of the UK Seas*, <http://www.defra.gov.uk/marine/pdf/science/stateofsea/chartprogress.pdf> ;

DEFRA on behalf of the UK Biodiversity Partnership, 2007, *Conserving Biodiversity - The UK Approach*, <http://www.defra.gov.uk/wildlife-countryside/pdf/biodiversity/conbiouk-102007.pdf> ;

DEFRA, 2008, *Draft UK Marine and Coastal Access Bill*, <http://www.publications.parliament.uk/pa/ld200809/ldbills/001/2009001.pdf>;

DETI, 2004, *Strategic Energy Framework for Northern Ireland*, <http://www.detini.gov.uk/cgi-bin/downutildoc?id=2221> ;

DOE, 2006, *An Integrated Coastal Zone Management Strategy for Northern Ireland 2006-2026*, http://www.doeni.gov.uk/iczm_document-2.pdf ;

DOE, 2002, *Northern Ireland Biodiversity Strategy*, <http://www.ni-environment.gov.uk/nibs2002.pdf> ;

DOE, 2006, *Towards Resource Management, Northern Ireland Waste Management Strategy 2006-2020*, <http://www.ni-environment.gov.uk/wms.17.pdf> ;

Nitrates Action Programme Regulations (Northern Ireland) 2006, (SR. 2006 No. 489) <http://www.opsi.gov.uk/sr/sr2006/20060489.htm>;

O'Neill, K., Stokes, K., McDonald, R. and Dick, J., QUERCUS, 2004, *Invasive Species in Ireland – An all-Ireland review*, funded by Environment & Heritage Service (NI) and National Parks & Wildlife Service (ROI)", Belfast.

ANNEX C

Climate Change

UK Climate Change Act 2008,

http://www.opsi.gov.uk/acts/acts2008/pdf/ukpga_20080027_en.pdf ;

European Commission, 2008, *Citizens' Summary - EU Climate and Energy Package*,

http://ec.europa.eu/climateaction/docs/climate-energy_summary_en.pdf;

SNIFFER, 2002, *Implications of Climate Change for Northern Ireland: Informing Strategy Development*, Edinburgh;

SNIFFER, 2007, *Preparing for a Changing Climate in Northern Ireland*,

www.doeni.gov.uk/preparing_for_a_climate_change_in_northern_ireland.pdf.

Foresight Exercises

European Commission, 2007, *Scenar 2020: Scenario study on agriculture and the rural world*,

http://ec.europa.eu/agriculture/publi/reports/scenar2020/index_en.htm;

European Commission, 2007, *Foresighting Food, Rural and Agri-Futures, Version 20*,

http://ec.europa.eu/research/agriculture/scar/pdf/foresighting_food_rural_and_agri_futures.pdf

Food Strategy Implementation Partnership, 2006, *Vision twenty/twenty: Report of the FSIP Foresight Leadership Group*, Belfast;

Office of Science and Technology, 2004, *Foresight Report on Future Flooding*,

http://www.foresight.gov.uk/Flood%20and%20Coastal%20Defence/executive_summary.pdf ;

Vision Group, 2001, *Vision for the future of the Agri-food Industry*, Belfast.

Other Relevant Research Strategies

COFORD (Irish National Council for Forest Research and Development), 2006, *A Review of forest recreation research needs in Ireland*, <http://www.coford.ie/iopen24/review-forest-recreation-research-needs-ireland-p-966585.html>;

Department for Employment and Learning (DEL), 2007, *Research Agenda 2007-2009*,

http://www.delni.gov.uk/research_agenda_07-09_final_2_.pdf;

Department for Enterprise, Trade and Employment (ROI), 2006, *Strategy for Science, Technology and Innovation 2006- 2013*,

<http://www.entemp.ie/publications/science/2006/sciencestrategy.pdf>;

DEFRA, 2006, *The Second Report of the Sustainable Farming and Food Research Priorities Group*, London;

DEFRA, 2005, *The First Report of the Sustainable Farming and Food Research Priorities Group*, London;

DEFRA, 2004, *Evidence and Innovation: Defra's needs from the sciences over the next ten year*, London;

DEFRA, 2003, *Delivering the Evidence: Defra's Science and Innovation Strategy (2003-06)*, London;

ANNEX C

DETI, 2008, *Research Agenda 2008/09- 2010/11*, <http://www.detini.gov.uk/cgi-bin/downdoc?id=3751>;

Food Standards Agency, 2006, *Science Strategy 2005-10*, <http://www.food.gov.uk/multimedia/pdfs/sciencestrategy.pdf>;

Home Grown Cereals Authority, 2007, *HGCA R&D Strategy 2007-10*, <http://www.hgca.com/content.template/7/0/Crop%20Research/Crop%20Research/Crop%20Research%20Home%20Page.aspx>;

Scottish Executive Environment and Rural Affairs Department, 2005, *Strategic Research for SEERAD 2005-10*, <http://194.247.95.101/Publications/2005/01/20526/49994>;

SNIFFER, 2007, Final Report for Scottish Government, *Initial Scoping Review of the High Level Strategic Themes for the Next Scottish Government Rural, Environment and Marine Research Strategy*, <http://www.scotland.gov.uk/Publications/2008/01/17154036/0>;

TEAGASC (Irish Agriculture and Food Development Authority), 2005, *Statement of Strategy 2005-07*, <http://www.teagasc.ie/publications/2005/strategy0507.pdf>;

TEAGASC, 2008, *Road Maps for Better Farming 2015*, <http://www.teagasc.ie/publications/2008/20080507/index.asp>;

University of Ulster, 2006, *SUPPORTIVE: strategy and action plan for research, research training and innovation 2006-09*, Belfast;

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