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Executive Summary

To ensure that the Department of Agriculture and Rural Development's (DARD) policy and operational activities are appropriately designed and targeted to achieve the Strategic Vision, we need sound scientific evidence across the full range of our responsibilities that is informed by strategic policy drivers and research needs. At the same time, we recognise the vital role of innovation in developing a sustainable and profitable regional economy. This Strategy describes the overarching framework for research and development for the period 2015-2017 to underpin evidence-based policy and delivery, and to promote innovation in agri-food, fishing, forestry and other rural businesses.

The reduction in the number of NI Departments from twelve to nine from May 2016 will result in the formation of the Department of Agriculture, Environment and Rural Affairs (DAERA), which will comprise all of DARD's existing functions (with the exception of Rivers Agency), Department of Environment's existing environment and marine functions (excluding Built Heritage), and the Department of Culture, Arts and Leisure's inland fisheries functions. The Evidence and Innovation Strategy 2015-17 will act as the bridging document between the DARD Evidence and Innovation Strategy 2009-13 and the development of a new DAERA Evidence and Innovation Strategy for 2018 and beyond. It will provide the framework for funding DARD policy-relevant and industry-relevant research and innovation during the period prior to the establishment of DAERA (2015/16) and provide a solid framework for research and innovation on which to build during the early stages of the new Department.

Our vision for this Evidence and Innovation Strategy 2015-17 is:

“Promoting a sustainable rural community and agri-food, fishing and forestry sector by funding policy-relevant research and supporting industry-relevant innovation responsive to local needs”

This places the research and innovation we will invest in at the heart of evidence-based policy development and implementation and central to supporting and responding to the needs of our local stakeholders and rural communities in order to grow a sustainable, profitable agri-food sector.

The strategic evidence and innovation needs and the research required to fulfil these needs will continue to be co-ordinated through 4 Programme Management Boards that align with the DARD Strategic Goals. This process will ensure the development of an evidence and innovation programme that is appropriately aligned to policy needs, provides a robust evidence base for future policy development, implementation and review and supports industry innovation within the scope of DARD's policy interests. The research commissioned to deliver this Strategy will be set out in a number of underlying programmes directed by policy need developed and shaped by industry need. This research will be delivered through (1) the DARD-directed Evidence and

Innovation Programme undertaken by the Agri-Food and Biosciences Institute (AFBI) (2) the DARD Postgraduate Studentship Scheme (3) the industry-led DARD Research Challenge Fund and (4) a portfolio of collaborative research funding partnerships with public funders of research in other regions and countries. Collaboration and partnership are re-occurring themes in the new Strategy as we look to build strong links with research funders across the UK and Ireland and with international partners. It is recognised that partnerships involving multi-disciplinary research teams and organisations are required to address today's increasingly complex issues for our agri-food sector and wider rural economy. Through such collaboration, we will seek to maximise the research capacity available from our investments in research to best meet our evidence and innovation needs.

Stakeholders will continue to play an important role in identifying and refining the research programmes ensuring that DARD has a clear understanding of the priorities of the sector and the challenges being faced so that research can be tailored to provide maximum support to underpin the sustainability of the agri-food sector and wider rural economy. In particular, emphasis will be placed on ensuring close linkages with the Agri-Food Strategy Board (AFSB) and giving due consideration to the Executive's response to the recommendations of the Agri-Food Strategy Board's *Going for Growth* report.

Finally, we are seeking to build stronger linkages between our research agenda and the new Rural Development Programme (RDP 2014-2020) utilising research to assess the effectiveness of the Programme and to inform policy. A key message arising from the analyses underpinning the new RDP was the role that enhanced skills and knowledge levels can play in ensuring sustainable development in the sector. Consequently, we will look to harness knowledge transfer and exchange mechanisms funded through the RDP to ensure that the latest findings from our research activities are fed through to end-users and likewise to ensure that information from end-users feeds through to help set the research agenda in a strategic manner.

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

[**PMB 1**: Performance in the Market Place; **PMB 2**: Informing Policy and Improving the Lives of Farmers and Other Rural Dwellers; **PMB 3**: Animal and Plant Health and Animal Welfare; **PMB 4** Sustainable Environment].

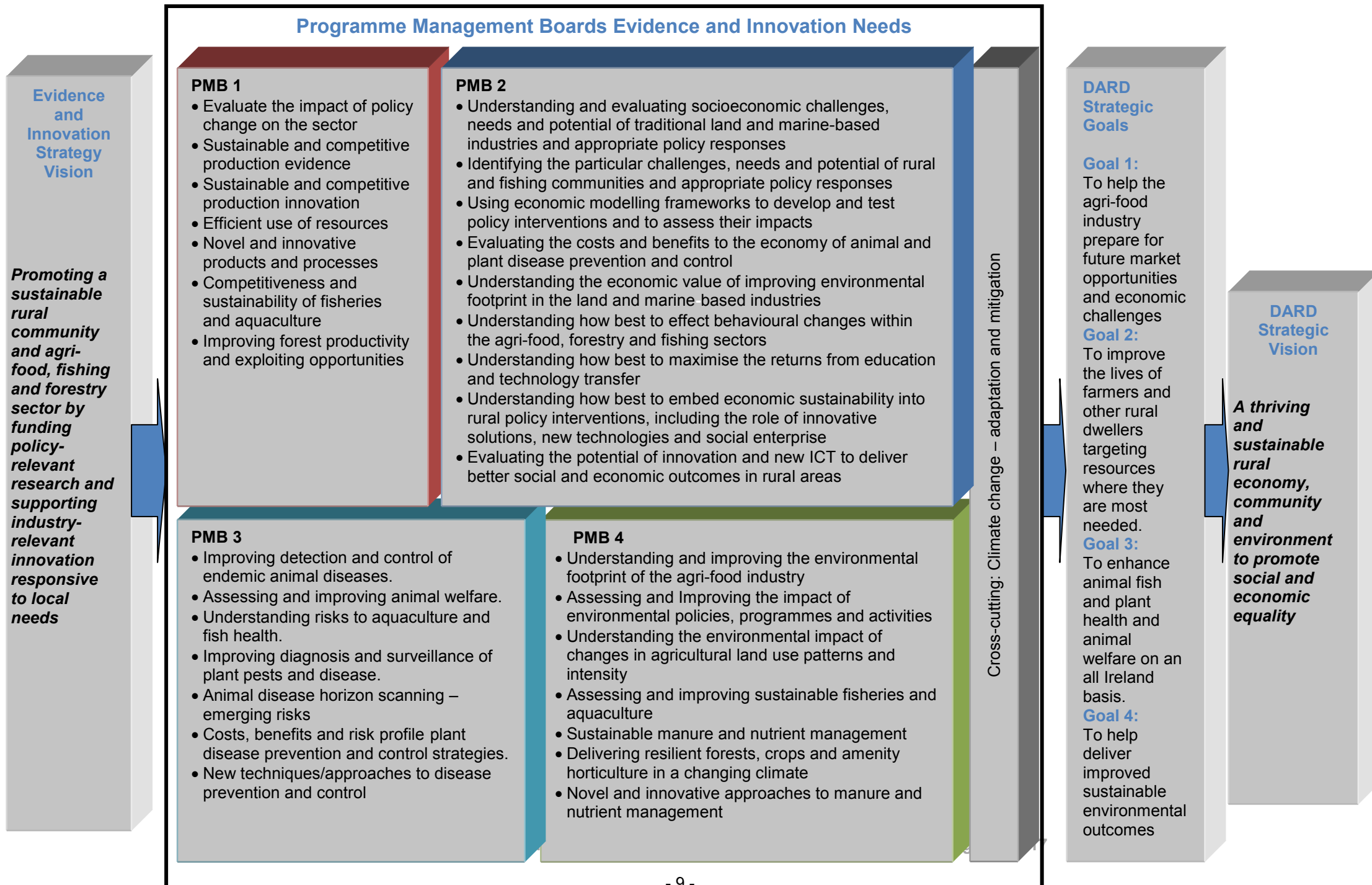


Figure 1 DARD Strategic Research Framework

1. The Context: Where We Are Now

The reduction in the number of NI Departments from twelve to nine from May 2016 will result in the formation of the Department of Agriculture, Environment and Rural Affairs (DAERA), which will comprise all of DARD's existing functions (with the exception of Rivers Agency), Department of Environment's existing environment and marine functions (excluding Built Heritage), and the Department of Culture, Arts and Leisure's inland fisheries functions. Whilst the remit and functioning of the new Department will represent a change, evidence-based policy development will still be a priority. Consequently the Evidence and Innovation Strategy 2015-17 will act as the bridging document between the ***DARD Evidence and Innovation Strategy 2009-13***¹ and the development of a new DAERA Evidence and Innovation Strategy.

The Evidence and Innovation Strategy 2015-17 sets out the principles and processes behind the investment DARD will make in research and innovation. It provides the framework for funding DARD policy-relevant and industry-relevant research and innovation during the period prior to the establishment of DAERA and for a period of 1 year following the establishment and bedding-in of the new Department. During this transition period the research and innovation needs of the new Department will be determined and used to frame the new DAERA Evidence and Innovation Strategy going forward.

To ensure that our policy and operational activities are appropriately designed and targeted to achieve the DARD vision of "*A thriving and sustainable rural economy, community and environment to promote social and economic equality*", we will continue to 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 for the period 2015-2017.

1.1 Background

The ***DARD Strategic Plan*** sets out in broad terms our strategic priorities over the period 2012-2020² The Plan defines DARD's 4 Strategic Goals and Objectives:

- 1 To help the agri-food industry prepare for future market opportunities and economic challenges;

¹ <http://www.dardni.gov.uk/evidence-innovation-strategy-2009-2013.pdf>

² <http://www.dardni.gov.uk/dard-strategic-plan-2020-english-version.pdf>

- 2 To improve the lives of farmers and other rural dwellers targeting resources where they are most needed;
- 3 To enhance animal, fish and plant health and animal welfare on an all Ireland basis; and
- 4 To help deliver improved sustainable environmental outcomes.


Research, development, knowledge and technology transfer are tools that have been identified as having key roles in helping us achieve our Strategic Goals and shape government policy across the portfolio of areas which the Department is responsible for. The investment in research and expansion of knowledge is not in itself a priority for DARD and this Evidence and Innovation Strategy is not autonomous, it exists to support established strategic policy objectives or those to be established in the future.

From the limited resources at our disposal, we will ensure that, as far as possible, the research commissioned is appropriately prioritised and aligned to meet policy needs providing a robust evidence base for future policy development, and will support industry innovation within the scope of DARD's policy interests.

2. The Vision: Where We Are Going

2.1 Strategic Vision

Our Vision for this Evidence and Innovation Strategy is:



“Promoting a sustainable rural community and agri-food, fishing and forestry sector by funding policy-relevant research and supporting industry-relevant innovation responsive to local needs”

Figure 2: DARD Evidence and Innovation Strategy Vision

Research and innovation will continue to be at the heart of evidence-based policy development and implementation, and it is central to supporting and responding to the needs of our local stakeholders and rural communities in order to grow a sustainable, profitable agri-food sector.

2.2 What Outcomes Do We Want to Achieve?

1. The policy developed by DARD is more robust because of a stronger evidence base;
2. Knowledge gained through DARD funded research is readily available to all stakeholders in the agri-food sector and wider rural community; and
3. The outcomes of DARD funded research are considered by the agri-food sector and the wider rural community in management decision-making ensuring all stakeholders are better equipped to become more profitable, efficient and sustainable as a result of the research funded by DARD.

In order to achieve these outcomes the research needs identified in this Strategy will seek to:

- Maintain and improve provision of robust, high quality, relevant and timely **evidence** to meet policy and operational needs within DARD;
- Provide high quality relevant **evidence** to support the sustainable development of the agri-food industry and rural communities; or
- Identify product, process and organisational **innovation** that will support the sustainable development of the agri-food industry and broader rural economy.

This will only be achieved if policy makers and stakeholders continue to play an important and on-going role in identifying and shaping the research priorities and research agenda and the benefits of DARD-funded research are harnessed through effective knowledge and technology transfer mechanisms.

2.3 Strategic Context of Evidence Gathering and Innovation Support

2.3.1 Evidence Gathering

The ***Economic Vision for Northern Ireland 2030***¹ seeks to rebalance and rebuild the economy to improve the wealth, employment and living standards of everyone through “ *stimulating innovation, R&D and creativity so that we widen and deepen our export base*”.

Supporting the agri-food sector is of vital importance, for many years it has been one of the primary drivers of our economy providing jobs and contributing to the sustainability of the rural sector. Investment in research is widely recognised as a key mechanism to achieving and maintaining this economic growth. It is accepted that only the enterprises operating to the highest standards of efficiency and sustainability will be capable of meeting the competitive challenges of the future. Providing these enterprises with a sound science-informed evidence base can provide confidence to developing businesses who are seeking to: meet the changing demands of consumers; improve productivity and sustainability; improve market orientation; and realise new growth opportunities.

DARD is also fully committed to an evidence-based approach to policy development and implementation. Our primary need for research is to obtain robust, high quality relevant and timely evidence to underpin the development, implementation and evaluation of our policies and to inform our operations and services, as broadly described in the DARD Strategic Plan. This includes having the evidence available to ensure that our legislation and regulatory practices are appropriately targeted, effective and impose the minimum necessary administrative and compliance cost. In order to properly address our priorities, we will work together across different policy areas and disciplines to take account of multiple social, economic and environmental factors at play and evidence will support all stages of policy development and delivery.

Therefore, in funding research to meet DARD’s and the agri-food sector’s evidence needs, we will continue to ensure that all our customers – DARD policy leads and stakeholders, have ownership of the research agenda and are fully engaged in defining the research needs.

¹ <http://www.northernireland.gov.uk/ni-economic-strategy-revised-130312.pdf>

2.3.2 Innovation Support

Innovation is the successful creation of more effective processes, products, services, technologies and ideas, which if supported can increase the likelihood of a business succeeding.

Increased investment in encouraging innovation and R&D has been recognised as a driver within the **Northern Ireland Economic Strategy 2012**¹ and within the **Northern Ireland Executive Programme for Government 2011-15**² vision for the economy as “a sustainable and growing private sector, with a highly skilled and flexible workforce operating in productive and innovative firms that are competitive in global markets”. The vital role of innovation in the growth of the economy is reiterated in the **Innovation Strategy for Northern Ireland 2014-2025**³ where the vision that “Northern Ireland will be recognised as an innovation hub and will be one of the UK’s leading high-growth, knowledge-based regions which embraces creativity and innovation at all levels of society”. The Innovation Strategy seeks to refine the priority given within the Economic Strategy to stimulate innovation and research. Encouraging the development of an innovative industry will be delivered in part through the supporting pillars of the **Investment Strategy for Northern Ireland 2008-2018**⁴. DARD equally recognises that stimulation of innovation research and the outputs from this research are central to supporting and responding to the needs of our local stakeholders and rural communities in order to grow a sustainable, profitable agri-food sector.

The benefits for individual innovation-active enterprises include: improved productivity; greater efficiency; enhanced response to customer need; faster turn-around times; increased value-added through improved product design/quality; waste reduction; and compliance with EU or other regulation. Introducing innovation within an enterprise is, however, a complex process requiring the co-ordination of multiple inputs including inter-firm collaboration, or collaboration between firms and universities/public sector research establishments. In the period 2010-12 forty percent of local enterprises (employing more than 10 people) were innovation-active compared to thirty three percent during 2008-10⁵; fifty six percent of micro enterprises (employing less than 10 people) were innovation-active⁶ with larger enterprises and micro-enterprises more likely to engage in innovative activities. The most common innovation partners are suppliers and clients and the least likely co-operation arrangements are with government or public research organisations.

¹ <http://www.northernireland.gov.uk/ni-economic-strategy-revised-130312.pdf>

² <http://www.northernireland.gov.uk/pfg-2011-2015-final-report.pdf>

³ http://www.detini.gov.uk/innovation-strategy-2014-2025_2.pdf

⁴ <http://www.northernireland.gov.uk/isnifinal.pdf>

⁵

http://www.detini.gov.uk/2013_innovation_survey_statistical_bulletin_11th_july_2014.pdf?rev=0

⁶ http://www.detini.gov.uk/micro_business_innovation_survey_2014.pdf

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. Other factors hindering businesses becoming involved in innovation include lack of resources, knowledge and skills.

2.4 Investing in Research and Innovation

Government intervention to support and promote research and 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, 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 funding also have key roles 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 this aspect of 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 continue to support and encourage industry and rural enterprises to become more involved in research and innovation. We will explore better mechanisms to engage with our agri-food industry to establish and direct the needs of the industry through development of appropriately aligned innovation research.

Building on the DARD Evidence and Innovation Strategy 2009-13, industry and rural enterprise involvement in the research agenda is now focussed through DARD support of industry-led action plans such as the Agri-food Strategy Board “*Going for Growth*” Strategy and through instruments such as the DARD Research Challenge Fund.

2.4.1 Agri-Food Strategy Board

In recognition of the importance of the agri-food industry to the economy, the Executive included a commitment in the Programme for Government (2011-2015) to develop a strategic action plan for the agri-food sector. The industry-led Agri-Food Strategy Board, following extensive consultation with the agri-food industry and other stakeholders, developed the ***Going for Growth Report***,¹ which sets challenging growth targets to 2020 for the local agri-food industry:

¹ <http://www.agrifoodstrategyboard.org.uk/uploads/Going%20for%20Growth%20-%20Web%20Version.PDF>

- Increase sales by 60% to over £7bn;
- Increase external sales by 75% to £4.5bn;
- Increase value added by 60% to £1bn; and
- Increase employment by 15% to 115,000.

Recommendations to achieve these targets including the development of innovation and skills aimed at accelerating the growth of farming, fishing and food and drink processing to 2020 and beyond. The Executive's response¹ to the *Going for Growth* report is a key driver for the identification of evidence and innovation research needs that underpin this Evidence and Innovation Strategy.

2.4.2 The DARD Research Challenge Fund

Investing in industry-led research is a key theme in *Going for Growth*, but many, especially smaller businesses, find this difficult due to perceived lack of capability and the costs and risks associated with undertaking research. The ***DARD Research Challenge Fund***² is a key element of the DARD Evidence and Innovation Strategy 2015-17 and aims to encourage industry and public sector research establishments to collaborate on innovative, high quality, pre-commercial research and technological development projects.

The projects funded through this stream have the potential to give small and medium sized businesses from the agri-food and other rural sectors an opportunity to get help with research that can further their sustainability and competitiveness. This initiative also has the potential to:

- increase the number of rural enterprises engaging in effective research and development - including those participating for the first time;
- increase the level of private sector expenditure on R&D;
- increase collaboration and effective cooperation between rural enterprises; and
- increase the level of collaboration between rural enterprises and the local, national and international research base, thereby creating the foundation for additional future collaborative research funding proposal to competitive EU funding streams such as Horizon 2020.

¹ http://www.dardni.gov.uk/ni_executive_response_to_going_for_growth.pdf

² <https://www.gov.uk/dard-research-challenge-fund>

3. How We Will Get There

3.1 DARD Strategic Evidence and Innovation Framework

3.1.1 *The Research Boundaries of this Strategy*

This Evidence and Innovation Strategy relates to DARD's evidence and innovation research and development agenda only. It does not encompass the wide range of evidence gathered through 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 which are independent of this Strategy (although it is recognised that research has an important role in informing and improving our delivery of these functions).

3.1.2 *Types of Research Funded*

Research-based evidence gathering can be categorised into three types of research and development: Basic, Applied and Experimental Development¹. DARD research funding will continue to 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 and meet the needs of our stakeholders. This will not preclude the undertaking of broader, more basic research and development, 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 (sections 4-8), nor should we necessarily seek to. We envisage that in many instances, our interests and those of our stakeholders can be adequately addressed through collation and interpretation of findings from research undertaken elsewhere, and from research collaboration with other research funders across the UK and wider afield.

¹ Frascati Manual, OECD, 2002

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

3.2 The Strategic Scope and Alignment of Evidence and Innovation Interests

The overarching policy context for the preparation of this Evidence and Innovation Strategy are the four Strategic Goals outlined in the DARD Strategic Plan 2012 – 2020 (Figure 3):



Figure 3: DARD Strategic Goals

The Evidence and Innovation Strategy is focussed on maintaining a research-framework that will assist DARD in delivering against these 4 Goals. The research required to meet evidence and innovation needs and deliver these Goals are coordinated through 4 Programme Management Boards (PMB) (Figure 4). The high level evidence and innovation research needs for each PMB are outlined in Sections 4-8.

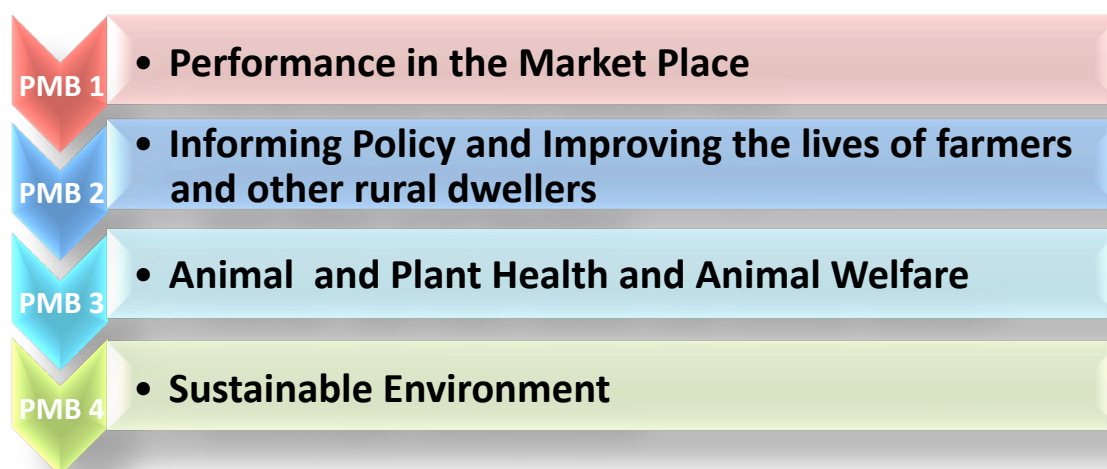


Figure 4: Format of DARD Programme Management Boards (PMBs)

4. DARD Strategic Goal 1: To help the Agri-Food Industry Prepare for Future Market Opportunities and Economic Challenges

The strategic evidence and innovation research needs required to deliver Goal 1 will be coordinated by Programme Management Board: PMB 1 *Performance in the Market Place*

4.1 Rationale

A shifting trading environment, with increased international competition, increasing costs and an evolving system of EU support, means that agri-food businesses must continually adapt their practices to improve profitability through developments in efficiency, competitiveness and economic sustainability while maintaining good environmental credentials.

Against this background, the Agri-Food Strategy Board's (AFSB) *Going for Growth* report is the key driver for PMB 1 research activities and emphasis will be placed on ensuring close linkages with the Strategy Board in promoting research that supports the sustainable economic development of the local agri-food industries through exploitation of new market opportunities, while balancing environmental and social needs. The report sets ambitious targets for growth of the sector to 2020 detailed previously (Section 2.4.1).

It is accepted that a highly skilled workforce is one of the key drivers for productivity, innovation and economic growth¹. Improving knowledge and skill within all agri-food sectors is intrinsic to competitiveness and therefore central to the remit of PMB 1. In this regard, effective co-ordination with PMB 2 is essential as research needs relating to education and skill development will be addressed by PMB 2. Furthermore, improved animal and plant health plays a key role in improving efficiency and also in securing access to valuable domestic and export markets, while good environmental practice underpins our local food credentials. This highlights the fact that performance in the market place is multi-factorial and reliant on the drivers and outputs incumbent within DARD's other strategic goals and therefore within more than 1 PMB.

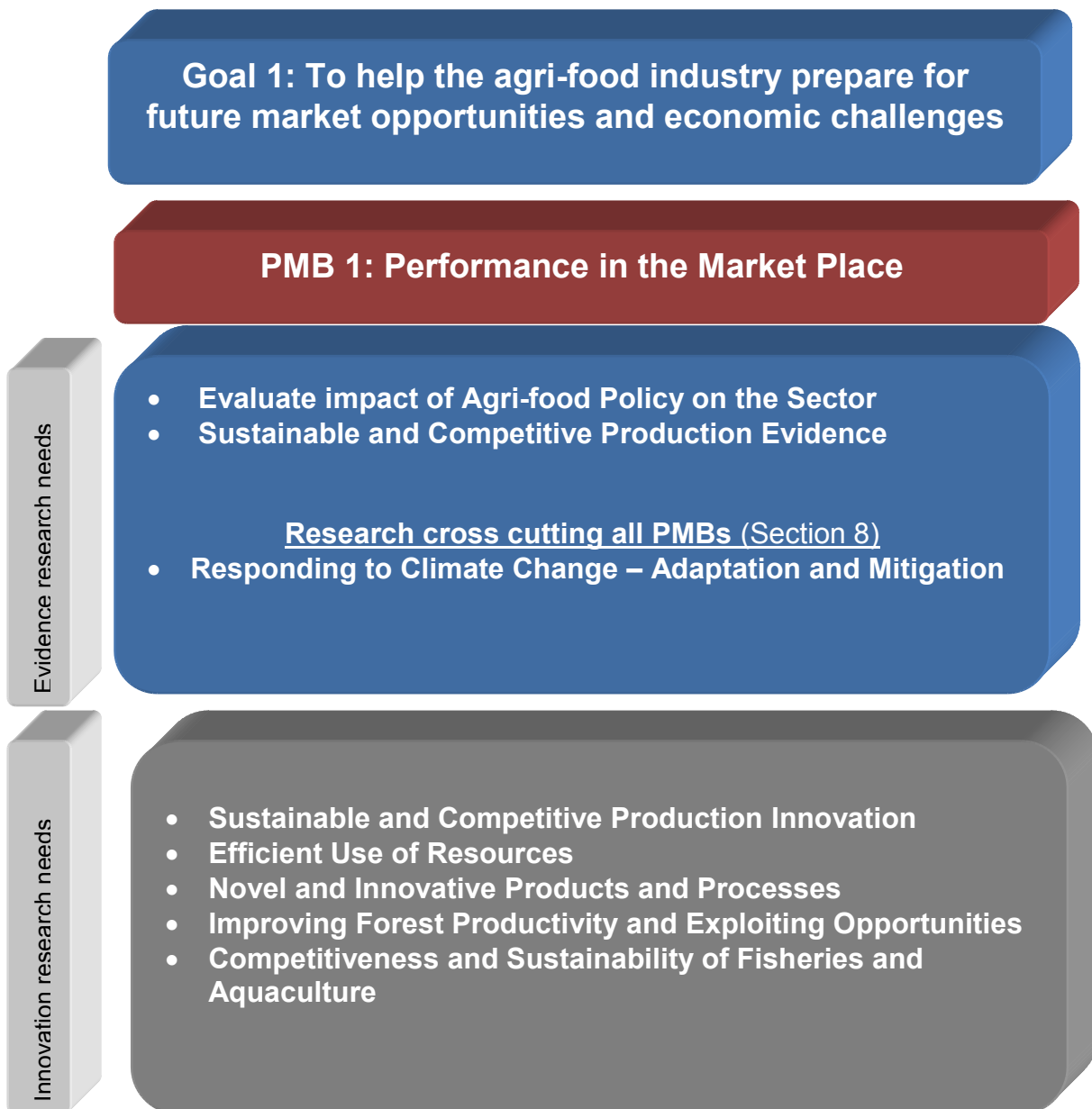
The focus of DARD's Strategic Goal 1 is creating and sustaining economic advantage. Therefore, it is crucial that there is effective stakeholder engagement to ensure that industry takes a lead in setting the research agenda through the identification of industry-relevant innovation research needs with a focus on subsequent knowledge exchange and technology transfer. In particular, emphasis will be placed on ensuring close linkages with the Agri-Food Strategy Board and its sub-groups.

¹ <http://www.northernireland.gov.uk/pfg-2011-2015-final-report.pdf>

4.2 PMB 1 Performance in the Market Place Strategic Policy Drivers

- *Going for Growth* Strategic Action Plan;
- NI Executive response to *Going for Growth*;
- DARD Strategic Plan 2012-2020;
- NI Programme for Government 2011-15;
- A Sustainable Development Strategy for NI 2010;
- NI Economic Strategy 2012;
- Innovation Strategy for NI 2014-2025;
- Regional Development Strategy for NI 2025;
- MATRIX reports – Agri-Food report 2008;
- Social Innovation report 2014;
- Rural White Paper Action Plan;
- Continuing CAP reform;
- WTO and bilateral trade negotiations aimed at increased trade liberalisation;
- UK strategy for agricultural technologies (Agri-Tech Strategy) 2013;
- Food Matters – Towards a Strategy for the 21st Century 2008;
- UK Long Term Economic Plan for Food ;
- Elliott Review into the Integrity and Assurance of Food Supply Networks – Final Report 2014;
- Organic Action Plan Group for NI: Action Plan 2006;
- Changing diets;
- Healthy Eating Initiative;
- Making Life Better – A Whole System Framework for Public Health 2013-2023;
- A Fitter Future for All: Framework for Preventing and Addressing Overweight and Obesity in NI 2012-2022;
- Consumer preferences and concerns e.g. on animal welfare, nutrition, food safety;
- GHG Action Plan;
- UK Climate Change Act 2008;
- EU Climate and Energy Package 2008;
- Strategy for the Sustainability of the Honey Bee (2011);
- Growing world population;
- Review and strategic priorities for development of the Arable sector in Northern Ireland (2014);
- Review of the NI Pig Industry – The Cogent Report (2012) and other sectoral reports;
- NI Forestry - A Strategy for Sustainability and Growth 2006;
- The Forestry Act (Northern Ireland) 2010;
- 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;
- Inshore Fisheries Strategy (2014) – “NI Inshore Fisheries: Delivering a Sustainable Future”;
- Interim Report of the Fishing Industry Task Force (2015);
- Common Fisheries Policy (EU 1380 2013); and
- Strategic Guidelines for the Sustainable Development of EU Aquaculture 2013.

4.3 Summary Overview of Evidence and Innovation Research Needs for PMB 1 Performance in the Market Place



4.4 Evidence Research Needs: PMB 1 Performance in the Market Place

4.4.1 Evaluate Impact of Agri-food Policy on the Sector

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, aquaculture and forestry industries function. This includes the impact of policy changes at European Union and World Trade Organisation (WTO) level, central to which is the influence of the Common Agricultural Policy (CAP) and the Common Fisheries Policy (CFP) and the influence of other bilateral agreements, such as the Transatlantic Trade and Investment Partnership (TTIP) on trade with the USA.

The importance of broader rural development within the CAP (which includes environmental, forestry and socio-economic strands) are likely to grow over time and this will have implications for the agri-food industry and the local economy. We need to understand the implications of emerging policy and regulatory proposals for the north so that we can seek to influence and respond appropriately to them. The impacts of policy changes initiated by the NI Assembly also need to be analysed.

Research is similarly needed to inform the north's position in the UK's negotiations with Europe and in implementing CFP reforms. Research and scientific data also underpin the environmental work required to be undertaken before DARD can issue the necessary licences for aquaculture sites.

Due to the multi-factorial nature of PMB 1 some of its evidence needs will be met by research commissioned within other PMBs.

Key research interests in this area are:

- Economic modelling of the agri-food sector to enable assessment of policy options, notably under CAP reform and WTO trade liberalisation (this aligns with the interests of PMB 2), as well the impact of emerging agri-food policies;
- Fish stock levels assessment and controls; and
- Sustainable fisheries management under CFP reform including reducing catches of unwanted fish (aligns with PMB 4 interests); and
- Assessment of risks and opportunities of remaining within the EU.

4.4.2 Sustainable and Competitive Production Evidence

The Agri-Food Strategy Board's *Going for Growth* report recognises the capability within our agri-food industries to create an efficient and sustainable food region. But to be sustainable at farm-level the agri-food industry must be

profitable throughout the supply chain and seek to target segments of the global market that offer the best returns, in a more efficient and effective manner that encompass economic and environmental sustainability.

Key research interests in this area are:

- Assessing the scale of opportunities available in international markets and the risks, barriers and benefits involved (this links with PMB 2 research interests); and
- Developing an evidence-base to support the claim of being an economic and environmentally sustainable food region.

4.5 Innovation Research Needs: PMB 1 Performance in the Market Place

4.5.1 Sustainable and Competitive Production Innovation

The development of a global reputation for environmentally sustainable production within all agri-food sectors is the key element of *Going for Growth*. Given the direction of EU agricultural policy and the increasing challenge from global competitors, farms need to become knowledge-based businesses which have access to, and can exploit new ideas and technologies. Agri-food supply chains need to identify and operate sustainable business models for the entire chain, not just individual enterprises. Genetic improvement has a key role to play in competitive livestock, crop and horticulture production systems and the development of a strategy to accelerate genetic gains within the local livestock sectors is a key area being addressed by the Agri-Food Strategy Board and its sub-group focussing on livestock genetics.

Farm businesses need to be able to operate at high levels of technical efficiency taking advantage of new technologies and new global opportunities for market-led, efficient agricultural production and processing. Whilst at the same time recognising the utility of home grown resources such as grass in improving competitive production systems and environmental credentials. Some research interests, particularly benchmarking, cross-link with the research interests of PMB 2.

Key research interests in this area are:

- Improving resource use efficiency to improve the competitiveness and environmental sustainability of farming systems;
- Harnessing the potential of livestock genetics, including genomics, to improve productivity (including quality of output), animal health and welfare and traceability;
- Identifying optimal sustainable production systems for different farm and horticulture enterprises and structures;
- Evaluating the effect of adoption of new technologies to improve efficiency and the profitability of agriculture and horticulture production systems;

- Assessing the scale of opportunities available in international markets and the risks, barriers and benefits involved (this links with PMB 2 research interests);
- Developing an evidence-base to support the claim of being an economic and environmentally sustainable food region;
- Benchmarking the competitiveness of local production against international best practice (this links with PMB 2 research interests);
- Exploring the linkages between agricultural production systems and technologies and food attributes; and
- Strengthening the local agri-food supply chain to ensure that the product delivered meets the needs of the marketplace.

4.5.2 Efficient Use of Resources

Modern agriculture is highly dependent on natural resources such as soil and fossil fuels and on commodities such as chemical fertilisers and livestock feed.

Management of the health of soil and other growing media (nutrition, structure, texture) is fundamental to the sustainability of agriculture and horticulture production systems. Developing new techniques or technologies that can improve the health or efficient use of soil and growing media have the potential to enhance productivity.

Energy efficient production systems and on-farm energy production have the potential to reduce costs while efficient use of animal manures and use of nitrogen fixation in the soil have the potential to reduce dependence on chemical fertilisers.

Key research interests in this area are:

- Improving efficiency of agriculture and horticulture production systems and resource use, with particular focus on energy, water and soil;
- New technologies to improve efficient use of animal manures as a fertiliser for grass and arable crop production;
- Evaluation of the potential for alternative forage legumes to reduce reliance on nitrogen fertiliser input; and
- Evaluation of biological alternatives to Crop Protection Products.
- Evaluation of forestry co-products as on-farm renewable energy sources.

4.5.3 Novel and Innovative Products and Processes

To succeed in the global marketplace, new approaches are required which will give local products distinctive and marketable attributes. In many instances, these attributes will be created by post farm gate processes.

By capitalising on opportunities such as the increasing interest in functional foods, and improved human health through developments in animal nutrition,

the local agri-food sector can reposition itself to capture greater value from the supply chain.

Key research interests in this area are:

- Improving food quality, food reputation, product attributes and system efficiency through process innovation;
- Exploiting food ingredients in the development of functional foods for improved health and wellbeing;
- Assessing the societal perceptions, attitudes and value placed on high welfare, traceable, or functional foods (research involving socioeconomic assessment would be undertaken by PMB 2);
- The potential exploitation of non-food crops for bio-compounds and biopolymers, e.g. packaging, cosmetics, textiles; and
- Assessing the potential of the grass crop as a substrate for non-animal feed uses.

4.5.4 Improving Forest Productivity and Exploiting Opportunities

Improving the productivity of forests presents new and future challenges requiring improvement in the quality and yield of production while meeting environmental regulatory requirements and the needs of the market.

Tree breeding programmes can offer significant increases in the desirable qualities of commercially grown trees, the products of which could have a major impact on forestry productivity.

Key research interests in this area are:

- How to regenerate, manage and maintain growth of woodland to maximise efficiency and effectiveness while meeting regulatory requirements;
- How to harvest, transport and offer produce to the market to maximise efficiency and effectiveness while meeting regulatory requirements;
- How to further improve yield per hectare and the quality of timber of both broadleaf and conifer trees; and
- Understanding the risks and benefits of exploiting wind energy on forest land.

4.5.5 Competitiveness and Sustainability of Fisheries and Aquaculture

Commercial sea fishing, aquaculture and mariculture make important contributions to the economy of a number of our coastal and rural communities. Therefore addressing current issues and identifying future opportunities is needed to ensure a sustainable and profitable industry for the future.

Currently one of the significant issues to sea fishing is the high level of discards of whitefish by-catches associated with shellfish fishing rigs.

Rising sea surface temperatures as a result of climate change may allow some shellfish cultures to colonise new waters¹, creating the potential for future local alternative commercial opportunities. Diversification into new species of shellfish and seaweed, as well as potential for development of crab and lobster fisheries have also been identified as future opportunities for sustainable growth in aquaculture and mariculture². Assessment and evaluation of these opportunities is required.

Some research interests cross-link with the research interests of PMB 4 and PMB 2.

Key research interests in this area are:

- Economics of sea fishing, including vessel and labour efficiency (aligns with PMB 2 research interest);
- Evaluating fishing gear selectivity;
- Marketing of fish types not previously landed;
- Promoting NI Fish Health Status: maintenance and protection of this competitive advantage;
- Evaluating the commercial opportunities for aquaculture; and
- Assessing the potential for expansion of crab and lobster fisheries.

¹Foresight report

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

²The Review of Inshore Fisheries Management in Northern Ireland

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

5 DARD Strategic Goal 2: To Improve the Lives of Farmers and Other Rural Dwellers, Targeting Resources Where They Are Most Needed

The strategic evidence and innovation research needs required to help deliver Goal 2, together with a portfolio of cross cutting socio-economic research to inform policy across the breadth of DARD's strategic interests, will be coordinated by Programme Management Board (PMB) 2: *Informing Policy and Improving the Lives of Farmers and Other Rural Dwellers*.

5.1 Rationale

Regeneration of rural areas requires a vibrant socio-economic structure. In order to inform and support government interventions identified in the Rural White Paper Action Plan¹, the Tackling Rural Poverty and Social Isolation Framework² and the Rural Development Programme³, and to support the implementation of the proposed Rural Proofing Bill, we need to have a robust understanding of the social and economic characteristics of rural areas, with a particular focus on identifying the genesis and perceptions of disadvantage and the impacts of current policies on it. We need to understand how these characteristics and needs vary between and within rural communities, and how this compares with urban counterparts. We also need to develop a more sophisticated understanding of what this means for the development and equitable delivery of government economic and social policies for all rural based groupings and interests.

The Department's requirement for a broadly based socio-economic research programme is underpinned by its need for robust, high quality and relevant evidence base to improve and support policy development, review and implementation. The Department needs to be able to monitor and assess the impact and effectiveness of all aspects of the Northern Ireland Rural Development Programme 2014-20 and inform the development of future policies and programmes. Sophisticated economic modelling of the farm and rural sectors will enable simulations of policy interventions to be developed and explored. Evidence gathering will also inform government, farmers, rural communities and rural businesses on the most economically, socially and environmentally viable systems of production, marketing, control and management.

¹ Rural White Paper Action Plan <http://www.dardni.gov.uk/index/rural-development/rural-white-paper-action-plan.htm>

² Tackling Rural Poverty and Social Isolation Framework <http://www.dardni.gov.uk/index/rural-development/rural-poverty-and-social-isolation.htm>

³ Rural Development Programme <http://www.dardni.gov.uk/rdp>

5.2 PMB 2 Informing Policy and Improving the Lives of Farmers and Other Rural Dwellers: Strategic Policy Drivers

- World Trade Organisation and Trade liberalisation negotiations;
- Europe 2020 Strategy and EU Common Strategic Framework;
- Reform of the EU Common Agriculture Policy;
- Reform of the EU Common Fisheries Policy;
- Northern Ireland Act 1998;
- Northern Ireland Programme for Government 2011-2015;
- Northern Ireland Economic Strategy 2012;
- Regional Development Strategy for Northern Ireland 2025;
- The Northern Ireland Executive's Strategic Energy Framework;
- DARD Strategic Plan 2012-2020;
- Going for Growth Strategic Action Plan;
- Rural White Paper Action Plan;
- Rural Development Programme 2014-2020;
- Tackling Rural Poverty and Social Isolation (TRPSI) Framework 2011-2015;
- Proposed Rural Needs Bill
- Lifetime opportunities;
- The 2008 Climate Change Act;
- DARD Renewable Energy Action Plan 2010;
- Strategy for the Equine Industry in Northern Ireland 2007;
- UK Marine Policy Statement 2011;
- Inshore Fisheries Strategy (2014) – “NI Inshore Fisheries: Delivering a Sustainable Future”;
- Interim Report of the Fishing Industry Task Force (2015);
- Guidelines for the Sustainable Development of EU Aquaculture;
- Multi-Annual National Plan for Aquaculture; and
- The Forestry Act (Northern Ireland) 2010
- NI Forestry - A Strategy for Sustainability and Growth 2006

5.3 Summary of Evidence and Innovation Research Needs for PMB 2: Informing Policy and Improving the Lives of Farmers and Other Rural Dwellers

Goal 2: To improve the lives of farmers and other rural dwellers, targeting resources where they are most needed

PMB 2: Informing Policy and Improving the Lives of Farmers and Other Rural Dwellers

Evidence research needs

- Understanding and evaluating socio-economic challenges, needs and potential of traditional land and marine-based industries and appropriate policy responses
- Identifying the particular challenges, needs and potential of rural and fishing communities and appropriate policy responses
- Using economic modelling frameworks to develop and test policy interventions and to assess their impacts
- Evaluating the costs and benefits to the economy of animal and plant disease prevention and control
- Understanding the economic value of improving environmental footprint in the land and marine-based industries
- Understanding how best to affect behavioural changes within the agri-food, forestry and fishing sectors
- Understanding how best to maximise the returns from education and technology transfer

Research cross cutting all PMBs (Section 8)

- Responding to climate change – adaptation and mitigation

Innovation research needs

- Understanding how best to embed economic sustainability into rural policy interventions, including the role of innovative solutions, new technologies and social enterprise
- Evaluating the potential of innovation and new technologies (ICT) to deliver better social and economic outcomes in rural areas

5.4 Evidence Research Needs: PMB 2 Informing Policy and Improving the Lives of Farmers and Other Rural Dwellers

5.4.1 Understanding and Evaluating Socio-economic Challenges, Needs and Potential of Traditional Land and Marine-based Industries and Appropriate Policy Responses

Evolving market forces, environmental pressures and public concerns will continue to drive changes in the practices, technologies and structures of traditional rural industries, such as farming and fishing, as well as the support and regulatory frameworks within which they will operate. This increases the need for the development of robust policy responses which will help ameliorate any negative impacts and maximise the opportunities afforded by change.

Key research interests in this area include:

- Benchmarking the economic competitiveness of local agricultural production and processing against international best practice;
- Identifying economically optimal and sustainable production systems for different farm enterprises and structures;
- Determining the most productive use of our limited land resources, including the identification of areas best suited for specific agricultural use whilst maintaining and enhancing environmental sustainability;
- Assessing the contribution of farm business innovations to profitability and sustainability;
- Assessing the economic impact of farm, food and fisheries business support interventions delivered under domestic and EU support programmes;
- Assessing how farm diversification and off-farm sources of income can impact on the sustainability of farming;
- Understanding the economic situation of farm households with multiple sources of income as opposed to the conventional concept of the farm as a standalone economic entity;
- Understanding the economics of sustainable fisheries under CFP reform, particularly the impact of the landing obligation;
- Understanding the economics of sea fishing, including vessel and labour efficiency;
- Assessing how best to support the shellfish aquaculture industry to develop in a sustainable manner, with an acceptable environmental impact and awareness of wider economic implications;
- Assessing the commercial opportunities for aquaculture and mariculture;
- Understanding the economic value of the complex range of ecosystem services that forests have to offer (including timber production) in the context of sustainable forest management.

5.4.2 Identifying the Particular Challenges, Needs and Potential of Rural and Fishing Communities and Appropriate Policy Responses

The Rural White Paper Action Plan sets out the Executive's commitments in rural areas covering a wide range of rural issues across five broad themes namely, (i) urban-rural linkages, (ii) rural communities, (iii) rural economies, (iv) access to services and (v) the countryside and will help government gain a better understanding of the characteristics, needs and expectations of those who live and work in rural and coastal communities.

Given the ongoing changes in the rural economy and society, there is a need to identify new ways of reconnecting and regenerating rural and coastal towns and villages which engage all parts of the community.

Promoting and facilitating the use of amenity areas such as forests for recreational and social purposes is seen as one potential mechanism to engage rural communities.¹

A key goal of DARD's is to strengthen the social and economic infrastructure of rural areas. One of the ways in which DARD can contribute to this goal is by developing a suite of measures aimed at addressing poverty and social isolation in rural areas. While poverty and multiple deprivation tend to be concentrated in urban areas, pressures on the agricultural sector, demographic change and the physical isolation leave many in rural communities in or at serious risk of poverty and social isolation. The Tackling Rural Poverty and Social Isolation (TRPSI) framework sets out the policy context for this work, the links with other government departments and statutory organisations. A sound evidence base is essential to effective policy interventions under this framework and to their subsequent evaluation.

Key research interests in this area include:

- Baseline and trend data on the socio-economic characteristics of different types of rural areas to enhance the 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;
- Assessing the impact of policy interventions delivered under domestic and EU support programmes, including support for economic diversification activities;
- Assessment of appropriate policy initiatives to promote equality of opportunity and to tackle poverty and social exclusion in rural areas;
- Understanding how best to secure, measure and maximise the benefits of community engagement and animation;

¹The Strategy to Develop the Recreational and Social Use of Forest Service Forests
<http://www.dardni.gov.uk/index/forestry/forestry-publications/forest-service-consultations/recreation-strategy-2009.htm>

- Assessment of socio-economic linkages and interdependencies between rural and urban areas;
- Understanding why, in contrast to other regions, the local rural population continues to grow, in many cases with dormitory workers, but service centres continue to decline;
- Assessment of the barriers that slow down the rate of rural regeneration and an analysis of the most appropriate policy instruments to overcome these obstacles;
- Evaluating recreation and social forest use and cost effective delivery of expectations, including opportunities for building partnerships for forest recreation; and
- Assessing and maximising the amenity value of forests and green spaces for community benefit.

5.4.3 Using Economic Modelling Frameworks to Develop and Test Policy Interventions and to Assess their Impacts

DARD needs a sound understanding of the complex economic interactions which shape the operating environment in which the agri-food, fisheries and forestry industries function. Ongoing investment in economic modelling tools will enable the Department to understand the dynamic effects of changes in policy and market drivers on the agri-food and rural economy at both micro and macro level.

Key research interests in this area include:

- Understanding the role of the rural economy in the broader local economy;
- Understanding the impact of EU and domestic agricultural or environmental policy and other changes (such as a change in global energy prices or changes to corporation tax or EU trade policy) on agriculture, on the wider economy and on the environment;
- Modelling the interactions involved in the joint production of market and non-market goods (such as environmental stewardship or improved animal welfare);
- Modelling the numerous physical and economic processes which characterise land, its use and the consequences of that use and extend locally “The Integrated Model” approach described in the UK National Ecosystem Assessment Follow On project;
- Understanding and estimating the value of non-market benefits and disbenefits arising from the activities of the agri-food, forestry and fishing sectors;
- Economic modelling of new innovations or innovative systems.

5.4.4 Evaluating the Costs and Benefits to the Economy of Animal and Plant Disease Prevention and Control

Considerable resources are expended by DARD and by the agricultural industry each year in preventing, controlling and eradicating a wide range of

animal and plant diseases. DARD needs a much broader understanding of the full economic costs and benefits of these efforts, together with a clearer picture of the most economically efficient disease control strategies and their associated risks.

Key research interests in this area include:

- Understanding the full costs, risks and benefits to the economy of alternative animal, fish and plant disease control, detection and prevention strategies;
- Understanding societal attitudes, perceptions and preferences about improved animal health and welfare and plant health and the value placed on improvements;
- The development of an economic framework to guide animal and plant health policy interventions and decision making.

5.4.5 Understanding the Economic Value of Improving Environmental Footprint in Land and Marine-based Industries

Agri-environment measures have formed the single largest element of successive Rural Development Programmes in the north and represent a major investment of both national and EU monies. The main focus of economic research in this area is on gaining a better understanding of the complex economic interactions (involving both market and non-market elements) between land and marine based industries and the natural environment.

The concept of ecosystems services is gaining increasing recognition, but it is a difficult concept to translate into a manageable and effective set of policy interventions. Placing a value on ecosystems services is difficult. Many studies focus on only one or a small number of ecosystem services, yet sustainable management of (often complex) ecosystems requires consideration of a wide range of ecosystem service trade-offs. Developing a coherent policy framework to incentivise and deliver an appropriate level of ecosystems services can only be achieved with the benefit and guidance of a sound research evidence base.

Key research interests in this include:

- Understanding the complex economic interrelationships between land and marine management practices and the environment (ecology, biodiversity, water quality, air quality and landscape amenity);
- Assessing the environmental and economic consequences, both positive and negative, of changing land use patterns and interactions, including the risks and consequences of land abandonment;
- Assessing the social and economic benefits of ecosystem services;
- Understanding how best to elicit maximum value for multiple ecosystem services;

- Evaluating the market and non-market values of existing agri-environment measures and policy interventions delivered under domestic and EU support programmes;
- Understanding the opportunities for, and economic benefits of, creating and exploiting market differentiation of agri-food products produced under environmentally sustainable land and marine management practices;
- Measuring the economic impact of alternative climate change adaptation and mitigation strategies;
- Understanding the economic impacts of the uptake of renewable energy enterprises by farmers on agriculture, the rural economy and the wider economy.

5.4.6 Understanding How Best to Affect Behavioural Changes Within the Agri-food, Forestry and Fishing Sectors

Much of government policy and intervention is aimed at driving behavioural change through regulation, education and incentivisation. The cost and the effectiveness of these alternatives is critically dependent on a deep understanding the drivers of existing behaviours and the receptiveness of the target population to policy instruments to effect change.

Key research interests in this include:

- Understanding the drivers and motivations that exist within farm and fishing family units (e.g. altering behaviour to encourage and increase the perceived value placed on the attainment of education and skills and understanding the barriers to new entrants and young farmers entering the industry);
- Understanding the social and personal barriers to change within farm and fishing family units and within rural communities, and how they can best be overcome to deliver improved economic, social and environmental outcomes;
- Understanding the drivers involved in land-use change decisions associated with woodland expansion, appropriate structures to deliver change and appropriate public and private incentives;
- Developing and testing innovative policy interventions to effect behavioural change and deliver improved economic, social and environmental outcomes.

5.4.7 Understanding How Best to Maximise the Returns from Education and Technology transfer

DARD invests heavily in a range of education and knowledge transfer activities to improve the economic and environmental performance of the agri-food sector. Education and knowledge transfer together represent a primary policy lever to effect change and improved performance and it is vital for both

DARD and for the agri-food industry as a whole that maximum impact is achieved from this investment.

Key research interests in this area include:

- Assessing the knowledge and skills needs of those in the agri-food sector;
- Understanding the barriers to knowledge transfer and uptake;
- Measuring the impact of current education and knowledge transfer interventions;
- Evaluating the cost and effectiveness of alternative education and knowledge transfer options.

5.5 Innovation Research Needs: PMB 2 Informing Policy and Improving the Lives of Farmers and Other Rural Dwellers

5.5.1 Understanding How Best to Embed Economic Sustainability into Rural Policy Interventions, including the Role of Innovative Solutions, New Technologies and Social Enterprise

Many rural policy interventions and initiatives remain critically dependent on on-going financial support from government for their continued existence. In an era of constrained government finances, this leaves such projects extremely vulnerable. Therefore, new approaches and new solutions are needed to try and embed economic sustainability into rural policy interventions so that they can attain a greater level of financial independence after an initial period of pump priming.

Key research interests in this area include:

- Assessing the role and potential of social economy enterprises in community development and regeneration (including possible negative effects such as displacement);
- Exploring new and innovative policy interventions to deliver more sustainable rural policy outcomes at lower cost to government.

5.5.2 Evaluating the Potential of Innovation and New Technologies (ICT) to Deliver Better Social and Economic Outcomes in Rural Areas

Traditional forms of service provision from both government and the private sector (e.g. retail shops, banking, etc.) are fast being replaced, particularly with the advent of e-services. Policy interventions should not attempt to slow the pace or reverse the direction of change. However, it must be recognised that change poses particular challenges for certain groups within society. For others, it opens up new opportunities and can negate any disadvantage associated with living in rural areas. Therefore, research is needed to understand both these challenges and opportunities and inform how policy interventions can be devised to mitigate the former and accelerate the latter.

Key research interests in this area include:

- Understanding the evolving opportunities for e-commerce as a rural social and economic catalyst;
- Understanding the extent, causes and consequences of the digital divide;
- Evaluating innovative new ways of delivering public services, including the role of the voluntary and community sector;
- Understanding how all groups within rural society can best be helped to adapt to the rapidly changing models of service delivery and avoid being excluded.

6. DARD Strategic Goal 3: To Enhance Animal, Fish and Plant Health and Animal Welfare on an All Ireland Basis

The strategic evidence and innovation research needs required to deliver Goal 3 will be coordinated by Programme Management Board: PMB 3 *Animal and Plant Health and Animal Welfare*.

Given the diversity of issues which impact upon on both animal health and welfare and on plant health (which includes forestry, crops, horticulture and amenity horticulture), and in order to ensure that the research portfolio addressing evidence and innovation needs, is fully represented across both animal and plant health, consideration will be given to delivering these research needs by separate Programme Management Boards within the new DAERA Evidence and Innovation Strategy. Given the short-term nature of this bridging strategy, the research needs for animal and plant health will continue to be addressed by PMB 3.

6.1 Rationale

Animal and plant health are key strategic considerations for the future safety and security of the food chain and the broader rural economy.

Animal (including fish) 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 and on-going endemic diseases such as bovine TB and the potential threat posed by emerging diseases provide ample evidence of the cost to the taxpayer of major outbreaks of animal disease; the animal welfare consequences; the loss of public confidence in the livestock industry; the wider economic impact of restrictions to international trade. Equally the consequences of fish diseases can have adverse consequences for the local fishing and aquaculture industry.

Implications for plant health issues are of fundamental importance not only to the sustainability of the horticulture, crop and forestry sectors but also to productivity, competitiveness and animal health within the livestock sector. Improving the resilience of crops, amenity horticulture and forests in the face of challenges by pests, diseases and potential climate change is clearly a prudent and necessary safeguard. Vigilance against new and emerging threats in the face of an increasingly open international trading environment is also a necessary precaution.

This highlights the importance of a strategic approach to protecting animal health and welfare and plant health supported by robust scientific evidence.

6.2 PMB 3 Animal and Plant Health and Animal Welfare Strategic Policy Drivers

- Northern Ireland Programme for Government 2011-15;
- The Department of Agriculture and Rural Development Strategic Plan 2012-2020;
- The Going for Growth strategic action plan.
- Animal Health Strategy for the European Union 2007-2013;
- Northern Ireland Animal Health and Welfare Strategy 2006;
- All Island Animal Health and Welfare Strategy 2008;
- UK 5 year Antimicrobial Resistance (AMR) Strategy 2013-2018;
- Appointment of the TB Strategic Partnership Group;
- The Diseases of Animals Order (NI) 1981
- Animal Health Requirements for Aquaculture Animals and Products (Council Directive 2006/88/EC);
- North Atlantic Salmon Conservation Organisation (NASCO);
- Fisheries Act 1966 (as amended);
- Plant Health Directive (Council Directive 2000/29/EC);
- National legislation: Plant health Act (NI) 1967, the Plant Health (NI) Order 2006 and the Plant Health (Wood and Bark) Order 2006 and the Seed Act (NI) 1965 and associated subordinate legislation;
- The Forestry Act (Northern Ireland) 2010; NI Forestry - A Strategy for Sustainability and Growth 2006
- Tree Health and Plant Biosecurity Expert Taskforce May 2013;
- All-Island Plant Health and Pesticides Strategic Work Programme 2013;
- Animal and Plant Health Package: Smarter rules for safer food (EU reform 2013);
- The All-Ireland Chalara Control Strategy, July 2013; and
- Invasive Species in Ireland Report, 2006.

6.3 Summary Overview of Evidence and Innovation Research Needs for PMB 3 Animal and Plant Health and Animal Welfare

Goal 3: To enhance animal, fish and plant health and animal welfare on an all Ireland basis

PMB 3: Animal and Plant Health and Animal Welfare

Evidence research needs

- Improving detection and control of endemic animal diseases.
- Assessing and improving animal welfare.
- Understanding risks to aquaculture and fish health.
- Animal disease horizon scanning – emerging risks.
- Improving diagnosis and surveillance of plant pests and disease.
- Costs, benefits and risk profile of animal and plant disease prevention and control strategies.

Research cross cutting all PMBs (Section 8)

- Responding to climate change – adaptation and mitigation

Innovation research needs

- New techniques/approaches to disease prevention and control

6.4 Evidence Research Needs: PMB 3 Animal and Plant Health and Animal Welfare

6.4.1 Improving Detection and Control of Endemic¹ Animal Diseases

Faster, more accurate and less costly disease detection will ultimately assist in disease eradication programmes and the early detection and prevention of the spread of endemic diseases such as bovine TB. This should help protect and improve the overall health status of animal population and, ultimately, create a more competitive agri-food industry.

Research into all aspects of TB control 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. The direction and scope of future bTB research will be informed by the actions of the TB Strategic Partnership Group – an industry/government group set up to develop a long term strategy for the eradication of bTB and by the DARD bTB Research Strategy.

Key research interests in this area are:

- Epidemiology of TB and methods of controlling the spread of disease from cattle to cattle and between wildlife and cattle, including optimisation of epidemiological investigations;
- Improved diagnostic tests (with particular emphasis of accuracy, timeliness and cost); and possible input to development of TB vaccines for cattle/wildlife; and
- Evaluation of available technologies, including genetic selection in the breeding of disease resistant cattle which is now increasingly based on genomics.

6.4.2 Assessing and Improving Animal Welfare

The growing society interest and concern for the welfare of kept animals is a key driver for strategic change. There is pressure to ensure that animal health and welfare policies do not simply ensure the absence of unnecessary suffering and disease, but also ensure, through education and awareness, that anyone with ownership of an animal has a duty of care to meet acceptable animal health and welfare standards.

Government and industry need to be aware of the benefits of improving welfare relative to the associated costs so that informed, evidence-based decisions can be made.

Key research interests in this area are:

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

- Understanding public perceptions and the benefits accruing to society from improved animal welfare relative to the costs [aligns with PMB2 research needs];
- Assessing the current status of local animal welfare in farming systems;
- 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.

6.4.3 Understanding Risks to Aquaculture and Fish Health

In order for NI to maintain disease-free zone status it needs to be alert to the potential for new disease threats. Given the nature of the environment in which fish are farmed, there are potential implications for welfare and for health.

There is also an important role to play in protecting and sustaining stocks of native species through encouraging and supporting stakeholders' research, innovation and breeding programmes.

Key research interest in this area is:

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

6.4.4 Animal Disease Horizon Scanning – Emerging Risks

Increased international travel and trade, as well as climate change and the growing problem of antimicrobial resistance, have the potential to impact significantly on the diseases affecting animals and fish. DARD needs to retain a capacity for the early detection of emerging threats so that appropriate action can be taken to protect the animal and fish health status in the north.

Key research interest in this area is:

- Horizon scanning and risk assessment technologies for animal and fish diseases.

6.4.5 Improving Diagnosis and Surveillance of Plant Pests and Disease

In the last few years new plant and tree pests and diseases have emerged as significant risks, spreading through gardens and woodlands and potentially causing serious damage to either our native flora or commercial crops. Predicted climate change effects, such as warmer winters and changes in seasonal rainfall and storm patterns, may also increase the risk of pest establishment, spread and impact.

Key research interests in this area are:

- Understanding how to achieve more effective evaluation of plant pests and disease risks;
- Development and application of a NI Plant Health risk register;
- More effective diagnosis of pests and diseases; and
- Understanding pest and disease epidemiology and development of more effective surveillance.

6.4.6 Costs, Benefits and Risk Profile of Animal and Plant Disease Prevention and Control Strategies.

This research need will be addressed under PMB 2 section 5.4.4

6.5 Innovation Research Needs: PMB 3 Animal Health and Plant Health and Animal Welfare

6.5.1 New Techniques/Approaches to Disease Prevention and Control

The control of disease is of great significance to the efficiency and profitability of modern agriculture, fisheries and aquaculture. 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 DNA sequencing, along with more comprehensive phenotypic databases, offer the potential for genetic/genomic 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 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;
- Improving the resilience of forests, crops and amenity horticulture to pests and diseases;
- Management of pests detrimental to agricultural crops through Integrated Pest Management strategies [alignment with PMB 1 and 4 research interests].
- Nutritional strategies to reduce susceptibility to disease; and
- Use of genetic selection (including genomics) to improve resistance to disease

7. DARD Strategic Goal 4: To Help Deliver Improved Sustainable Environmental Outcomes

The strategic evidence and innovation needs required to deliver Goal 4 will be coordinated by Programme Management Board: PMB 4 *Sustainable Environment*.

7.1 Rationale

Agriculture occupies around 75% of the land area of the north. Therefore, given its size, agriculture is of major importance to both the local economy and environment. Water quality, biodiversity, GHG emissions and carbon intensity are fundamental issues in relation to agriculture and achieving sustainable environmental outcomes.

A better understanding of the value attached to sustainable land and marine management may provide the opportunity to create and exploit market differentiation for the products of the agri-food sector. DARD will continue to work in strategic partnerships with industry and environmentalists, to improve sustainability and address environmental pressures and needs. DARD will also lead the development of an agricultural land use strategy to determine how to optimise production efficiency and balanced environmental outcomes from agricultural land.

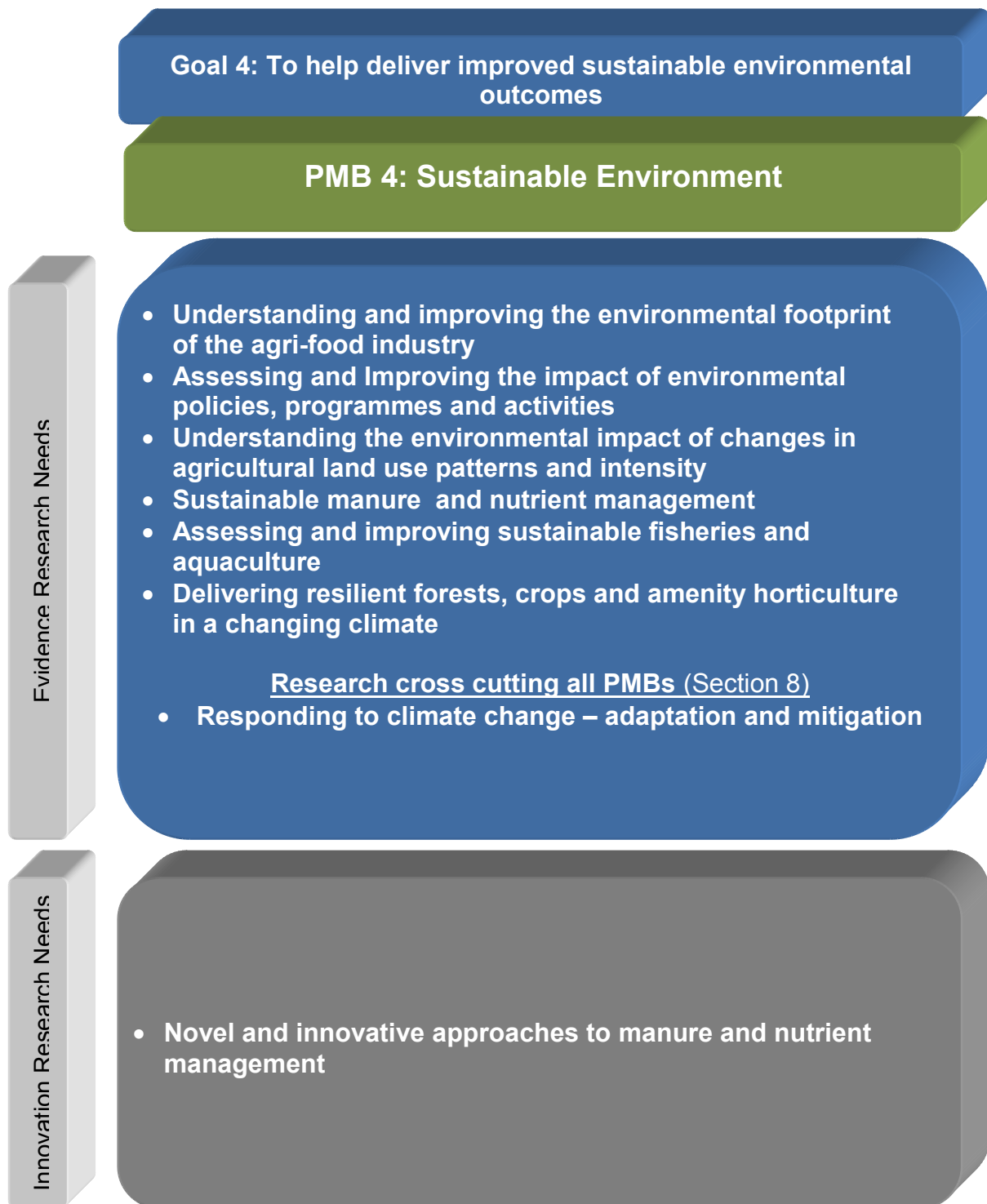
Key environmental issues and actions include:

- Reducing agricultural emissions of GHGs and Ammonia;
- Developing a suite of sustainable environmental measures and policies to compliment agri-food growth targets;
- Agreement on a GHG Phase 2 Action Plan;
- Agri Land Use Action Plan;
- Agri measures for Water Framework Directive River Basin Management Plans;
- A monitoring framework for NIRDP environmental outcomes; and
- Sustainable Manure and Nutrient Management; and
- Increasing the use of Integrated Pest Management.

7.2 PMB 4 Sustainable Environment Strategic Policy Drivers

- EU Directives: notably on Birds (79/409/EEC as amended), Habitats (92/43/EEC), Nitrates (91/676/EEC), Water Framework (2000/60/EC), Floods (2007/60/EC), National Emissions Ceilings (2001/81/EC), The Sustainable Use of Pesticides (2009/128/EC);
- Northern Ireland Programme for Government 2011-16;
- Northern Ireland Nitrates Action Programme 2015-2018;
- Strategic Energy Framework for Northern Ireland;
- *Going for Growth* Action Plan
- Executive's Response to *Going for Growth*;
- GHG Action Plan;
- Rural Development Programme 2014-20;
- River Basin Management Plans 2016-2021;
- Agricultural Land Use Strategy;
- Northern Ireland Biodiversity Strategy 2015 ;
- EU Common Fisheries Policy(Regulation 1380/2013);
- UK Marine and Coastal Access Act 2009;
- Charting progress: An integrated Assessment of the State of the UK Seas 2005;
- An Integrated Coastal Zone Management Strategy for Northern Ireland 2006-2026;
- Marine Act (NI) 2013;
- EU Marine Strategy Framework Directive;
- NI Inshore Fisheries: Delivering a Sustainable Future 2014.
- The Forestry Act (Northern Ireland) 2010; and
- NI Forestry - A Strategy for Sustainability and Growth 2006.

7.3 Summary Overview of Evidence and Innovation Research Needs for Sustainable Environment



7.4 Evidence Research Needs: PMB 4 Sustainable Environment

7.4.1 Understanding and Improving the Environmental Footprint of the Agri-food Industry

Recognising that farming is one of the most important land use activities in the economy, we need to continue to find means to enhance the environmental sustainability of existing and future agricultural systems while improving land management and raising productivity.

There is alignment and cross-linkage between PMBs 4, 3 and 1 in relation to pest management and the implications of regulatory changes to pesticides usage on the environment, plant health and crop productivity.

Key research interests in this area are:

- Sustainable production - managing and mitigating the impact of agriculture to ensure sustainable environmental outcomes;
- Assessing outcomes of environmental policies;
- Precision nutrient management leading to resource efficiency and reduced environmental impact;
- Optimising land use and the management of soil nutrients;
- Maximise soil and grass carbon sequestration;
- Managing ammonia emissions;
- Recovery of biological water quality;
- Monitoring changes in biodiversity; and
- Management of pests detrimental to agricultural crops through Integrated Pest Management strategies.

7.4.2 Assessing and Improving the Impact of Environmental Policies, Programmes and Activities

One of the key mechanisms by which DARD can deliver sustainable outcomes is through environmental measures which form a major element of the Rural Development Programme 2014-2020.

Key research interests in this area are:

- An evaluation of the impact of these measures and their further potential will help to ensure that current and future intervention is targeted appropriately to deliver the desired outcomes.
- A better appreciation of the costs of environmental interventions relative to the benefits derived by wider society.

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

Appropriate land management practices are key to the success for sustainable agricultural land management. These practices must highlight and demonstrate to land owners and land managers how to continue to

develop more profitable farms while achieving balanced and enhanced environmental outcomes.

DARD can help support land owners by undertaking a review of the current and future drivers of land-use change which impact on land-use. Examining the likely synergies and trade-offs between the alternative uses of agricultural land, highlighting best practice that optimise agricultural efficiency while achieving balanced and enhanced environmental outcomes will be examined in-depth.

Key research interests in this area are:

- The assessment of the environmental impact, both positive and negative of changing support policies and land use patterns; and
- Support to aid the development of an Agricultural Land Use Strategy.

7.4.4 Sustainable Manure and Nutrient Management

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 implementation of legislation^{1,2,3,4} places requirements on the local farming industry and the way it deals with manures and chemical fertilisers. The Nitrates Directive Action Programme⁵ controls the management of manure and other nutrients (quantum and timing of spread to land) which can be a challenge for intensive livestock holdings. Ongoing evidence is needed to underpin the implementation and evaluation of this Programme in the north.

Significant quantities of livestock feed are imported into the north and means the agriculture sector overall operates with a phosphorus surplus. This impacts on water quality with nutrient enrichment a widespread problem in rivers and lakes. Therefore, more efficient use of phosphorus and a reduced overall surplus is necessary. Reducing ammonia emissions will also be necessary to meet future EU limits.

Key research interests in this area are:

- Reducing the Phosphorus surplus in local agriculture;
- Underpinning the implementation and evaluation of the Northern Ireland Nitrates Action Programme;

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

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

³Integrated Pollution Prevention and Control Directive <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1996L0061:20060224:EN:PDF>

⁴Waste Management Regulations (Northern Ireland) 2006
<http://www.opsi.gov.uk/Sr/sr2006/20060280.htm>

⁵Nitrates Directive Action Programme
http://www.doeni.gov.uk/index/protect_the_environment/water/nitrates.htm

- Assessing the impact of the related EU Nitrates Derogation (permitting higher organic nitrogen applications on certain holdings)¹;
- Minimising phosphorus and nitrogen losses to water from livestock systems; and
- Management and reduction of ammonia emissions.

7.4.5 Assessing and Improving Sustainable Fisheries and Aquaculture

The Common Fisheries Policy Reform requires the conservation of marine biological resources and a fisheries science programme to support the development of a Discard Plan for our main fisheries as well as to inform strategies to help improve the economic and environmental sustainability of the industry. The EU Marine Strategy Framework Directive forms the environmental pillar of the EU Maritime policy. This Directive requires an ecosystem approach to management and the implementation of a programme of measures to achieve “good environmental status” by 2020.

These Directives herald change and future challenges to the local fishing industry. In conjunction with the Strategy for the development of inshore fisheries, which will provide the framework for the future marine science programme, continued development of a robust local evidence base is essential in maintaining the growth of a sustainable local fishing industry and the implementation of current EU legislation.

Key research interests in this area are:

- Managing fish and shellfish and aquaculture sustainability;
- Marine planning to protect and enhance habitats, species and ecosystems to meet national and EU obligations;
- Determining the environmental impact of aquaculture activities
- Understanding the impact of climate change on coastal processes, fish stocks and disease and how management regimes must evolve to ensure sustainability of the sea fishing industry; and
- Understanding of how the marine ecosystem provides services that sustain biodiversity, fisheries and our aquaculture sector.

7.4.6 Delivering Resilient Forests, Crops and Amenity Horticulture in a Changing Climate

Reliable and up-to-date information is needed on the state of forest resources in terms its area and change in area, including parameters such as growing stock, wood and non-wood products, carbon, protected areas, use of forests for recreation and other services, biological diversity and forests’ contribution to national economies is important to support decision-making for policies and programmes in forestry and sustainable development.

Increasing the resilience of woodland ecosystems is a desirable outcome in

¹ http://www.doeni.gov.uk/notification_pursuant.pdf

face of climate change, pest and disease threats.

One of the greatest threats to delivery of a resilient ecosystem is from those importing live plants and plant produce. In delivering resilience in terms of developing a resilient ecosystem we need to consider citizen involvement in service delivery (e.g. growing crops, developing forestry) and receipt of benefit (e.g. buying produce, visiting forests). Therefore the delivery of ecosystem benefit must also be resilient and acceptable to all those who enjoy the benefits.

Key research interests in this area are:

- Development of evidence to support strategic forest planning, growth modelling and forecasting systems;
- Defining the 'resilience' of different types of ecosystem which may have multiple functions (industry, citizen) and therefore different types of risk that will vary spatially /temporally;
- Understanding the integration between agriculture, forestry and the wider environment to contribute to halting the loss of biodiversity, control invasives and maintain plant health;
- Maintaining ecosystem services and biodiversity whilst understanding what affects the achievement of resilience;
- Assessing the risk and understanding the factors which influence adoption of measures to increase resilience and support adaptive management approaches.
- Understanding how we design, cultivate and manage adaptive, resilient cropping systems /woodlands; and
- Increasing focus on protecting existing crops/woodland and better management of undermanaged cropping systems or woodlands.
- Understanding the implications of managing forests on deep peats.

7.5 Innovation Research Needs: PMB 4 Sustainable Environment

7.5.1 Novel and Innovative Approaches to Manure and Nutrient Management

New knowledge and technological innovation can contribute to more efficient and sustainable nutrient management. Rapid diagnostic tools are available to assess accurately the nutritive value of feeds and fertilisers. Advances in genetics, including genomic technologies, have the potential to progress the selection of plants and animals with improved nutrient efficiency. Additives to stabilise chemical fertilisers provide an opportunity to reduce ammonia emissions. These novel approaches can help to reduce the environmental impact of agriculture, contribute to the wider public good and improve efficiency on farm.

Key research interests in this area are:

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- Development of technologies to facilitate precision nutrient management in crops and animals;
- Development of a better understanding of technologies for ammonia abatement; and
- Development of new methods, including use of genetic selection, to increase nutrient utilisation in crops and animals.

8. Cross-Cutting Research

Although our research interests have been set out under DARD's four key Strategic Goals there are examples of research that cut across the evidence and innovation research needs from more than one Programme Management Board e.g. knowledge and skills; sustainable forestry; sustainable fisheries and aquaculture; socio-economic research, with each Programme Management Board addressing different aspects.

Responding to climate change – adaptation and mitigation cuts across the evidence and innovation research needs of all Programme Management Boards. Therefore for the purposes of this Strategy, this has been classified separately as a Cross-Cutting Research Strand which will be addressed through cross-PMB commissioning of research.

8.1 Evidence Research Needs Cross-cutting all PMBs

8.1.1 Responding to Climate Change: Adaptation and Mitigation

Climate change has been identified as one of the biggest challenges we face today with a number of EU legislative and policy initiatives^{1,2,3} to address this issue. In addition the UK Climate Change Act requires an 80% reduction in Green House Gas emissions by 2050. In the local context the Executive's current Programme for Government target is to achieve a 35% reduction in greenhouse gas emissions by 2025 based on 1990 levels.

It is estimated that agriculture accounts for 30% of GHG emissions in the north, with the major components being, 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 intensity from agriculture, information is needed on the relative cost

¹The EU Climate and Energy Package

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

² UK Climate Change Act

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

³ UK Committee on Climate Change report <http://www.theccc.org.uk/reports/>

effectiveness of these methods and potential implications of their adoption on the local industries.

The Climate Change Risk Assessment for Northern Ireland was produced as part of the UK Climate Change Risk Assessment (CCRA). This report presents a national assessment of potential risks (and opportunities) from climate change facing the north for the period to 2100. Its findings inform the development of adaptation work in the north. The results of the assessment are presented in five themes:

- Natural environment;
- Agriculture and forestry;
- Business;
- Buildings and Infrastructure; and
- Health and Wellbeing.

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 in this area are:

- Developing the evidence base on GHG emissions from agri-food, fisheries and forestry in the north;
- Assessing the potential impact of EU, UK and local 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.

9. Delivering the Evidence and Innovation Strategy

9.1 Evidence and Innovation Research Delivery

Following on from the Evidence and Innovation Strategy 2009-13, focus will be given to how we can continue to improve on the delivery of evidence and innovation research in an environment of increasing financial constraint where we seek to retain an affordable, balanced collective research investment across all Programme Management Boards.

Particular attention will be given to ways to enhance the existing portfolio-led approach (Section 9.3) in a way which will allow longer-term needs to be addressed strategically through a longer-term programme approach of commissioning, where this is appropriate. This will complement the project-based approach which will remain the most effective mechanism in certain areas, particularly where emerging and pressing needs for new evidence arises.

Naturally there will continue be linkages across the Programme Management Boards requirement for evidence and innovation research. The perspective of each Programme Management Board's portfolio of research will be directed by an overarching policy framework and specific policy objectives.

9.2 The Evidence and Innovation Research Commissioning Cycle

Figure 5 provides an overview of the evidence and innovation research commissioning cycle:

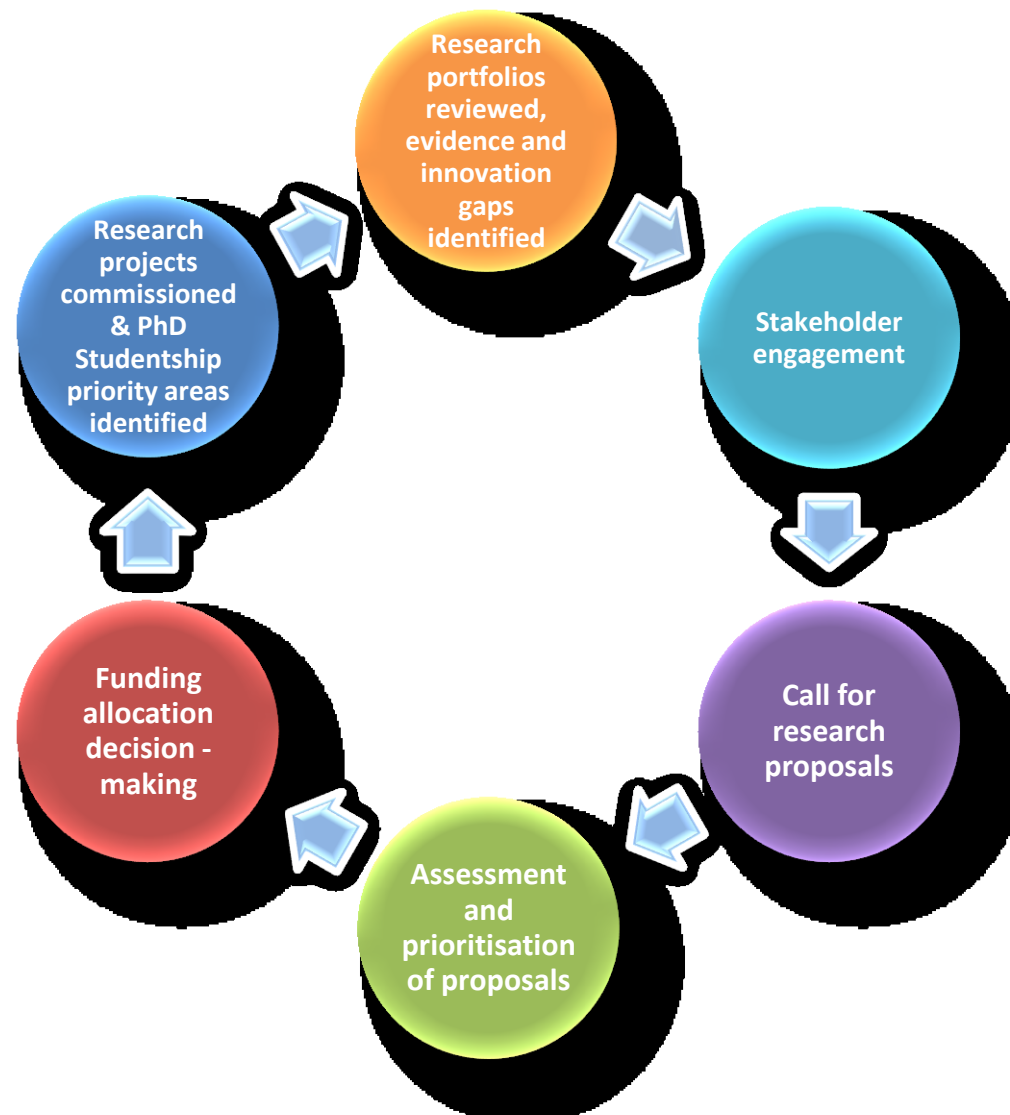


Figure 5: DARD annual evidence and innovation research commissioning cycle

9.3 Identification of Evidence and Innovation Priorities

Evidence and innovation research needs will be identified by DARD informed by both informal and formal engagement with stakeholders with a particular focus on close engagement with the Agri-Food Strategy Board regarding research needs around innovation. On an annual basis Programme Management Boards will review their existing research portfolio in conjunction with the strategic evidence and innovation research needs (outlined in Sections 4-8) and together with their stakeholders, establish the priority evidence and innovation gaps that should be filled by the commissioning of new research through the DARD-directed AFBI Evidence and Innovation programme and the DARD Postgraduate Studentship Scheme. This will also provide the framework for establishing priorities within collaborative research initiatives established with other public funders of research in other regions and countries.

We will seek to ensure that all sectors are given the same opportunity to feed into the priority evidence and innovation identification process. However given the finite budget available to DARD for research not all evidence and innovation needs will be addressed annually. Programme Management Boards will seek to prioritise research needs based on a number of criteria¹. This process will ensure the development of an evidence and innovation programme that is appropriately aligned to policy needs, provides a robust evidence base for future policy development, implementation and review and supports industry innovation within the scope of DARD's policy interests.

9.3.1 Stakeholder Engagement

Stakeholder engagement will include correspondence and face-to-face meetings with industry and organisational groups to discuss priorities in addition to an annual Evidence and Innovation Stakeholder Forum which will provide an opportunity for stakeholders to comment on gaps and priorities identified by the Programme Management Boards.

This will ensure that DARD has a clear understanding of the priorities of industry and the challenges being faced so that the research budget can be tailored, in as far as it is possible, to provide maximum support to underpin the sustainability of each sector.

Over the duration of this bridging strategy and the publication of a new DAERA Evidence and Innovation Strategy we will seek to identify further opportunities to increase the involvement of, and communication to, industry groups and stakeholders during the evidence and innovation gap identification

¹ Criteria for research gap prioritisation

- Policy need;
- Strategic importance to the sector;
- Existence of research outcomes elsewhere that can address the need; and
- Availability of co-funding from other parties

and research commissioning processes. We will ensure that relevant up-to-date information on the research commissioning process is available to stakeholders on the DARD web-site.

9.4 Delivering Evidence and Innovation Research

The Agri-Food and Biosciences Institute (AFBI) was created by DARD in 2006, with the prime purpose of operating as our principal science provider and under the founding legislation, there is a statutory requirement for AFBI to have an annually agreed work programme for DARD which includes both research and statutory, diagnostic and analytical services.

It is recognised that not all evidence and innovation research needs can be met by AFBI, and there will be instances where the relevant expertise required to deliver such needs is found within other research institutes. Equally we recognise that there are other research providers with the expertise to deliver parts of DARD's evidence and innovation needs and that support is needed for the wider agri-food research base.

Over the duration of this Strategy we will explore the feasibility of developing systems to support and expand the funding of collaborative research projects exploiting expertise available within all local research institutes. We will ensure that any contract commissioning procedures introduced will enhance the reputation for excellence and relevance in rural, agricultural and environmental research and will be robust, transparent and comply with best practice in public procurement.

9.5 Governance of Research Portfolios

Before funding research we will ensure that all research proposals are:

- Policy relevant and will provide outcomes in a timeframe appropriate to policy needs;
- Assessed as Value for Money;
- Of sufficient scientific quality; and
- Have adequate knowledge exchange/technology transfer mechanisms in place.

We have existing appropriate systems in place for the monitoring of progress on all commissioned research ensuring that all research commissioned remains cost effective and delivers on objectives.

9.6 Funding of Commissioned Research and Private Sector Contributions

The consensus emerging from extensive stakeholder engagement during the consultation exercises held for the Evidence and Innovation Strategy 2009-13 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 will therefore continue 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 will generally fall within the innovation research needs identified in Section 4-8 particularly under Goal 1: *To help the agri-food industry prepare for future market opportunities and economic challenges.*

Where industry do contribute to funding research within DARD's strategic areas of interest, there will be a significant level of collaboration in setting the direction of research (within the context of this Strategy) to meet precise industry needs.

We will also continue to deliver the DARD Research Challenge Fund (Section 2.4.2) which aims to encourage local industry and public sector research establishments to collaborate on innovative, high quality, pre-commercial research and technological development projects.

In tandem with the Research Challenge Fund, we will explore mechanisms for signposting agri-food and rural enterprises to the opportunities presented by InvestNI innovation support schemes¹, EU funding programmes² and UK innovation strategies such as the ***UK Agricultural Technologies Strategy***³.

9.7 Funding Research that Falls Outside of the Annual Commissioning Cycle

It is important that all DARD funded evidence and innovation research is governed by a transparent standardised process. However there will be instances when commissioning of evidence research may be deemed necessary at times, or on time scales, which do not align with the DARD annual evidence and innovation commissioning process e.g. urgent research. Under these circumstances separate supplementary commissioning arrangements will be employed.

We will continue to fund long-term strategic research programmes which collect baseline data or underpin key scientific assets and resources that provide benefit to the local agri-food sector as a whole.

¹ <http://www.investni.com/support-for-business/funding-for-business/funding-for-innovation-and-research-and-development.html>

² <http://ec.europa.eu/programmes/horizon2020>

³ <https://www.gov.uk/government/publications/uk-agricultural-technologies-strategy>

9.8 Increased Collaboration

Discussions with other government departments and funders, as well as the examination of other local, national and international research strategies, emphasise the potential for collaboration across a number of areas of mutual interest.

We will deliver this strategy through the commissioning of policy and industry relevant research and through increased effective collaboration with others including the Department of Agriculture, Food and Marine, Dublin, National Institute of Food and Agriculture, US Department of Agriculture and UK Research Councils. We will identify further opportunities for commissioning research that exhorts maximum support for the industry while extracting maximum benefit from the funding at DARD's disposal. This focus on collaborative research options with other regions and countries is looking to effectively expand the research capacity that is available to DARD and the local industry across its priority areas.

9.8.1 Local Opportunities

On a local basis, we will continue to work with the Department for Employment and Learning (Department for the Economy post May 2016) on education issues, with the Department of Social Development (Department for Communities post May 2016) on rural needs, with the Department of Culture, Arts and Leisure (DAERA post May 2016) on inland fisheries, with the Department of the Environment (DAERA post May 2016) on biodiversity, climate change adaptation and waste management, and with the Department of Enterprise, Trade and Investment (Department for the Economy post May 2016) and InvestNI on stimulating innovation.

We will continue to engage with InvestNI in relation to the Agri-Food Quest Competence Centre which is an industry-led collaborative research centre whose aim is to increase the competitiveness of local agri-food businesses through an industry defined research agenda that leads to market led research delivered by academia and local research institutes.

We will maintain engagement with other agricultural research funders funding local research (for example AgriSearch, Pig Regen, Pig Research Consortium, Home Grown Cereals Authority; Livestock and Meat Commission; NI Fruit Growers Association; Food Standards Agency) exploring the scope for joint planning and co-funding of new research to extract greatest advantage from the funding at DARD's disposal and to ensure that the research we fund meets the needs of our local industry.

9.8.2 All-Island-basis Opportunities

Given the similarity in climatic and soil conditions within the island of Ireland, DARD is committed to enhancing the arrangements for animal and plant health on an all-Island basis by working with the Department of Agriculture,

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Food and the Marine. 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 the **All-island Animal Health & Welfare Strategy**¹ and Surveillance Strategy² in addition to the **All Ireland Chalara Control Strategy**³ are vehicles to ensure effective, ongoing cooperation across the island of Ireland for mutual benefit.

9.8.3 National, International Opportunities

We will engage with external partners and build on existing co-ordination mechanisms and groups (government and industry) in order to improve the identification of evidence and innovation research needs that will deliver policy and industry requirements while delivering high quality evidence with maximum value.

Nationally and internationally, through DARD membership of a variety of research networks and funders' fora, such as the UK Animal Diseases Research Funders' Forum, The UK Plant Health Strategic Evidence Group and the UK Animal and Plant Health Science Partnership⁴, opportunities will be identified for co-ownership, co-design and co-funding of research and the sharing of research findings for mutual benefit.

We will continue to engage in the European arena through appropriate mechanisms such as: liaising with representatives on the European Commission Standing Committee on Agricultural Research (SCAR); and the DARD-funded Northern Ireland Contact Point for Horizon who facilitates local agri-food industry access to EU research and development funding now available under Horizon 2020 and ERA-NET Co-fund mechanisms. This assists in facilitating the delivery of the Executive's 20% target for increased drawdown of competitive European funds outlined in the Programme for Government 2011-15. Furthermore, the new NI Horizon 2020 Strategy, agreed by the Northern Ireland Executive Sub Committee on the Economy, sets out the key actions required to deliver the Executive's target of €145m.

Additionally we will pursue the European Innovation Partnership (EIP) goal of fostering a competitive and sustainable agriculture and forestry that "achieves more from less" and works in harmony with the environment, achieved by bridging the gap between farming practice and science. The EIP will focus on forming partnerships - using bottom-up approaches where farmers, advisors, researchers, businesses, and other actors work together. We will examine the scope for the joint planning and development of agri-food sector relevant

¹ <http://www.northernireland.gov.uk/news-dard-310310-all-island-animal>

² The Surveillance strategy is yet to be published but its precursor was the All-Island surveillance reports. See: http://www.afbini.gov.uk/all-island_animal_disease_surveillance_report_2011reduced.pdf

³ <http://www.agriculture.gov.ie/media/migration/forestry/ashdiebackchalara/AllIrelandChalaraControlStrategyJuly13.pdf>

⁴ <https://www.gov.uk/government/publications/animal-and-plant-health-in-the-uk-building-our-science-capability>

Operational Groups which capture ideas from these interested actors and set up industry-relevant innovation projects. These Operational Groups will link with other groups through an EIP network under rural development and will provide a link into Horizon 2020 research consortia on specific topics.

9.9 Knowledge and Technology Transfer

Knowledge exchange is about facilitating the dissemination, exchange and access to quality information from research across all sectors in order to support economic development¹. There is clearly a need to invest in knowledge transfer and exchange measures to ensure that knowledge exchange forms an integral part of any research activity and is considered in both the design and implementation phases of research. Findings from research, evidence or innovation, must also be translated into useful, easy-to-understand and easy-to-apply knowledge for the end-users, namely policy makers, farmers, agri-food industries, and rural communities.

The College of Agriculture, Food and Rural Enterprise (CAFRE) is responsible for the competence development of those working in the agri-food industry, achieved through a number of programmes including knowledge and technology transfer, there is however scope for additional knowledge and technology transfer particularly in subject areas that fall outside of CAFRE's immediate remit.

Therefore a sizeable proportion of our efforts must be directed towards achieving effective knowledge and technology transfer, or at least in facilitating such activity. To this end we will ensure that all DARD research programmes continue to have a clearly identified knowledge and technology transfer delivery plan at the outset 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.

We will strengthen the connections between DARD staff involved in policy development and the broader research community through continuation of the ***DARD Research Discussion Forum***² which aims to encourage and increase interaction between research providers, policy makers and service delivery.

We will develop appropriate methods to ensure that the end users of research outcomes from DARD evidence and innovation research are kept informed of the progress and the final outcomes and outputs from our research portfolios. Given the importance of this delivery of effective knowledge and technology transfer to DARD, its stakeholders and the public we will launch a ***DARD Knowledge Hub*** which will provide up-to-date information on all the research

¹ http://www.detini.gov.uk/innovation-strategy-2014-2025_2.pdf

² http://dardnet/index/central-policy-group/science-evidence-and-innovation-policy/research_discussion_forum.htm

we fund and will provide links to the scientific outputs published during completion of the research.

10. Review and Evaluation

The Evidence and Innovation Strategy 2015-17 is a bridging document providing the framework for funding DARD policy-relevant and industry-relevant research and innovation during the period prior to the establishment of DAERA and for a period of 1 year following the establishment and bedding-in of the new Department. It will be replaced by a new Evidence and Innovation Strategy to be published in 2018.

Listed in Annex A, are a number of targets featured in this Strategy. These will be used to measure progress on the Strategy. Annex A also presents the outcomes that will be achieved through the implementation of this Strategy and how these outcomes will be measured.

ANNEX A

Key Targets and Indicators

By March 2016 we will:-

- seek to identify further opportunities for industry groups and stakeholders to become more involved in the processes surrounding the commissioning and review of evidence and innovation research.
- launch a DARD Knowledge Hub which will provide up-to-date information on all the research we fund.

The outcomes we want to achieve

1. The policy developed by DARD is more robust due to it being evidence based.
2. The outcomes of DARD funded research are considered by all stakeholders in the agri-food sector and the wider rural community in management decision-making and in doing so assist the sector achieve the key targets within the AFSB's Going for Growth report.
3. Knowledge gained through DARD funded research is readily available to all stakeholders in the agri-food sector and wider rural community.
4. NI farmers are better equipped to be more profitable, efficient, sustainable as a result of the research funded by DARD.

Measuring progress against achievement of outcomes

- Number of policies where evidence from DARD-funded research projects has been used.
- Number of hits on the DARD Knowledge Hub (when developed)
- Number of knowledge exchange opportunities to farmers, based on DARD-funded research, presented by AFBI; other co-funding groups such as Agrisearch, Pig Regen, Pig Research Consortium, Ulster Arable Society; NI Fruit growers Association, Home Grown Cereals Authority.

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