

KET's in Agri-Food Northern Ireland perspective



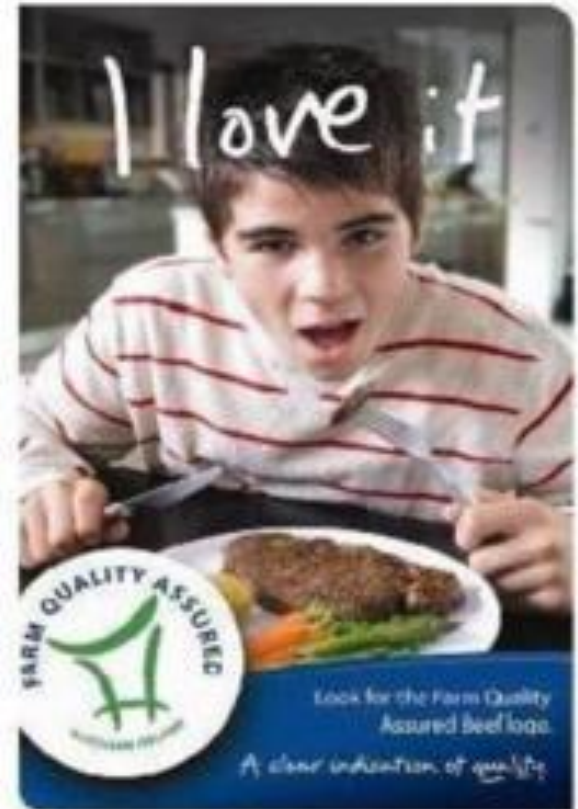
Michael Lilley BSc MBA

Smart Specialisation Coordinator

Department of Enterprise, Trade & Investment

11th April 2013

Unique Selling point



Long Term Focus on quality niche areas



**Medium Term
Development**



Cost reduction

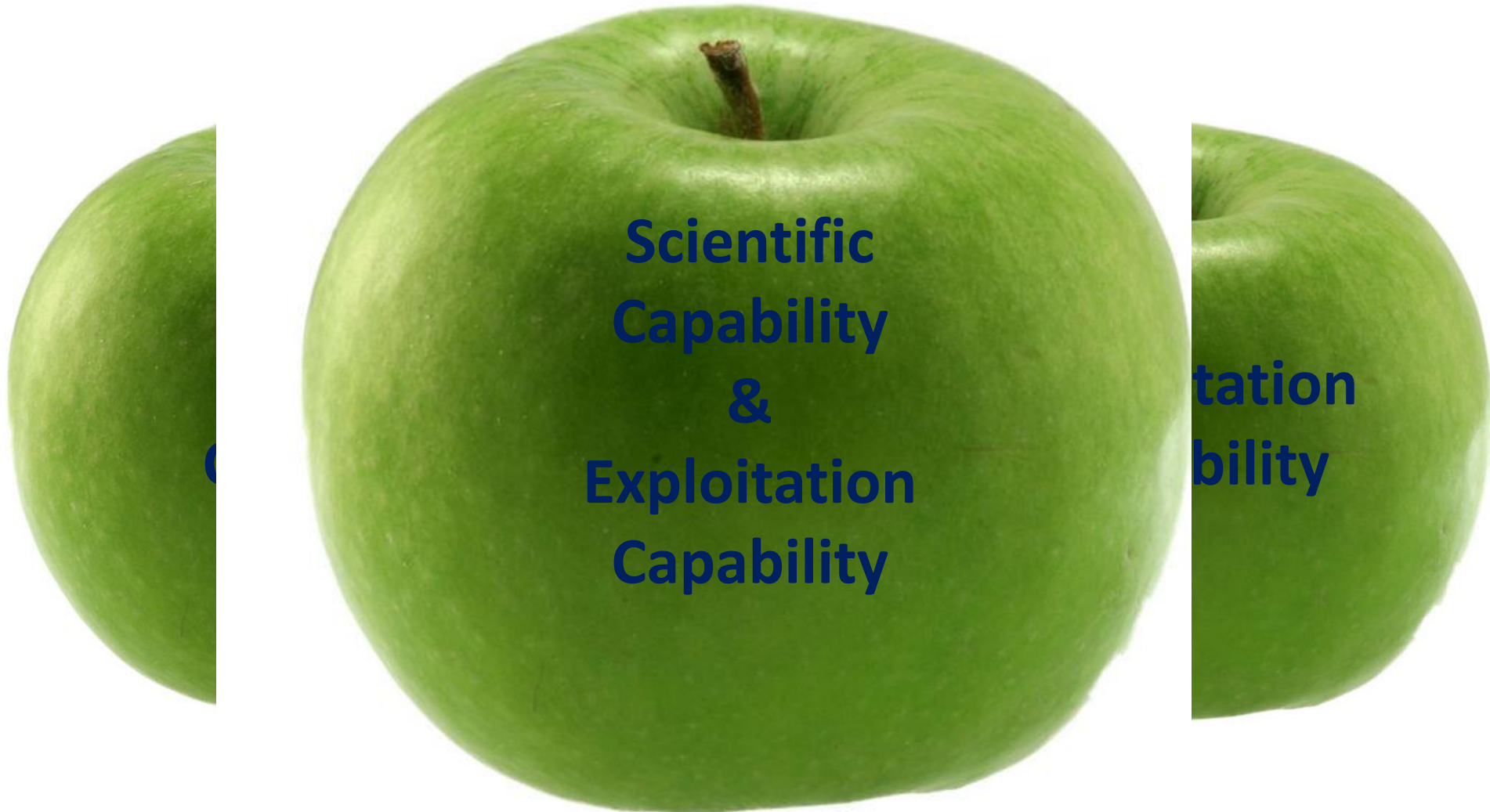


**Medium/ Long Term
development**



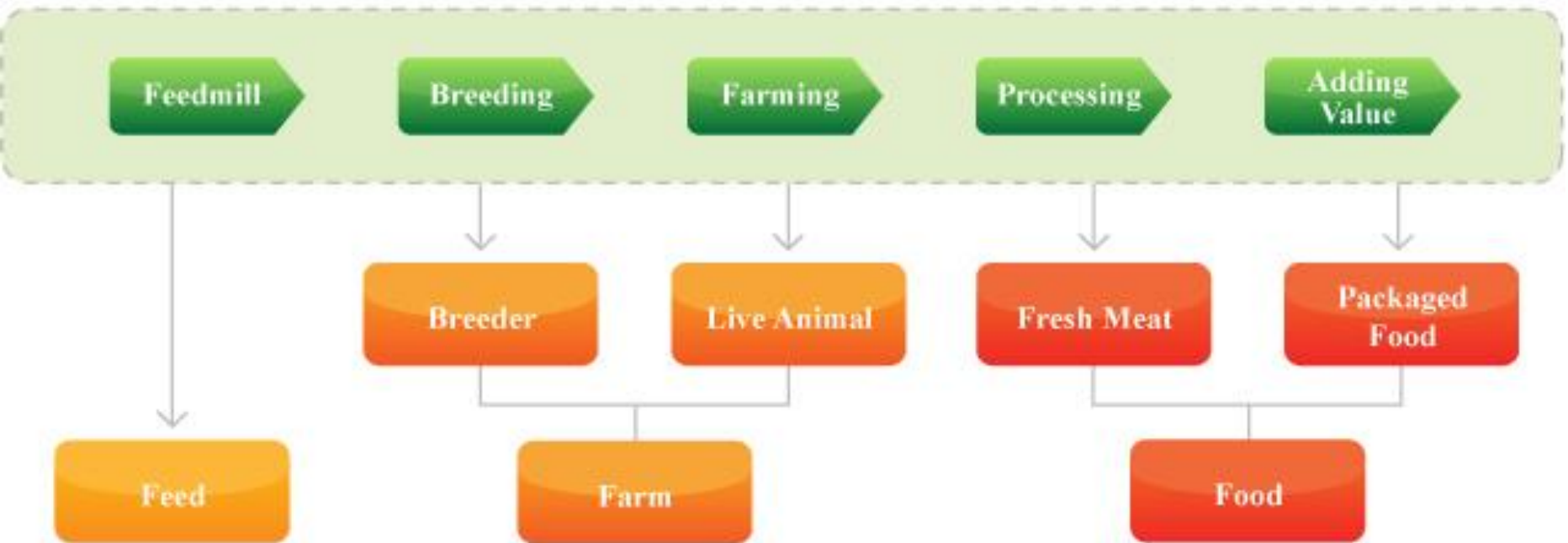
**Quality and niche
areas**

Need for Integration



Need for Integration

Vertical Integrated Agri-Food Business



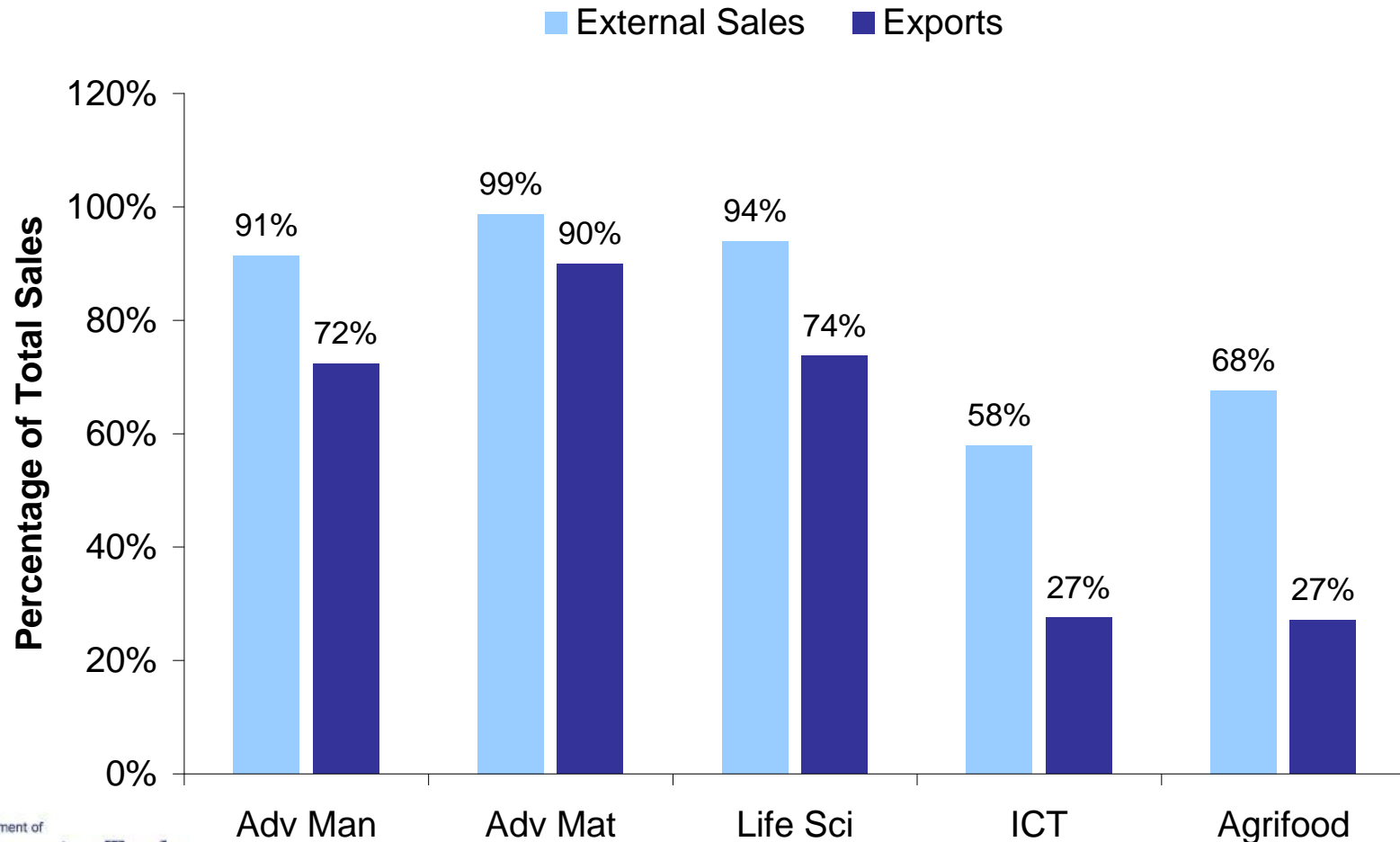
Presentation Structure

- Agri-food Context
- Issues
- Opportunities
- Vision
- Key Enabling Technology Mapping (MATRIX)
- KET mapping recommendations
- Focus areas & Leadership areas
- World class research
- Conclusions
- Sources

Agri-Food Context

- £4 billion turnover in 2011
- 20% of total NI manufacturing sales
- Employs 50,000 people
- 18,000 in food processing
- Continued growth
- Potential of 15,000 new jobs by 2020
- Multiplier effect within NI economy

Agri-Food Context



Agri-Food Context

Table 2: Agriculture: general data, 2011

	NI	Scot	Wales	Eng	UK	ROI	EU27
Share of total GVA (%)	1.6	0.7 ¹	0.5 ¹	0.5 ¹	0.6 ¹	2.5 ¹	1.7 ¹
No. employed in agriculture forestry & fishing ('000)	25	41	35	271	371	80 ³	N/A
Share of employment (%)	3.1	1.6	2.6	1.1	1.3	4.5 ³	N/A
Number of farms ('000)	24	53	41	105 ⁴	223	140 ¹	13,449 ²
Average farm size (Ha)	41	118	37	85	77	33 ¹	13 ²
LFA (% Agricultural area)	70	86	80	17	48	75 ²	N/A

1. 2010, 2. 2007

3. CSO Quarterly National Household Survey, 4th quarter, 2011

4. Relates to commercial holdings only as defined by EU regulation.

Due to National Accounting principles, GVA figures do not include Single Farm Payment

Source for UK employment data (SIC 2007, main job) - Labour force survey (Quarter 1, 2012)

Agri-Food Context

Table 4: Agri - food sector GVA and employment, 2011

	NI		UK	
Gross value added ¹	£m	% of GVA	£m	% of GVA
Agriculture	437	1.6	8,845	0.6
Food and drink processing	686 ²	2.4 ²	21,158 ³	1.7 ³
Employment	'000 persons	% of total employment	'000 persons	% of total employment
Agriculture, forestry and fishing	25 ⁴	3.1 ⁴	371 ⁵	1.3 ⁵
Food and drink processing ⁶	27 ⁴	3.4 ⁴	388 ⁵	1.3 ⁵

1. GVA figures are at basic prices

2. DARD Size and Performance of the NI Food and Drinks Processing Sector, Subsector Statistics, 2010 Provisional estimate. (This includes an estimate of the value added of those food and drinks processing businesses with a turnover of less than £250,000.)

3. UK 2009 figures

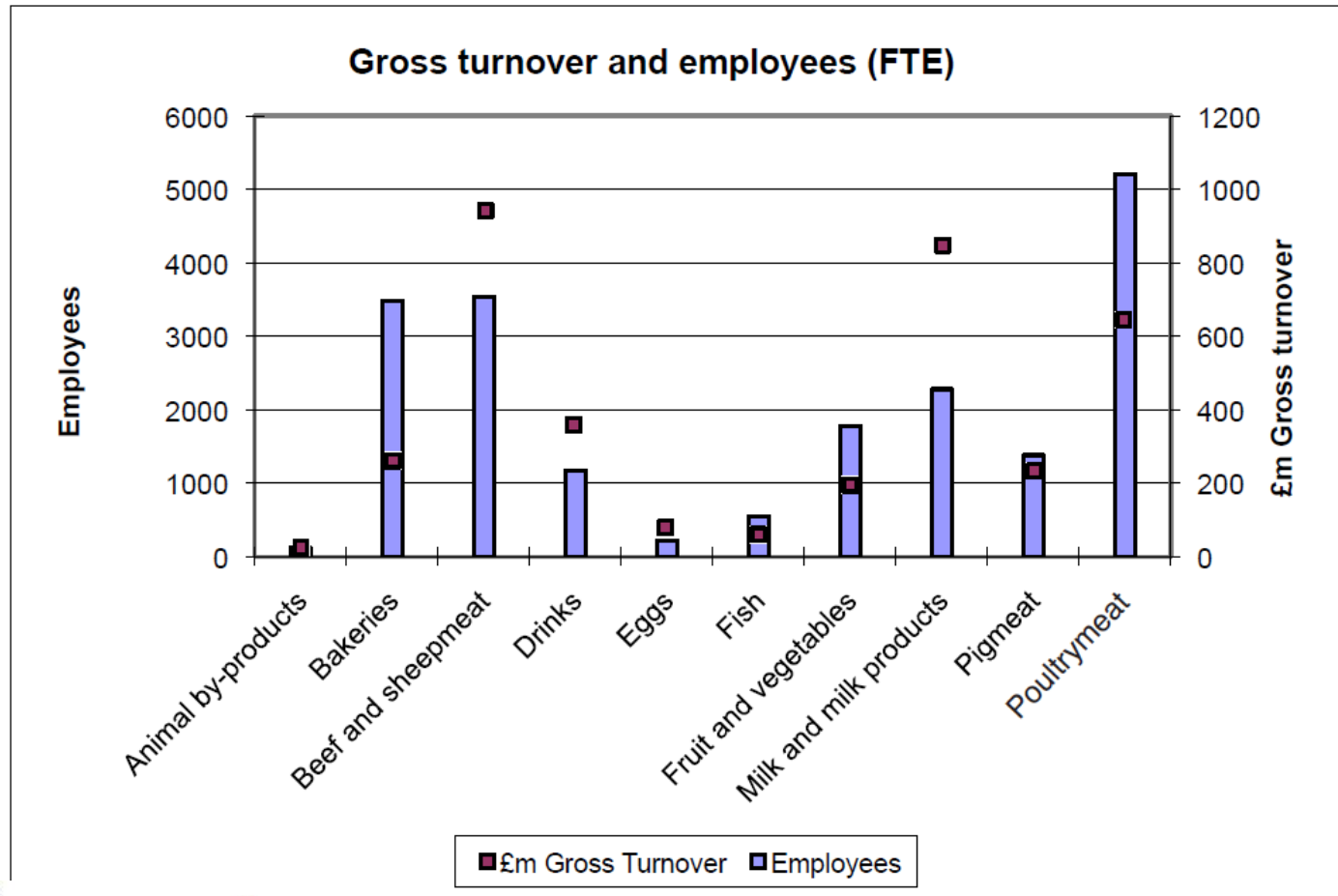
4. % of total LFS employment (802,000 in NI at Q1, 2012)

5. % of total LFS employment (29,147,000 in UK at Q1 2012).

6. Includes SIC 2007 10.11 - 11.07

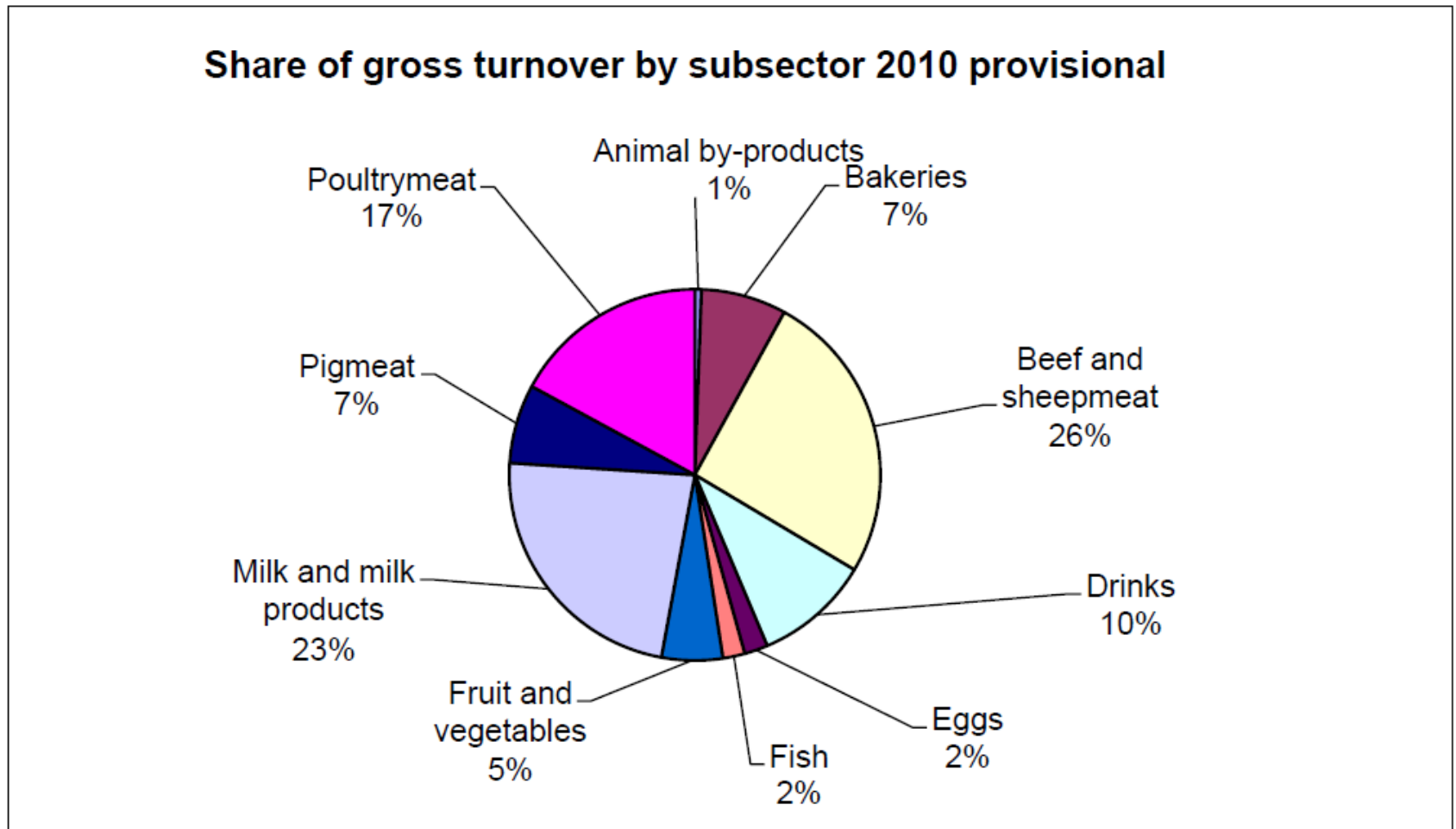
Agri-Food Context

Figure 3 - Gross turnover and full time equivalent (FTE) workforce by food processing subsector, NI (Provisional 2010)



Agri-Food Context

Figure 4 - Proportion of gross turnover by subsector, NI (Provisional 2010)



Agri-Food Issues

- Maintain Quality
- Innovation through value chain
- Access to information
- Supply chain efficiencies- cost savings
- Excellent Innovation and R&D

Agri-Food Issues



- Food security and bio-based economy
- Climate Change and resource efficiency, including raw materials
- Secure, clean and efficient energy

Opportunity

- 31% innovation active (33% Uk)
- Some world class highly commended research in Global food Security (Traceability & contamination)
- World class producers and processors
- Opportunity to be world class in quality
- Opportunity to integrate value chains
- Opportunity to integrate science and exploitation capability

Vision

- By 2020:-

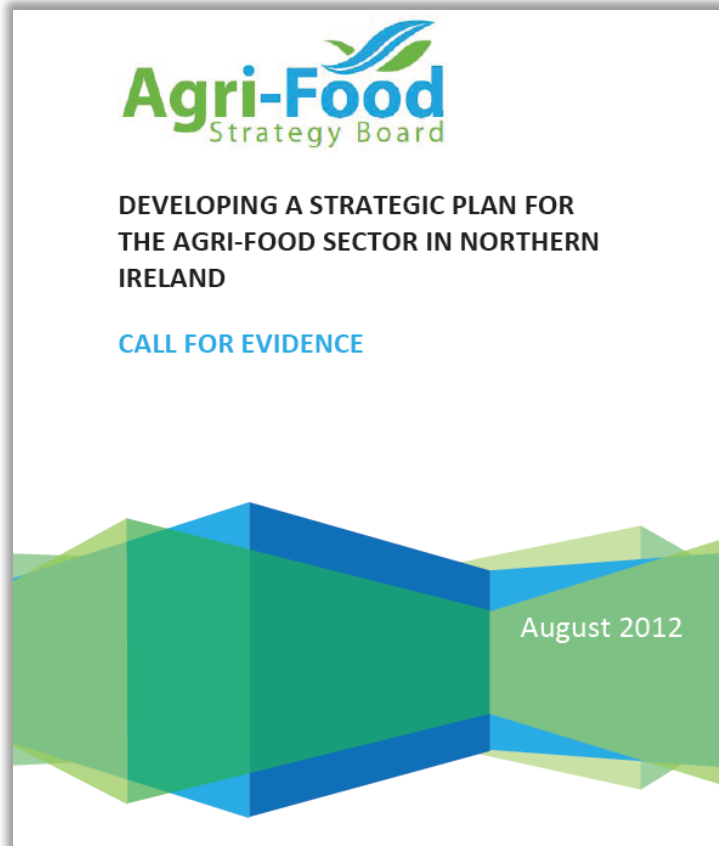
- Large scale export of dairy to Asia
- Large scale exports of meat to Africa
- Exports to Russia and Baltics

- Accessing quality information
- resources to interpret information

- Increased Innovation and R&D- consumer led

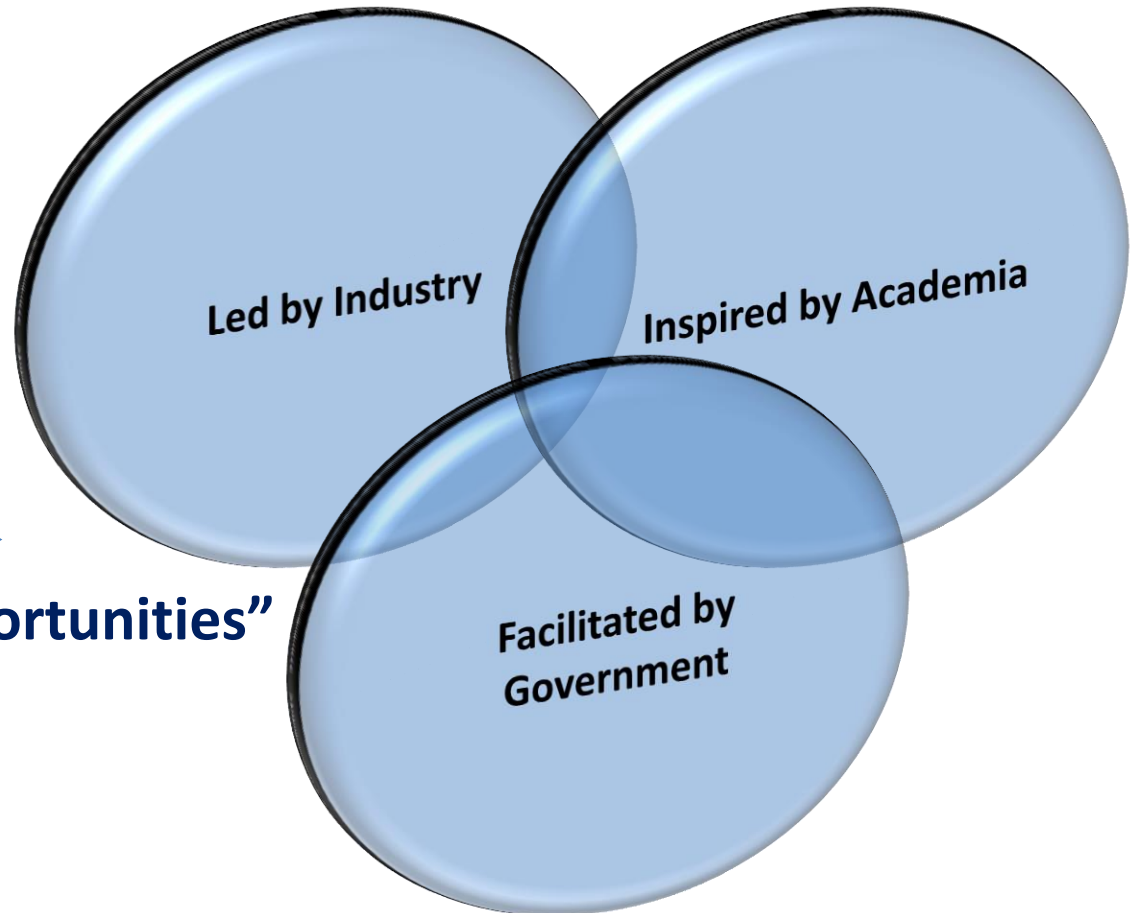
Vision

Agri-Food strategy board 2012



- 9 Industry representatives
- 4 Government representatives
- Call for evidence 2012
- Innovation and R&D top priority

Key Enabling Technology mapping



“Cross sectoral market opportunities”

Key Enabling Technology mapping

The logo for MATRIX, featuring the word "MATRIX" in white capital letters on a blue background that is shaped like a parallelogram.

NORTHERN
IRELAND
SCIENCE
INDUSTRY
PANEL

- 13 members (9 from industry)
- Focus on strategic markets not sectors
- ‘Now sight’ then Foresight
- Involving 100 companies
- R&D and science and technology issues
- Emerging relevant technology priorities
- Promotion of innovation, R&D, and creativity
- Promotion of Collaboration
- Overcome the perceived disadvantage of SME dominated economy
- Reports build on regional strengths and skills capabilities

Key Enabling Technology mapping



Key Enabling Technology mapping

Northern Ireland Strategic Markets MATRIX Foresight

	Advanced Manufacturing	Advanced Materials	Sustainable Production & Consumption	Life & Health Sciences	ICT	Electronics & Photonics	Agri-Food	Sustainable Energy
ICT	✓	✓	✓	✓	✓	✓	✓	✓
Micro-nanoelectronics	✓	✓	✓	✓	✓	✓	✓	✓
Photonics	✓	✓	✓	✓	✓	✓	✓	✓
nanotechnology	✓	✓	✓	✓	✓	✓	✓	✓
Industrial biotechnology	✓	✓	✓	✓	✓	✓	✓	✓
Advanced Materials	✓	✓	✓	✓	✓	✓	✓	✓
Advanced Manufacturing	✓	✓	✓	✓	✓	✓	✓	✓

KET's

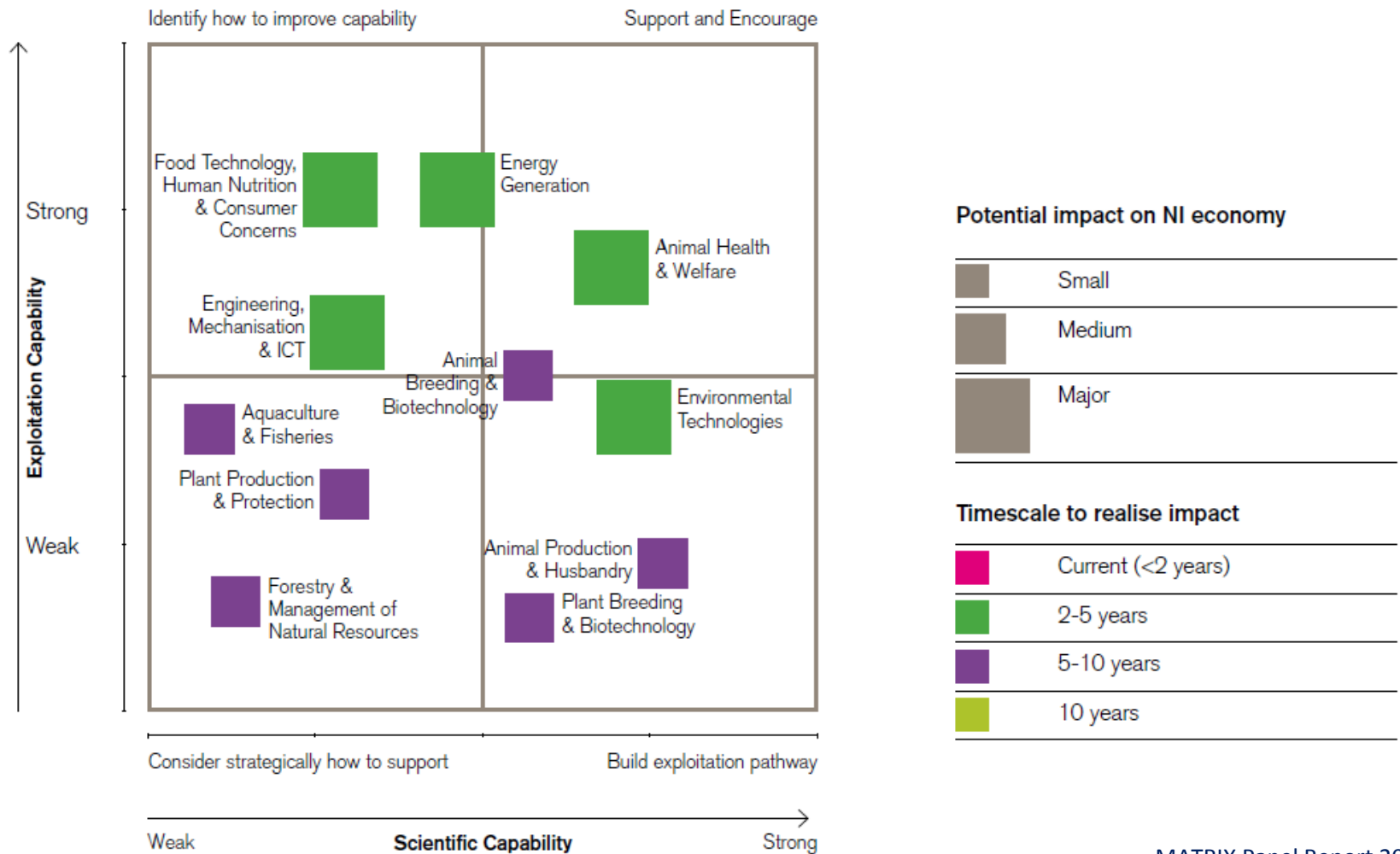
Key Enabling Technology mapping

Technology Capability Study – 2006- Business Identified Priorities

- **Strategic Markets** (Cross Sectoral)
- **Key trends**
 - Higher education numbers, Private Sector Capability analysis, Public sector capability analysis, Academic sector analysis
- **Benchmarking**
 - Regional, Technological Scoring, environment, Technology Readiness levels, Technological Infrastructure
- **Framework Conditions**
 - Degree of Clustering, Business environment, markets, collaborations, skills & training, Funding, Government support, FDI sectors, Technology transfer
- **Conclusions**
 - Northern Ireland Technology Capability, Technology Capacity, Priorities for Northern Ireland

Sustainable Production & Consumption Capability in Northern Ireland

FIGURE A: SUSTAINABLE PRODUCTION AND CONSUMPTION⁴ CAPABILITY IN NORTHERN IRELAND.

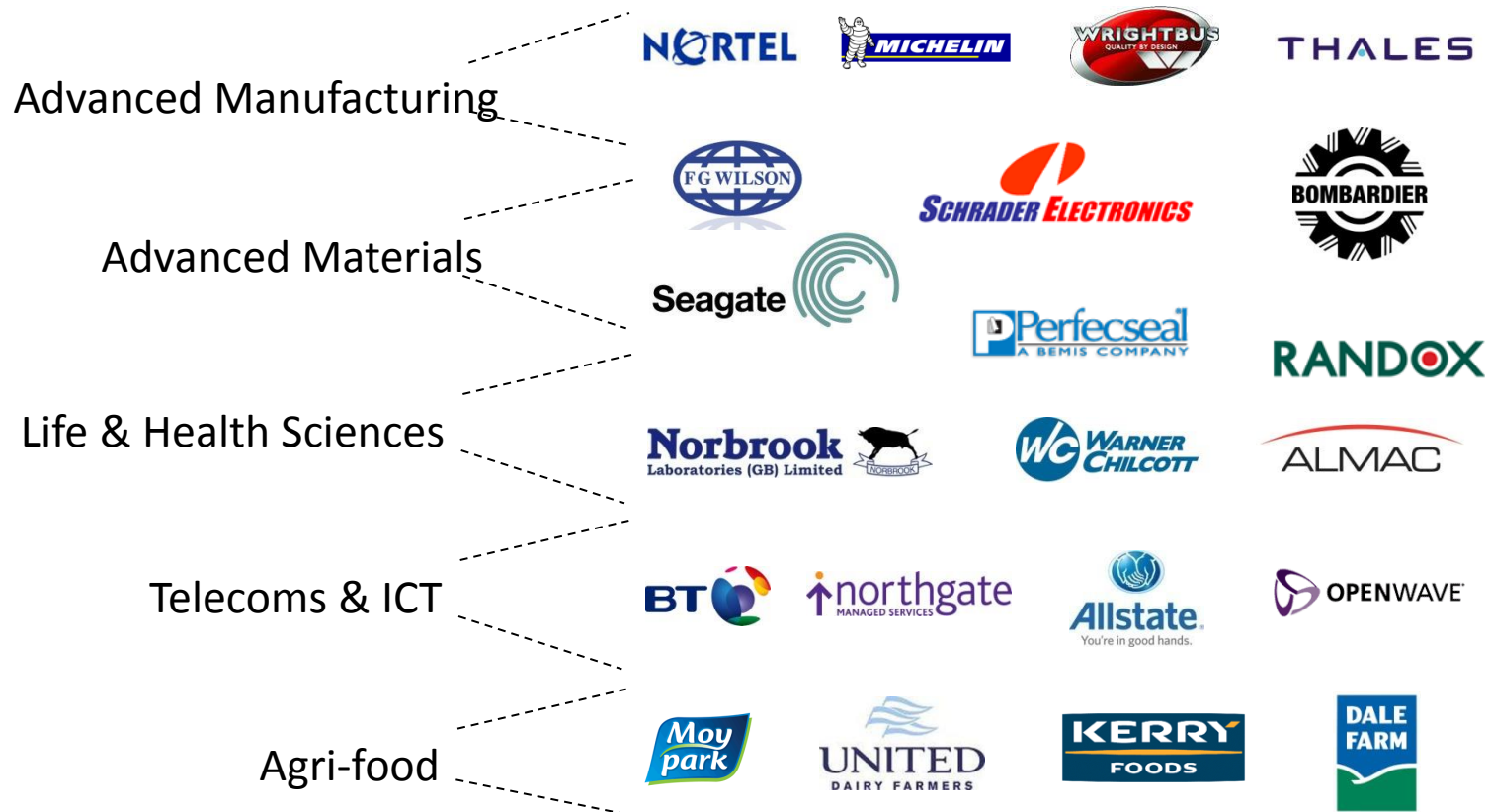


Key Enabling Technology mapping

Overview of Strategic Markets

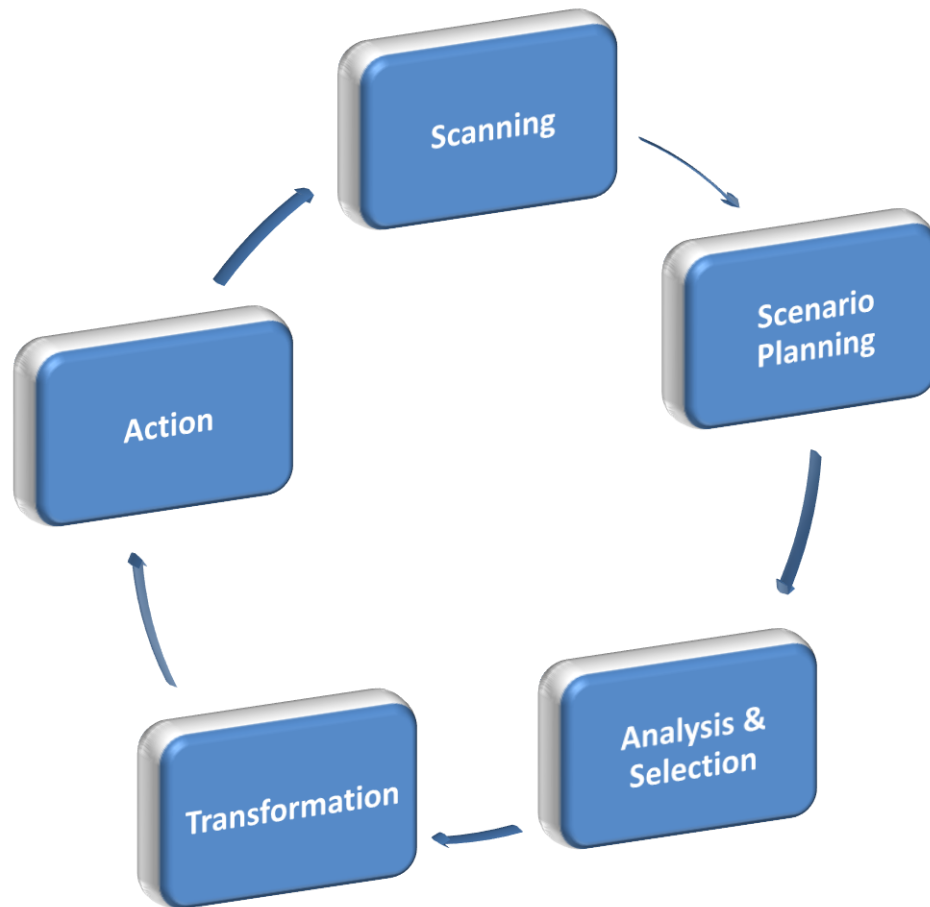
MATRIX Sectors	SIC 07 Sectors	Key Sectors
Advanced Engineering	7	Engineering Electronics
Advanced Materials	7	Rubber and Plastics Scientific R&D
Life Sciences	4	Pharmaceuticals Technical Testing
ICT	4	Computer Programming Telecommunications
Agri-food	2	Food Products Chemicals

Key Enabling Technology mapping



Key Enabling Technology mapping

Foresight



System Scanning

Creates shared understanding of issues

Scenario Planning

Conceptual modelling of market opportunity scenarios

Analysis & Selection

Prioritisation through negotiations among stakeholders

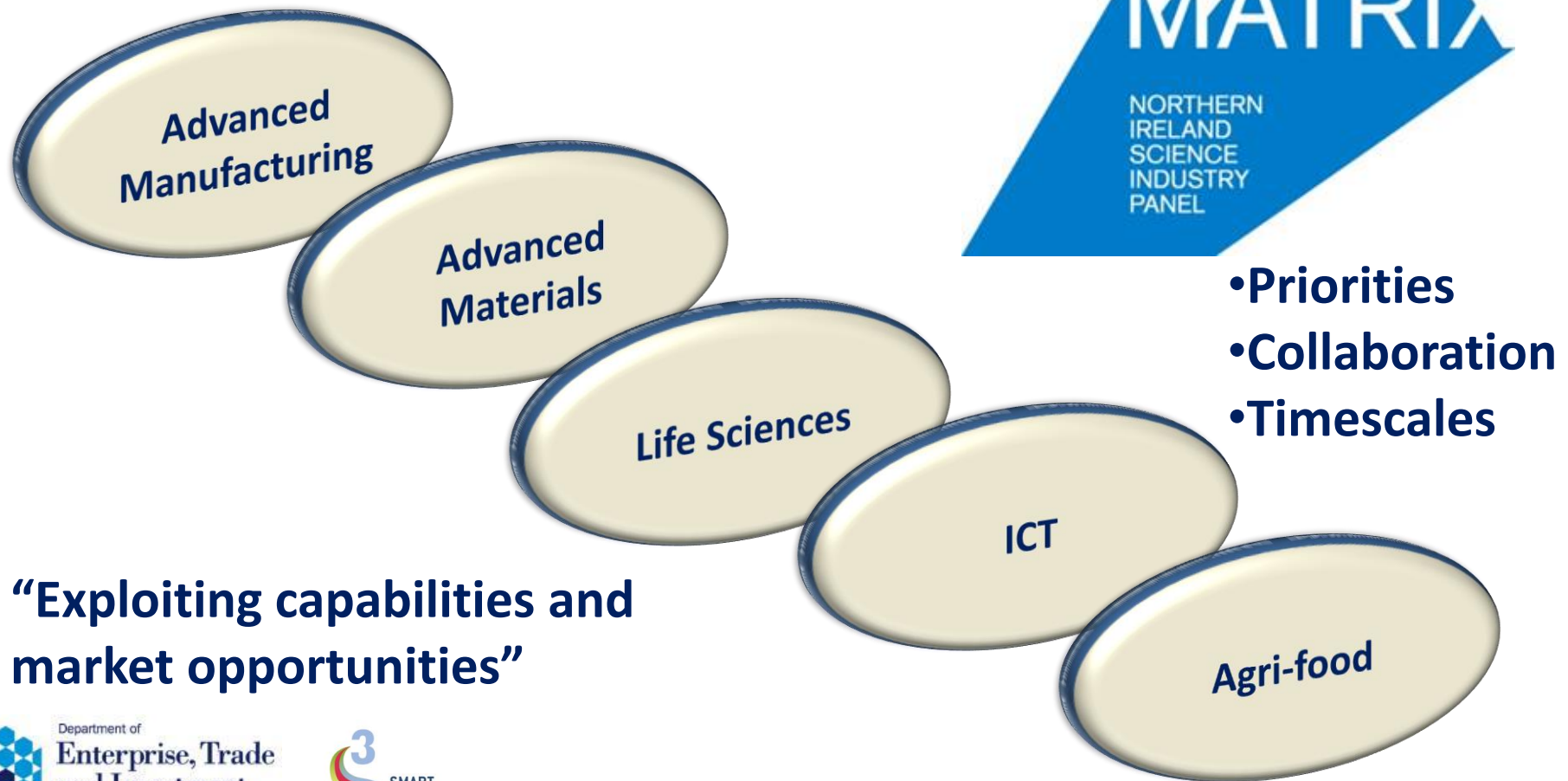
Transformation

Establish relationship between future and present for a change programme

Action Plan

Create structural and behavioural transformations to exploit markets

Key Enabling Technology mapping 2008



Key Enabling Technology mapping

SECTOR	20/20 CAPABILITIES REQUIRED	EXISTING NI CAPABILITIES IDENTIFIED	GAP TO BE BRIDGED
Life Sciences	Human Genomics, Enzymes, Epidemiology, RNA and Gene Regulation	Strong capability identified in genomics and epidemiology. Some degree of overlap with the diet and food science.	The scale of this capability is most likely to be insufficient to create a future food industry. Additionally, the focus of epidemiology, enzymes and genomics on food interactions with the human body needs to be further examined.
ICT	Computational Science (Modelling/ Simulation of Genomics), Management of Animal Disease, Processing and safety profiles, ICT tools to demonstrate intermittency in energy networks	Strong capability in computational science (Bioinformatics), very strong capability in managing animal disease (once a leadership position in Northern Ireland), food processing etc	Whilst the capabilities do exist at a component level in Northern Ireland, there is a need for an advanced toolset of capabilities creating solutions that track and trace, enhance existing animal disease tracking etc.
Sustainable Production and Consumption	Probiotics, Nutrigenomics, Nutraceuticals.	Some capability identified however not sufficient for a future food industry.	This is a particular gap that has to be addressed in scale and scope.
Advanced Manufacturing	Pharma Robotics, Advanced Processing techniques	Excellent advanced manufacturing capability in Northern Ireland is seen in this sector, Life Sciences, aerospace etc.	This capability resides primarily around processing and needs to be further extended to the food industry.
Advanced Materials	BioMaterials, Active Packaging, Intelligent Packaging, Coatings, Sensors, Advanced Materials for use in energy generation	Excellent advanced materials capability in BioMaterials, Coatings, Sensing etc. Rarely seen in the Agri-food space and most likely seen in the space in Aerospace, Electronics etc.	These existing capabilities need to be applied to the packaging of foods and the integration of packaging with function in foods.
Sustainable Production and Consumption	Market Knowledge. Agri-food Intelligence Databases, Econometric Modelling,	Some degree of capability but this is not replicated consistently.	Gap in understanding international food markets and updating this intelligence rapidly so that Northern Ireland industry knows how to respond.
Sustainable Production and Consumption	Coagulation, Flocculation, Irradiation, Purification, Water Management	Some degree of capability in Northern Ireland although this is 'hidden' in a number of other sectors. The entire spectrum of Environmental Technologies or Clean Technologies needs to be further evaluated. There are some clear capabilities in this space in Northern Ireland but they tend to be fragmented.	Need to align all the existing capabilities into a consistent framework for Cleantech within Northern Ireland.
Sustainable Production and Consumption	Animal and Plant Genetics, Animal and Plant Breeding, Animal Biotechnology, Soil Science and Soil Management	Strong area of capability for Northern Ireland. Excellent capability in AFBI, DARD, CAFRE (see Appendix 2).	Need to leverage more of this capability into the future of the industry in Northern Ireland.
Sustainable Production and Consumption	Releasing embedded energy (Aerobic Digestion etc), Catalysis in energy saving, construction science, storage technology, photovoltaics,	Strong area of capability in Northern Ireland that is building on experiences in Holland, Denmark and creating new sustainable solutions.	Need to leverage this capability to create some formal structures of critical mass.
Sustainable Production and Consumption	The multifunctional use of land - land farming, bioventing, bioaugmentation, biostimulation, bioreactors, energy generation, biodiversity, biological genomics,	Strong area of capability in Northern Ireland that is building on US, Austria, Swedish, UK and other experiences. Excellent leadership position.	Need to leverage this capability to create some formal structures of critical mass that augment Northern Ireland leadership in this area.

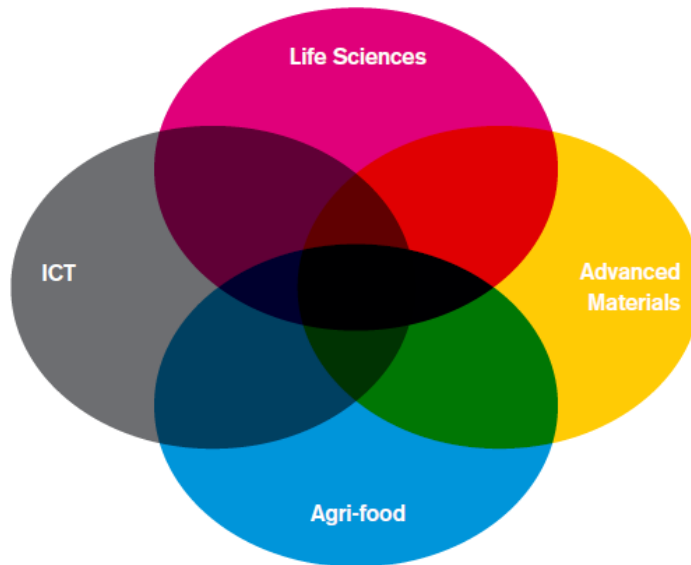
Key Enabling Technology mapping

TABLE 5.2: A SUMMARY OF THE CAPABILITIES REQUIRED TO REALISE THE 20120 VISION

SECTOR	CAPABILITIES
Life Sciences	Human Genomics, Enzymes, Epidemiology, RNA and Gene Regulation
ICT	Computational Science (Modelling/Simulation of Genomics), Management of Animal Disease, Processing and safety profiles, ICT tools to demonstrate intermittency in energy networks
Sustainable Production and Consumption	Probiotics, Nutrigenomics, Nutraceuticals
Advanced Manufacturing	Pharma Robotics, Advanced Processing techniques
Advanced Materials	BioMaterials, Active Packaging, Intelligent Packaging, Coatings, Sensors, Advanced Materials for use in energy generation
Sustainable Production and Consumption	Market Knowledge, Agri-food Intelligence Databases, Econometric Modelling
Sustainable Production and Consumption	Coagulation, Flocculation, Irradiation, Purification, Water Management
Sustainable Production and Consumption	Animal and Plant Genetics, Animal and Plant Breeding, Animal Biotechnology, Soil Science and Soil Management
Advanced Manufacturing	Ambient temperature, Magnetic Resonance, Pharma Robotics
Sustainable Production and Consumption	Releasing embedded energy (Anaerobic Digestion etc), Catalysis in energy saving, construction science, storage technology, photovoltaics,
Sustainable Production and Consumption	The multifunctional use of land - landfarming, bioventing, bioaugmentation, biostimulation, bioreactors, energy generation, biodiversity, biological genomics,

Key Enabling Technology mapping

FIGURE B: THE FUTURE OF NORTHERN IRELAND AGRI-FOOD DEPENDS ON CAPABILITIES FROM MULTIPLE SECTORS⁸



Life Sciences

Genomics
Biological Enzymes
Epidemiology
Bioinformatics
New processing techniques
New packaging techniques
(active, edible etc)
RNA and Gene regulation

Advanced Materials (and processing)

Biomaterials
Computational Science
New functional materials
Sensors
Nano Technology
Bioremediation
Energy Materials (Catalysis,
Photovoltaics)
Fuel Storage
Biomarkers
Coatings

Agri-food

Farming (production)
Proteins
Animal and Plant Genetics
Processing & Packaging
Alternative Energy
Soil Science
Water Management
Environmental Science
Land Use

ICT

Computational Science
Modelling
Knowledge Management
Traceability
Analytical Toolsets

KET mapping recommendations 2008

1. Fill the Gaps!
2. Commercial Intelligence
3. Aligning Research base with Industry
4. Support SME base
5. Enable producers to be innovative in line with 5 leadership areas.

Commercial Intelligence

Collaborative Networks “working together to achieve a common goal”



Minimum of 4 N.I. companies

Project Focused

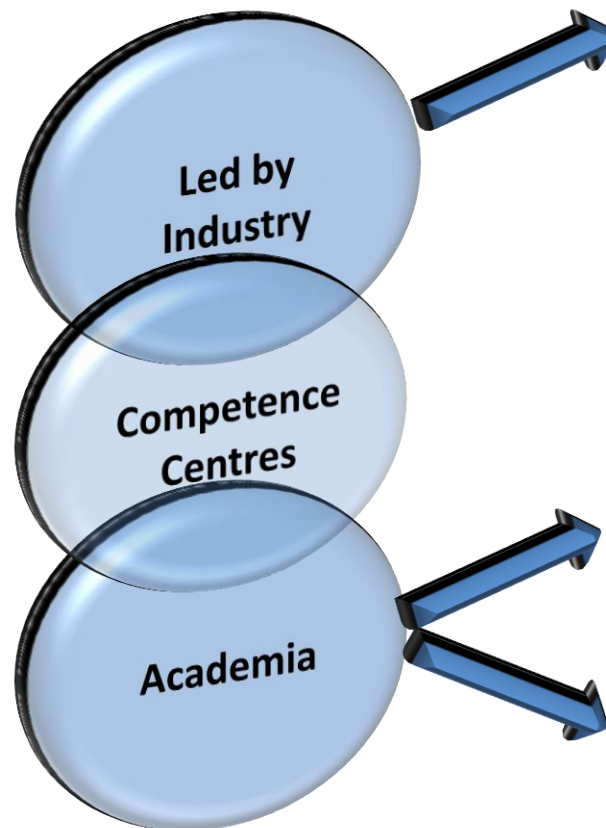
Private Sector/ Company led

Invest
Northern
Ireland

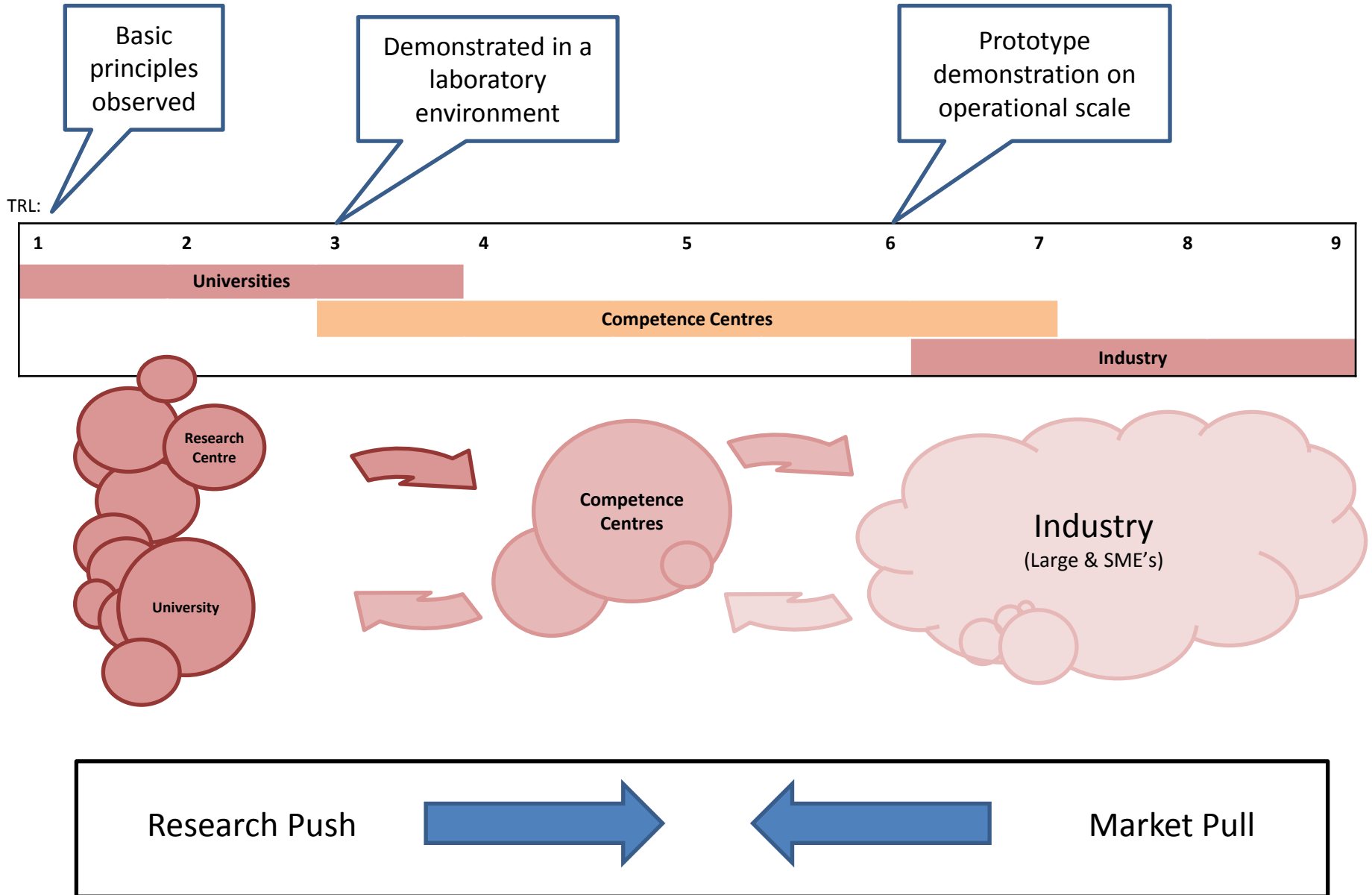
“ Government provides Industry Experts as Honest Brokers”

Aligning Research Base with Industry

Competence Centres

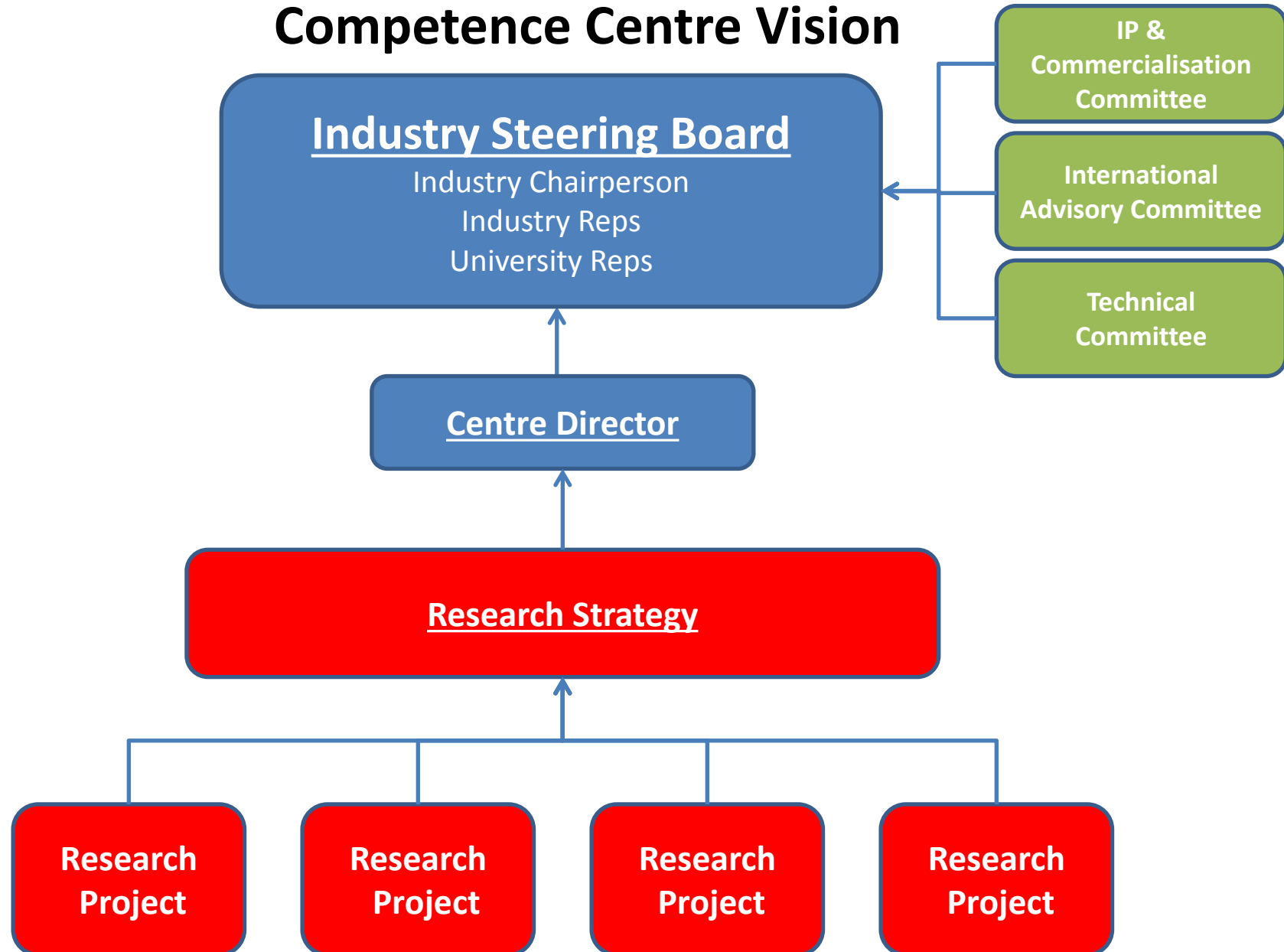


Aligning Research Base with Industry



Aligning Research Base with Industry

Competence Centre Vision



Aligning Research Base with Industry

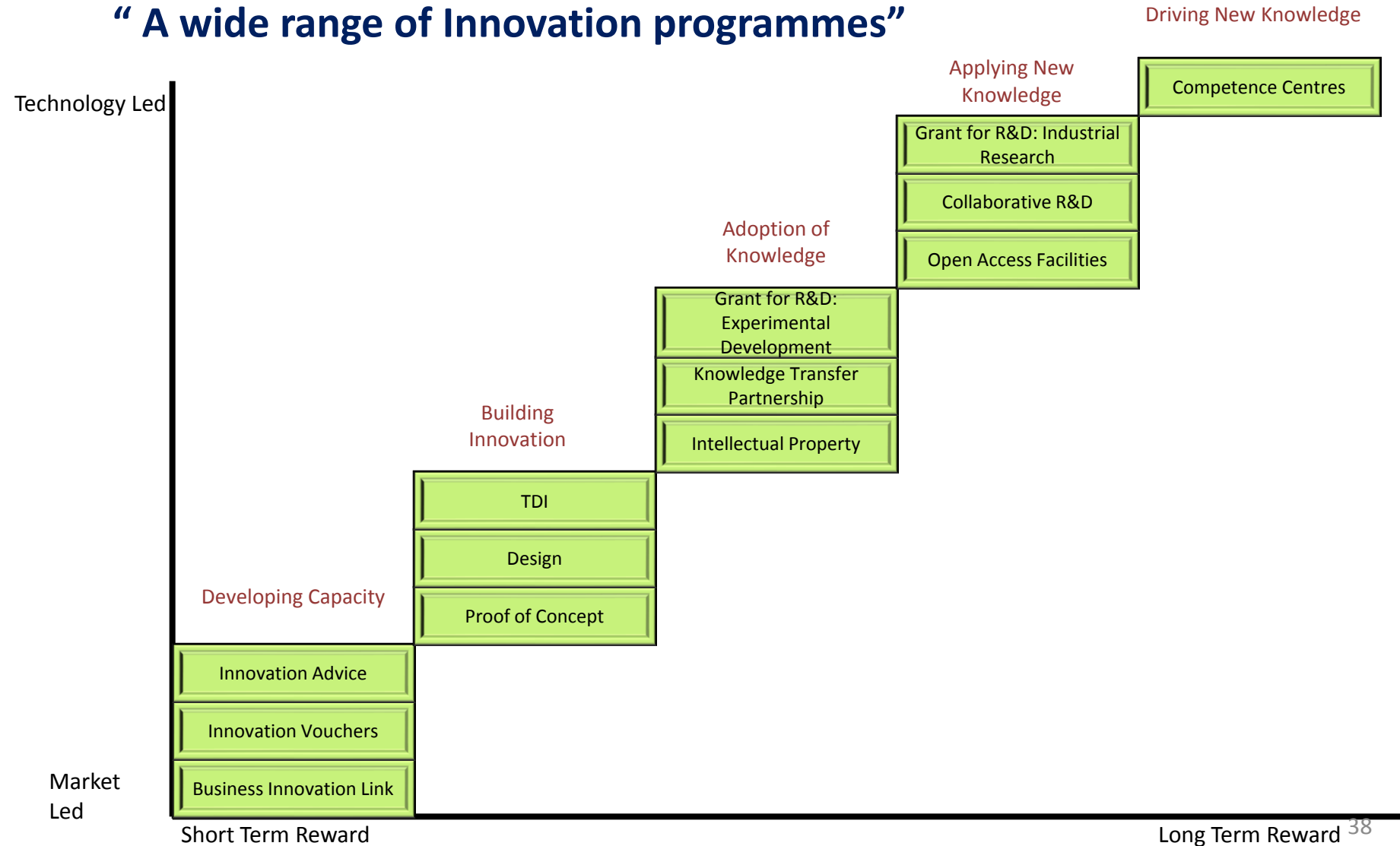
- A critical mass of research activity involving a mix of locally based SMEs & multi national companies alongside international participants, in sectors strategically important to the N. Ireland economy
- Funding Model:
 - 75% public sector
 - 25% Industry (Contribution in Kind -CiK)
- Total revenue £1.35m pa (or greater); with £350k pa from businesses
- Centres must leverage other funding sources e.g. TSB, Horizon 2020, US/Ireland

Support SME base

- EU & UK R&D support
- TSB competitive calls
- R&D tax credits
- Innovation vouchers
- Grant for R&D
- Collaborative R&D
- Collaborative networks
- Competence Centre (in development)

Support SME base

“ A wide range of Innovation programmes”



Innovative Public Procurement (SBRI)

Un-met Need



Competition Phase

Proof of Concept

Proof of Concept

Proof of Concept

Proof of Concept



X



Prototype



X



Prototype

Full Open
Procurement



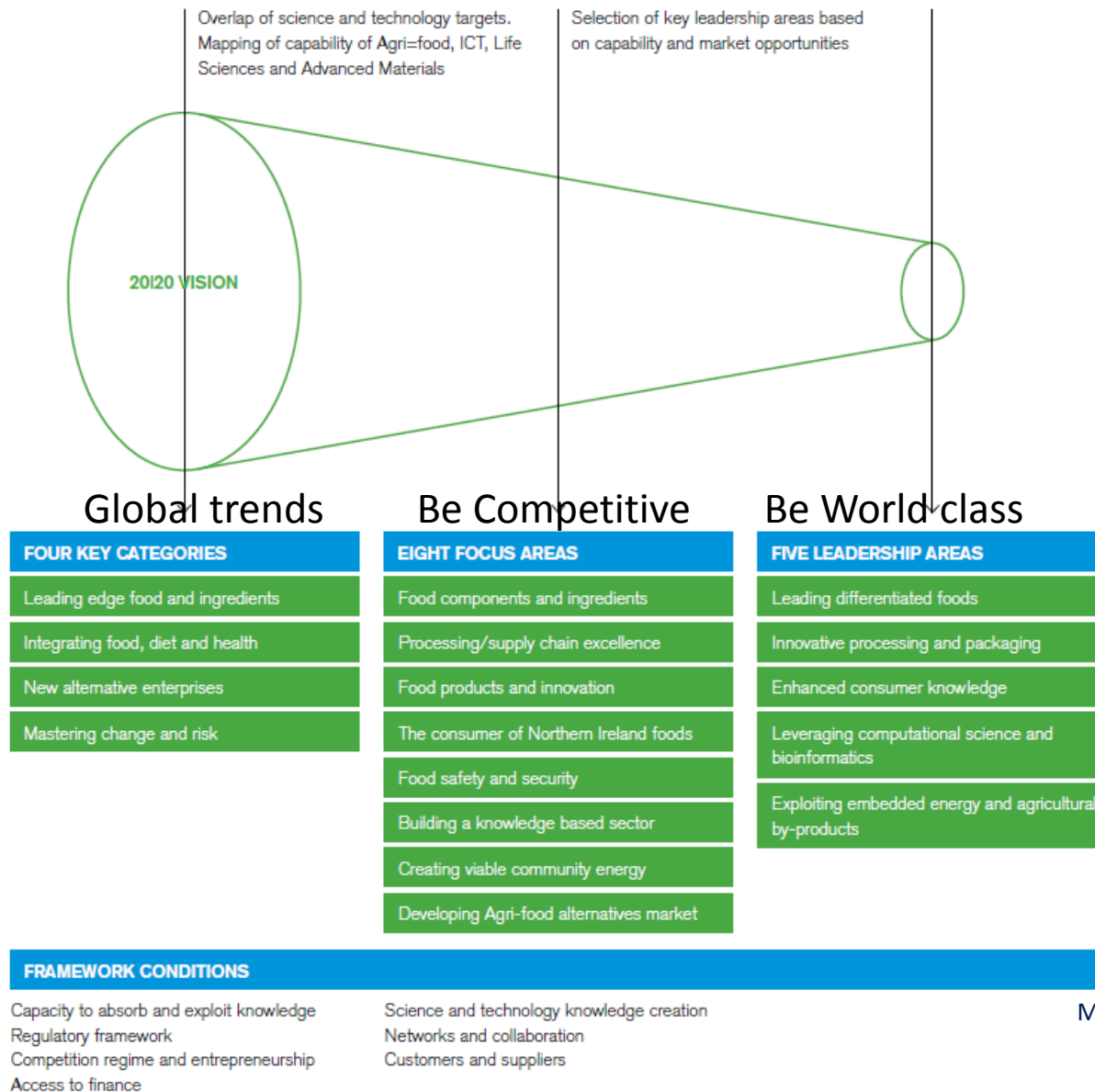
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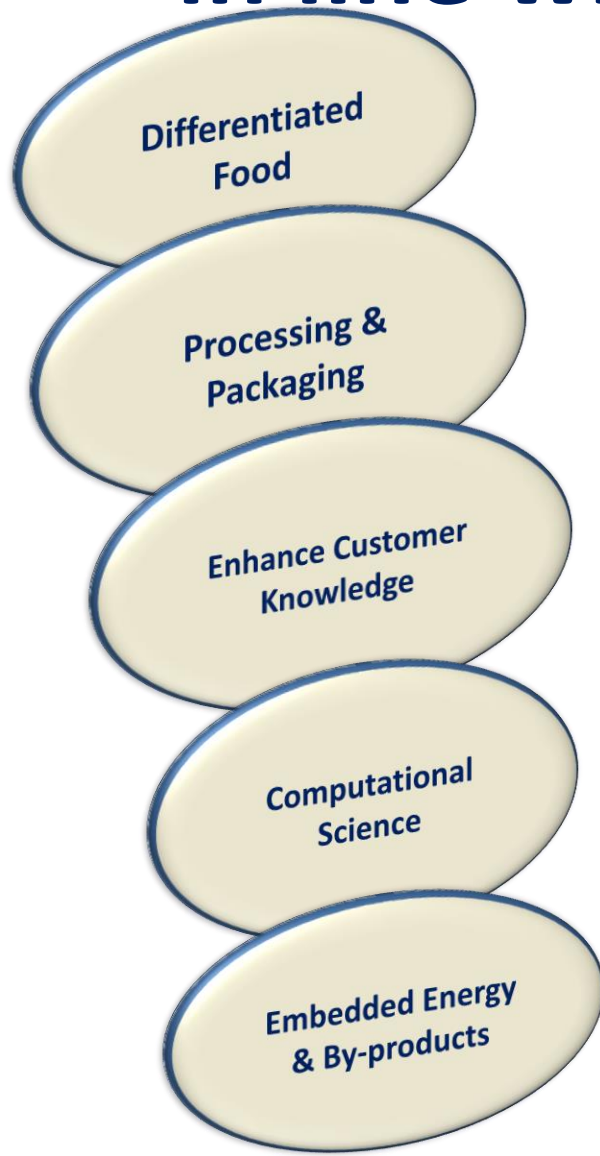
SMART
SPECIALISATION
PLATFORM

Focus areas and leadership areas

FIGURE C: THE REFINEMENT OF 20/20 TO FOCUS AREAS AND LEADERSHIP POSITIONS BASED ON EXISTING CAPABILITIES IN ALL SECTORS AND THE GLOBAL MARKET OPPORTUNITIES.



Enable producers to be innovative in line with 5 leadership areas



- Functional Foods (Life & Health Science)
- Shelf life, reduce costs, convenience, safety (ICT, Life & Health science, advanced materials)
- Communicate safety, security purity, traceability (ICT)
- Food modelling, food security, benchmarking (ICT, advanced materials)
- Reduce energy costs, intelligent energy systems, release embedded energy

The key to success for a region the size of Northern Ireland is to focus on areas where there is the potential for international leadership in research that feeds into global food markets. The focus areas described above are too broad to create sufficient focus for leadership positions. Therefore, these focus areas have been further refined into five Leadership Areas for Northern Ireland to be underpinned by framework conditions to achieve long term success within the sector. These leadership areas have been selected because they allow Northern Ireland create market growth in a developing aspect of the global Agri-food sector and can also be used to spearhead the development of the sector.

1. **Leading Differentiated Foods**

The development of world leading foods, using pharmaceutical techniques to produce differentiated (e.g. functional) foods that can be customised to individual needs and produce vitality protein products that are focussed on the Premiumisation, Beyond Health and Convenience markets;

2. **Innovative Processing and Packaging**

The development of existing processing and materials skills, (drawing on other areas of Life Sciences and advanced materials) to produce innovative processing and packaging mechanisms that meet the requirements of enhanced shelf life,

reduced preservation costs, consumer convenience and safety;

3. **Enhancing Consumer Knowledge**

The development of knowledge based toolsets that enhance and communicate the safety, security and purity aspects of products (e.g. traceability) and provide assurance through to the consumer;

4. **Leveraging Computational Science**

The further development of existing Computational Science capability to advance the sector in terms of food and process modelling and to master change and alleviate risks associated with food security, food risk, etc. and overall industry risk;

5. **Exploiting a multifunctional nature of Agri-food and finding mechanisms to release the embedded energy in the sector**

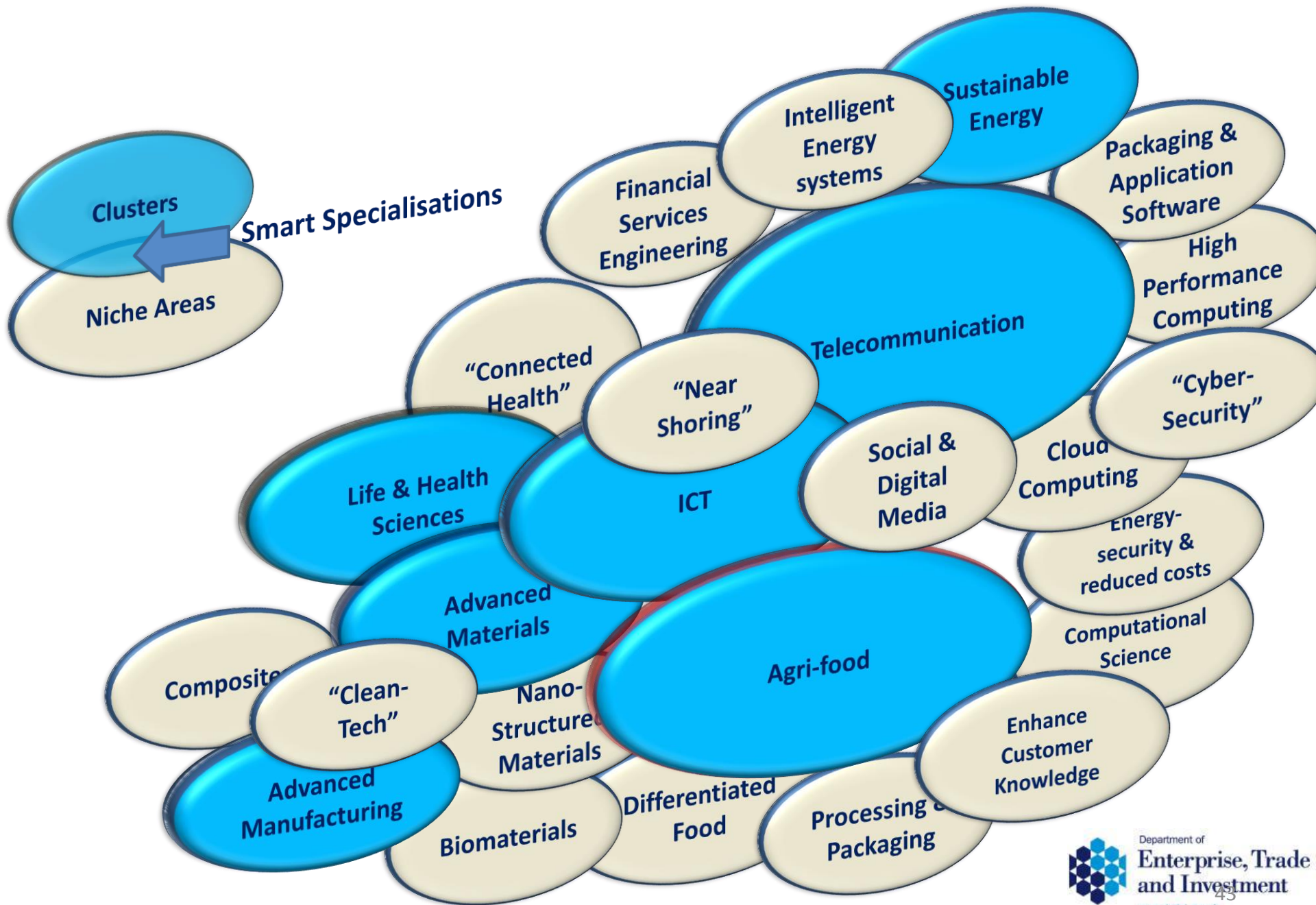
The creation of a complete supply chain of the Northern Ireland Agri-food sector that looks at the multifunctional usage of the sector to increase the productivity of the sector and also seeks to release the embedded energy within Northern Ireland food products thereby creating energy security and reducing costs. These two areas can then be used to displace energy and waste costs by a mixed model of

food and alternatives usage. This includes an 'end to end' perspective of energy including storage and construction, and supported ICT to alleviate fluctuations in demand and to develop sophisticated models for effective land use. Additionally, the alternatives from by-products from Agriculture and land (animals, plants etc) are to be integrated into an Northern Ireland system of energy recapture and new product creation in terms of Biorefineries for packaging, fuel and other novel products.



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Institute for Global
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Supplying the world with a sustainable, safe and secure food supply



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- A Solution To Global Swine Disease
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- Next Generation Parasite Control
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Opportunities

- PhD Studentships
- Careers Information

News/Events

- Institute for Global Food Security - Official Launch

RUSSELL
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Key Links

Contact Information

World Class Research

Institute for Global Food Security

- Prof Chris Elliott, Director, heads up an international team of world renowned experts, focusing on major research themes:
- [Food Safety and Food Integrity;](#)
- [Human nutrition and Health;](#)
- [Animal Health and Welfare;](#)
- [Parasitology](#)
- [Plant and Soil Science;](#)
- [Climate Change.](#)



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Latest News

- Institute for Global Food Security – official launch (Thursday 14 March 2013) Queen's University Belfast officially launched the Institute for Global Food Security. T... [\[more\]](#)
- SafeFood Networks Biotoxins Conference The Biotoxins in food safeFood networks held a one day conference on the 29th November... [\[more\]](#)
- SafeFood Networks Biotoxins Conference The Biotoxins in food safeFood networks will hold a one day conference on the 29th No... [\[more\]](#)

Welcome

Welcome to the Centre for ASSured, Safe and Traceable food (ASSET) at Queen's University, Belfast. Launched in January 2009, ASSET is a new Research Centre within the Institute for Global Food Security that is based in three Schools - the School of Biological Sciences; the School of Planning, Architecture and Civil Engineering (SPACE) and Queen's University Management School.

ASSET's Vision:

- A food supply chain which is safe, transparent, rapidly traceable and sustainable;
- Innovative, state-of-the-art scientific techniques that will create a niche food forensic strength to develop a new dimension in animal and human health, food safety monitoring and traceability;
- A major All Island research centre that brings together four key research groups on the Island.



The Institute for Global Food Security are delighted to announce that the 2nd Food Integrity and Traceability Conference (ASSET 2014) will take place at Queen's University Belfast during 8 – 10 April 2014



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This Project is supported by the Department for Employment and Learning through its "Strengthening the all-Island Research Base" initiative.



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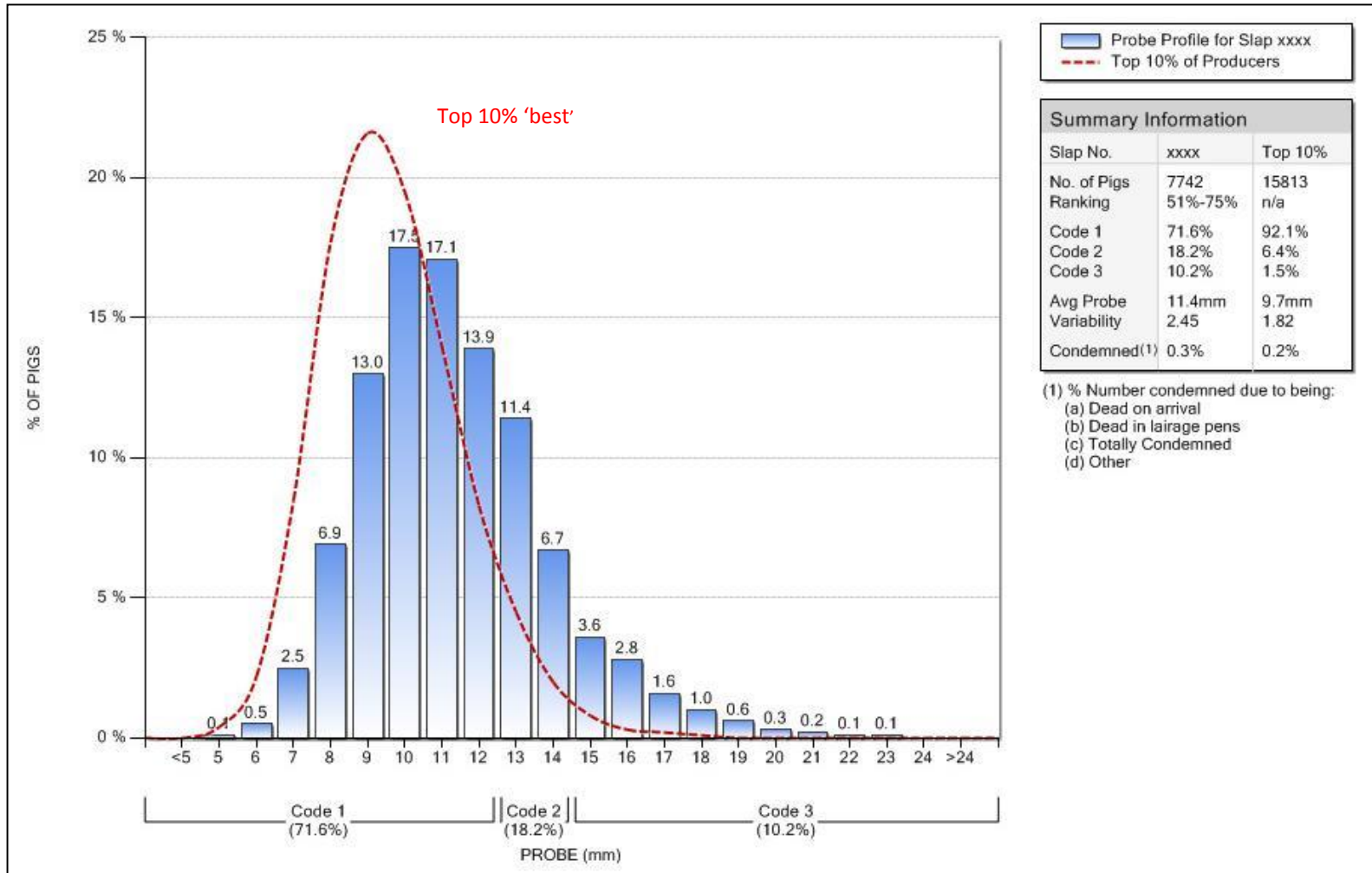


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PiGIS® - Carcass quality graphs



World Class Research

BovIS - Benchmarking
Benchmarking Report

BovIS - Benchmarking carcass quality

Select Breed/Breed Category:

---- Holstein (71) ▼

[View Report](#)

[Compare Breed](#)

Summary

Conformation

Fatness

Weight

Carcass Gain

Animal Data

Summary Data

Report Date Range: 01/11/2011 to 30/11/2012

Animal Type: Steers
Breed Category: Pure Dairy
Breed: Holstein

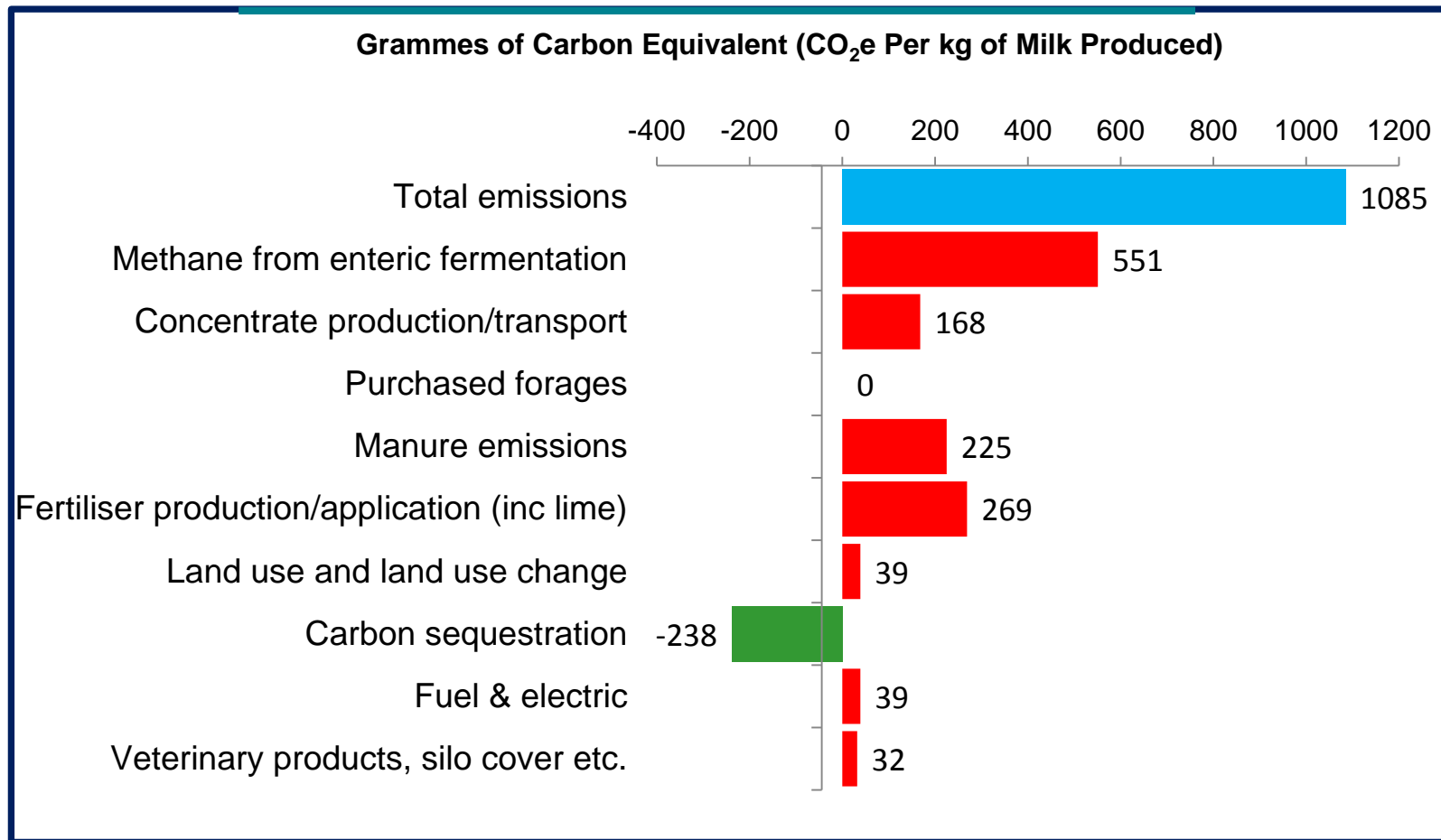
Animal Count: 71
Carcass Gain Rank: 97 out of 556

Summary of Your Performance

	Animal Count	Weight (kg)	Fatness	Conformation	Age (mths)	Carcass Gain (kg/day)	In Spec (%)
My Steers	71	330.2	3=	O-	23.8	0.46	2.8
Top 10%	419	290.0	2+	O-	16.8	0.58	1.2
All Producers	4,285	299.2	2+	P+	25.7	0.40	0.4
My Aberdeen-Angus	18	344.0	4-	O=	24.4	0.46	11.1
Nov 2010 - Oct 2011	72	298.7	3+	P+	21.1	0.47	0.0

World Class Research

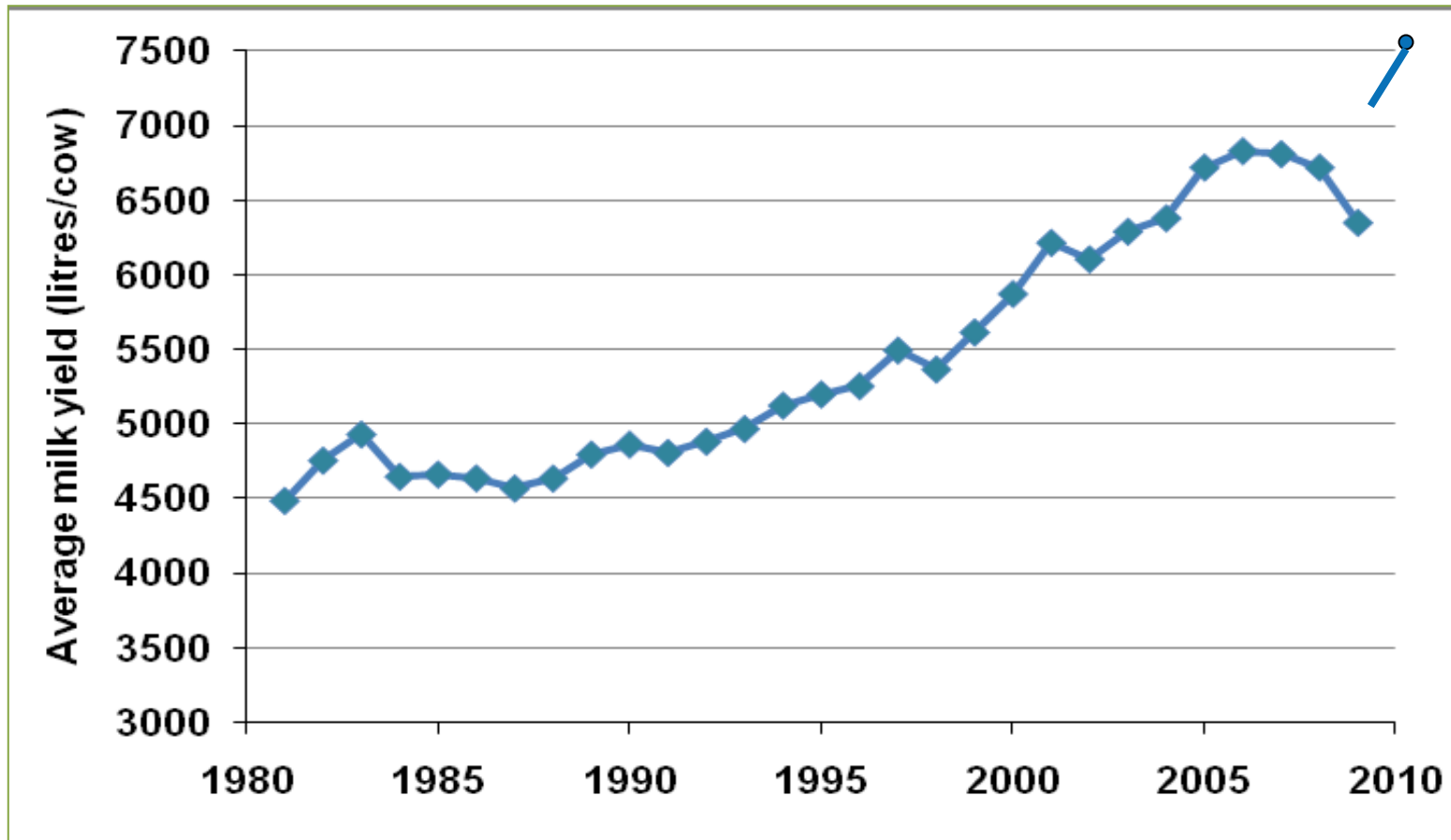
Greenhouse Gas Emissions



Carbon Footprint of a Northern Ireland dairy farm feeding 2.1 tonnes of concentrate and producing 6800 litres per cow

World Class Research

Milk output per herd in NI



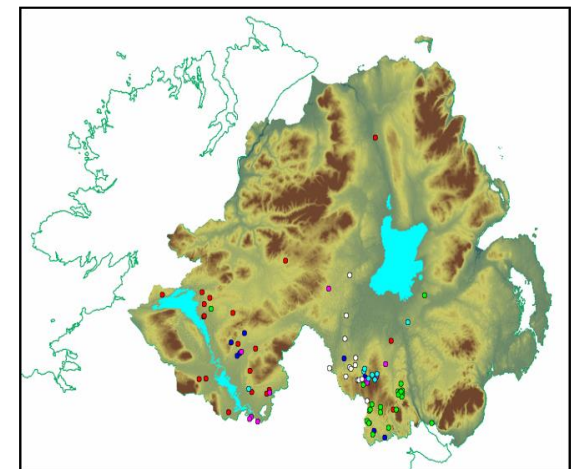
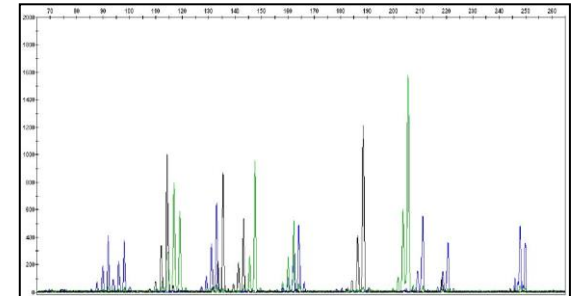
◆ 1986-2006 milk yield +110 litres/cow/year

◆ Over $\frac{3}{4}$ of increase could be attributed to genetics

World Class Research

Bovine brucellosis - molecular genetics

- Collaboration with Veterinary Laboratories Agency and Broad Institute MIT, Boston
- Characterised DNA markers which discriminate between strains of *Brucella abortus*
- Routine analysis of *Brucella* isolates to inform on source of infection
- Molecular epidemiological advice helps DARD implement effective containment / eradication measures



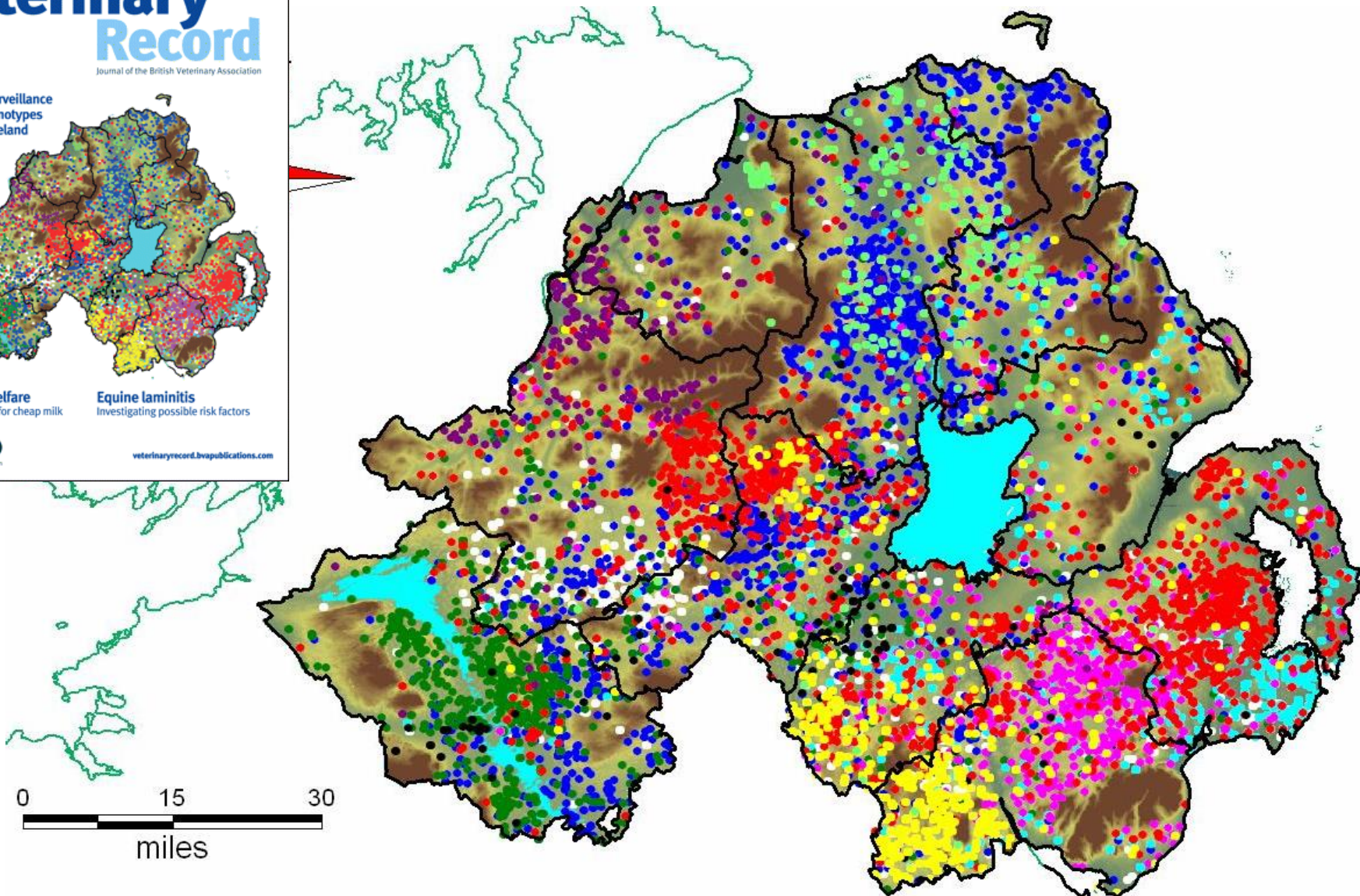
World Class Research

Bovine Tuberculosis

- Investigation of genetic susceptibility to bTB in cattle (BBSRC)
- TB biosecurity study (DARD)
- An evaluation of IFN γ (interferon gamma) use in NI (DARD)
- Development of vaccines for strategic use as control measures for bovine tuberculosis (Ferret Model) (EU FP7: TB STEP)
- Helminth co-infection as a modulator of the bovine immune response (Science Foundation Ireland, University Collage Dublin)



World Class Research



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Plant health and crop improvement

Challenges for industry and policy:

- EU policy on reductions in agrochemical availability
- Plant quarantine for agriculture, forestry and horticulture
- Emerging risks from climate change and EU expansion
- Increased threats to long-term sustainability of production

What AFBI Science is doing:

- Developing lower input pest and disease strategies
- Enhanced molecular diagnostics of pests and diseases
- Major threats to forest trees – *Chalara fraxinea*, *Phytophthora ramorum* & *P. lateralis*
- Disease and pest monitoring – during summer/pest risk analysis
- Practical advice to help industry adjust to new threats

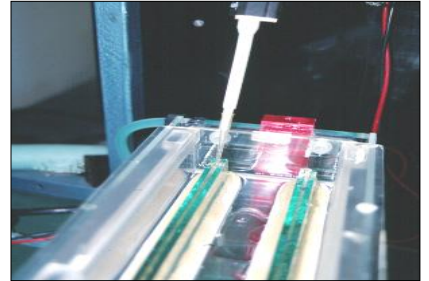


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Plant genetics and crop improvement

Challenges for industry and policy:

- A competitive and sustainable local agri-food industry
- Changing EU requirements and developing market needs
- Access to the best varieties for local farming conditions
- Optimum use and management of crop and grassland varieties



What AFBI Science is doing:

- Identifying traits for higher yields and disease resistance
- Improving quality and seasonality of crops and grassland
- Commercial breeding partnerships and development of tools for selection- spectroscopy & somatic embryogenesis
- Recommended varieties and agronomic advice to industry

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Food quality



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Eating quality of beef versus dairy breeds “Free range” grass fed beef and milk

Two new E&I projects funded by DARD and LMC

- aiming to make the most of NI beef and milk

- Can differences in eating quality between dairy and beef breeds be explained and exploited?
- Do outdoor grass-fed cattle give increased vitamins in beef and milk?



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Functional Food: Reduced fat cheese fortified with omega-3 fatty acids

Aims:

- To produce reduced-fat Cheddar cheese fortified with omega-3 fatty acids
- To optimise quality of reduced fat cheese



Outcomes to date:

- Optimised transfer of fatty acids into the cheese
- Identified appropriate omega-3 supplement to take forward
- Scale-up study at Loughry College in January 2013
- Sensory panels will be conducted

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AFBI Economics

Micro Models

Optimising farm business and farm household incomes under different market, policy and technology conditions

Sector Models

Projecting the impacts of policy changes on animal, crop and biofuel sectors and on GHG emissions at EU and UK levels

Systems Models

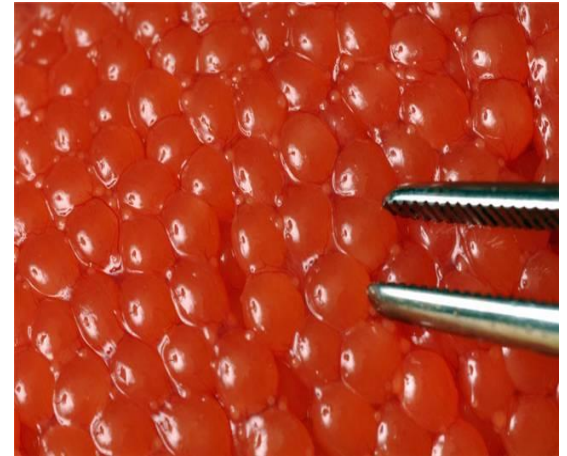
Mapping the regional economic system, contributions of agri-food/rural sectors and economic multiplier effects



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Fisheries & Aquatic Ecosystems

- R&D, monitoring and technology transfer in support of sustainable management of fisheries and aquatic resources in Northern Ireland



Conclusions

- The return on investment from research in Northern Ireland has been shown to be very positive
- Opportunity for more growth
- linkages with all stakeholders at each stage in the R&D process
- KET's play a large part in the Agri-food industry
- Highly complex to provide a clear policy framework

Sources

- MATRIX reports - <http://www.matrix-ni.org/#/publications-reports/4570999724>
- Northern Ireland Economic Strategy <http://www.northernireland.gov.uk/ni-economic-strategy-revised-130312.pdf>
- DARD- <http://www.dardni.gov.uk/>
- Institute for global food security- <http://www.qub.ac.uk/research-centres/InstituteforGlobalFoodSecurity/>
- AFBI- <http://www.afbini.gov.uk/>
- CAFRE- <http://www.cafre.ac.uk/>