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Innovative Food Product Development Cycle: Frame for Stepping Up Research Excellence of FINS

European Commission

Agriculture Fair Workshop

Novi Sad, 16th May 2018

Horizon 2020 | European Union funding for Research & Innovation
Grant Agreement number: 692276 — FOODstars | H2020-TWINN-2015

Modern Approaches to Technology Transfer for SMEs

Declan J. Troy, Assistant Director of Research,Teagasc, Ireland.

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Innovative Food Product Development Cycle: Frame for Stepping Up Research Excellence of FINS

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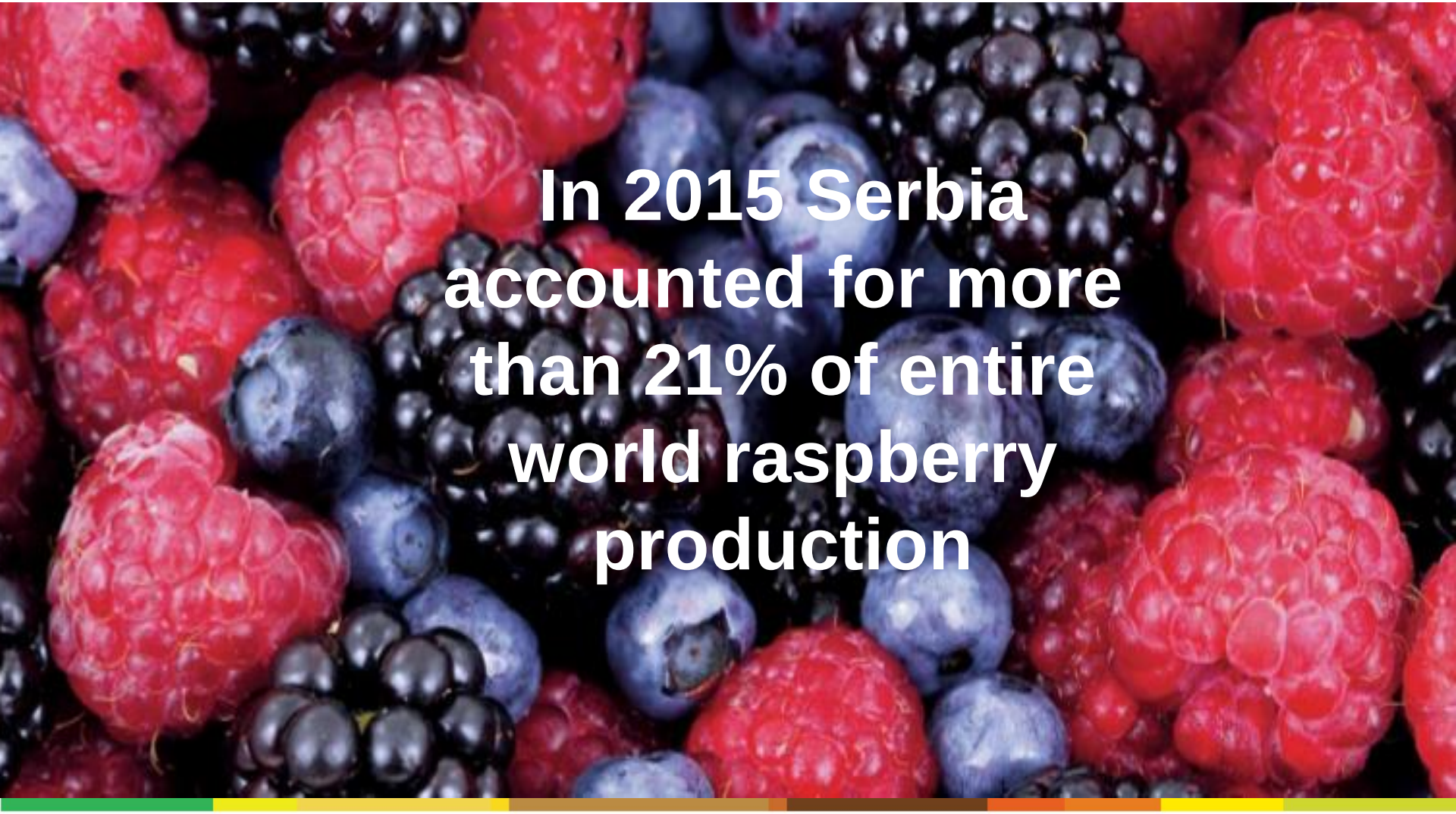
The Irish Agriculture and Food Development Authority

EXPORTS


In 2015 Serbia accounted for more than 21% of entire world raspberry production


MAKE IT
EASY

Greater than 10 fold in value

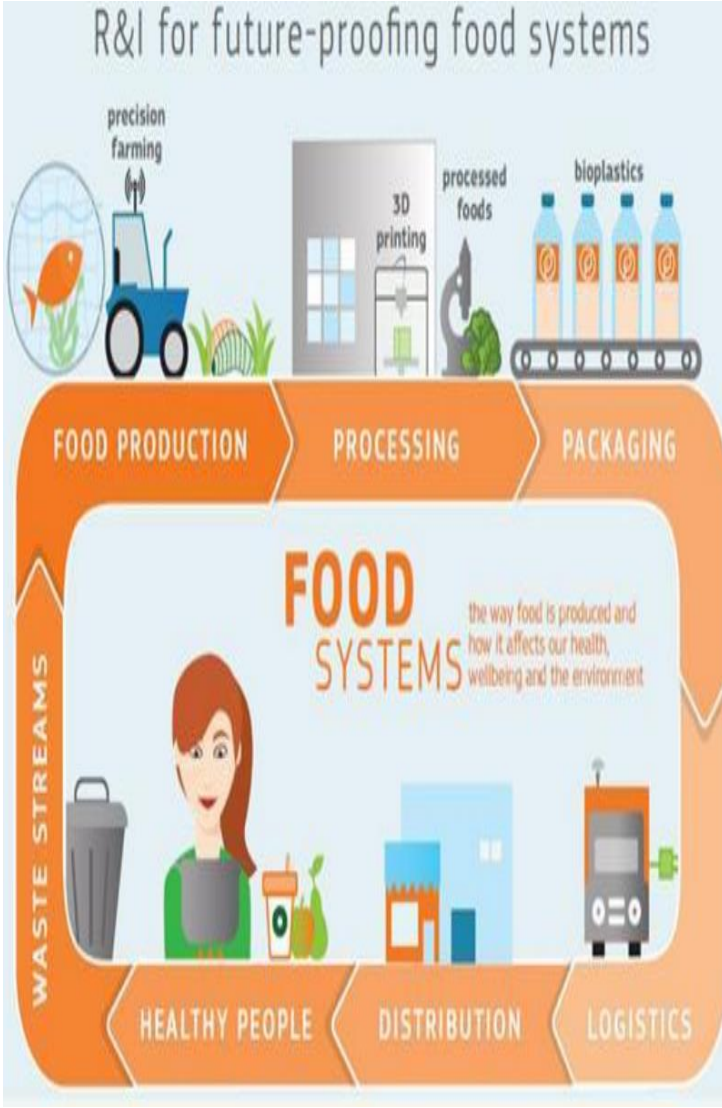
Greater than 25 fold in value

Greater than 100 fold in value

The Irish Agriculture and Food Development Authority

Outline

- Introduction
- Global Dynamics
- Consumer Trends
- Technological Opportunities
- Modern Approaches to Effective TT in Food SMEs
- Actions and Responses
- Conclusions



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“To support science-based innovation in the Irish food sector that will underpin profitability, competitiveness and sustainability”

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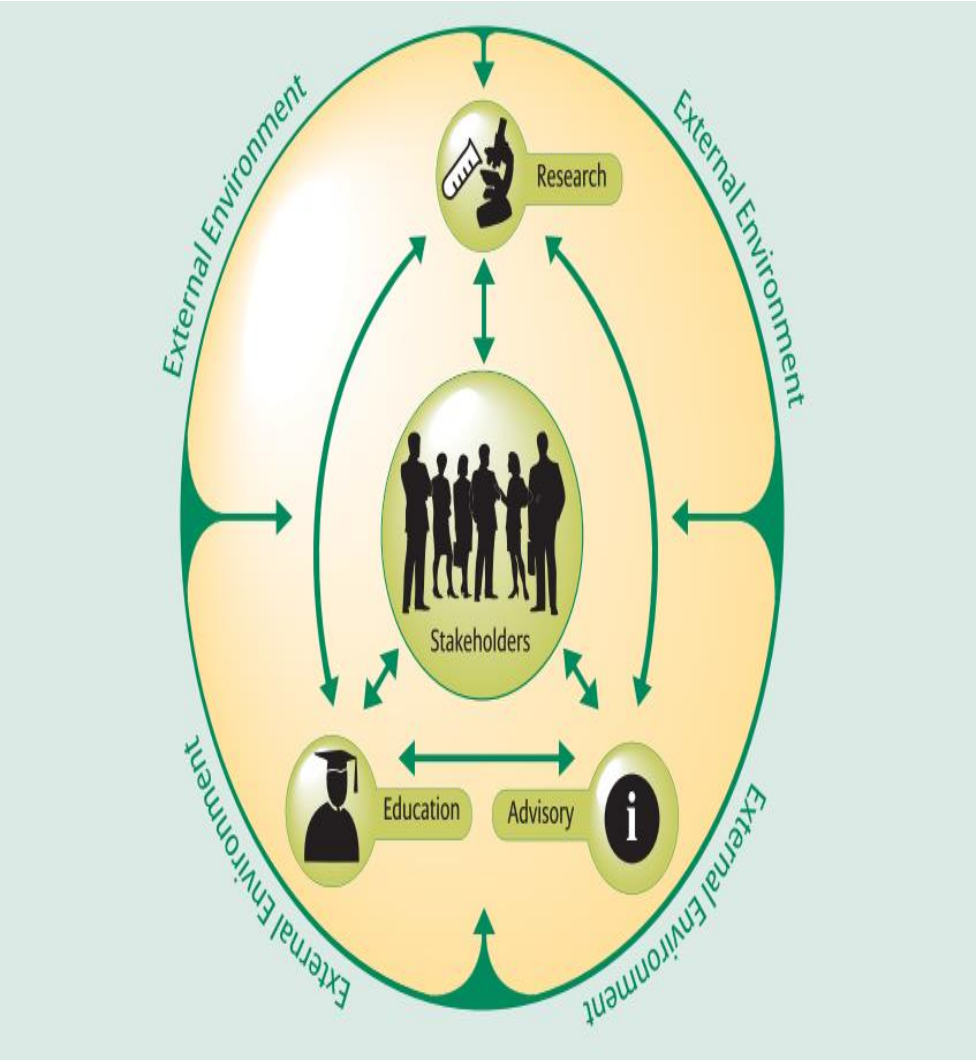
- State Body providing integrated research, advisory and education services to the Irish agri-food industry
- Funded 70% by State Grant, with balance earned from competitive research contracts extension fees etc. and trading income



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“To support science-based innovation in the Irish food sector that will underpin profitability, competitiveness and sustainability”

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Teagasc Goals

1. Improve the competitiveness of agriculture, food and the wider bio-economy
2. Support sustainable farming and the environment
3. Encourage diversification of the rural economy and enhance the quality of life in rural areas
4. Enhance organisational capability and deliver value for money.

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Cascade model

Component research

Component research

Research Farms
Dairy
Beef
Sheep

BETTER farms
Beef – 37
Sheep – 10
Dairy – 37

14,000 Discussion Group members

45,000 Clients

140,000 Farmers

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Nutrition & Food Systems face "perfect storm“ (Bell, 2016)

Some Current Challenges

- 50% increase demand by 2030, 100% by 2050
- 805 million still hungry (781m in developing countries)
- Vast majority live in rural areas with low income, poor infrastructure, excessive food waste, poor sanitation
- Land and water use limited
- Climate change affects these areas
- Animal based foods questioned

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but….

“there are also growing incomes, and an increasing sophistication of consumers with specific demands for food to deliver lifestyle benefits and innovative solutions for different life-stages”.

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Food waste – latest estimate EU-28

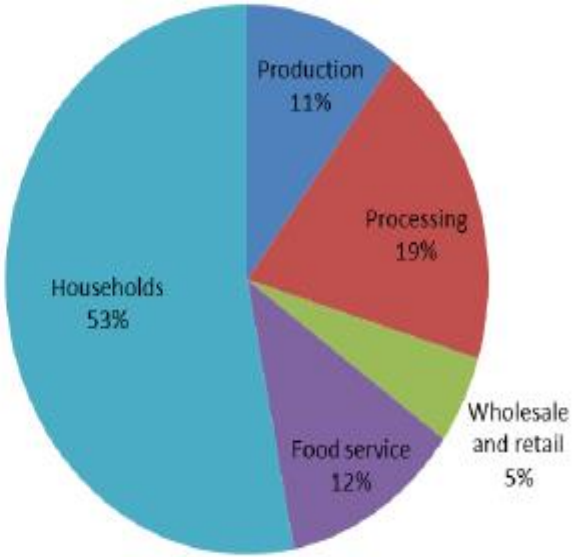
EU-28 PRODUCES

88 MILLION TONNES of food waste per year

amounting to an estimated 143 BILLION EUROS

For more information on data and quantification, access the March 2016 FUSIONS reports **"Estimates of European Food Waste"** & **"Food Waste Quantification Manual to monitor Food Waste Amounts and Progression"**

- Equivalent of **20%** of all produced food in EU
- **143** billion euros
- ~ **304 Mt CO2 eq** (6% of total emissions of GHG in EU28%)



Wageningen Food & Biobased Research

WAGENINGEN UNIVERSITY & RESEARCH

173 kg pro-capita food waste

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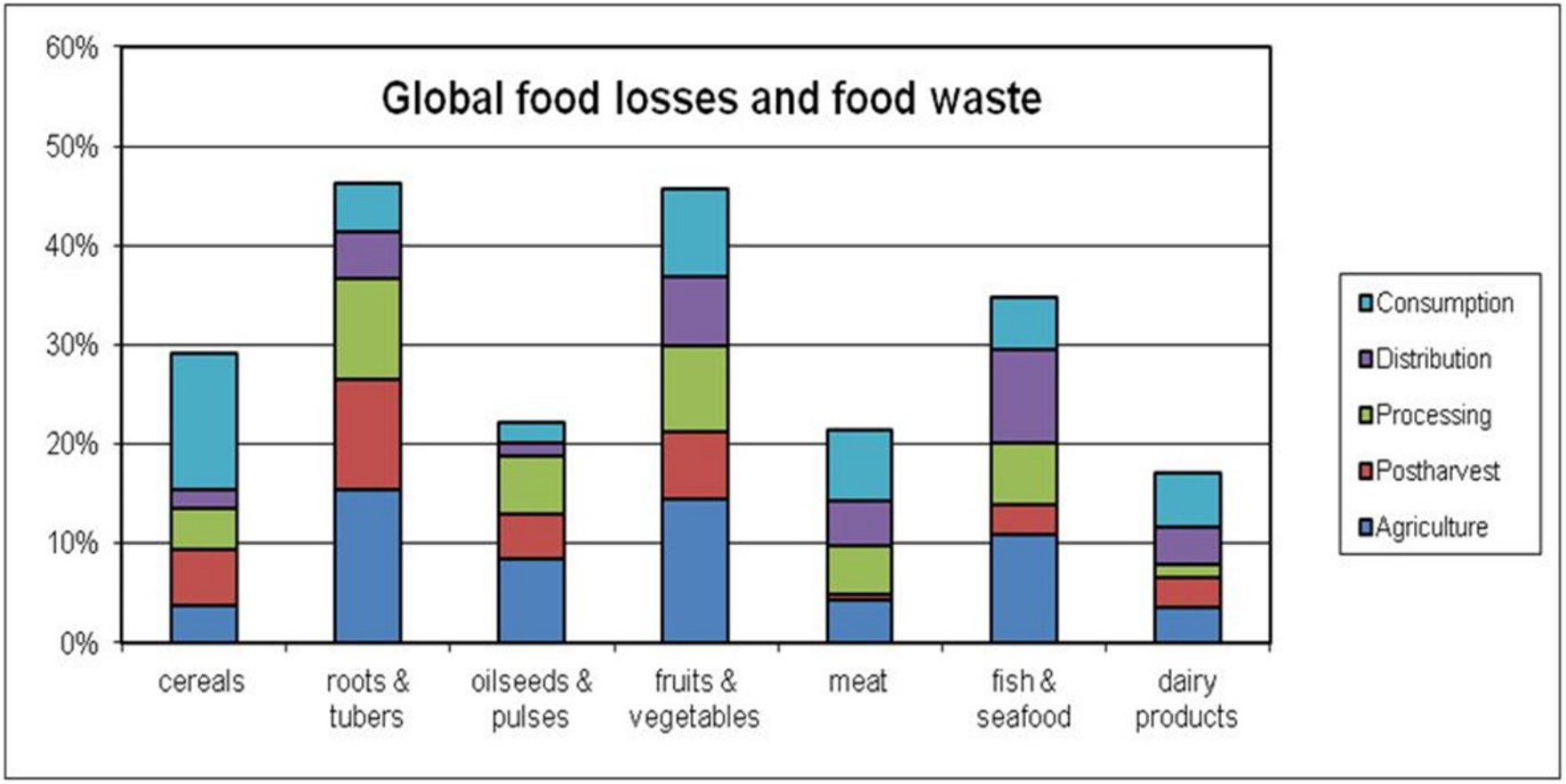
Global food losses and waste: estimated at 1.3 billion tonnes / year



Source: FAO. 2011. Global food losses and food waste

1. Shifts in the balance of world economic power

The world economic order has changed. Economies in the South and East are now leaders in terms of GDP. China is ranked number 2 in the world, Brazil number 7 and Russia and India 9th and 10th respectively.

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2. Increasing empowerment of women

Though inequalities remain, women are making huge strides in education, employment and commerce.

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3. Global urbanisation

Urban living will increasingly be the norm across the world, raising issues about quality of life and community dynamics.

Rapid urbanization is accelerating the dietary transition

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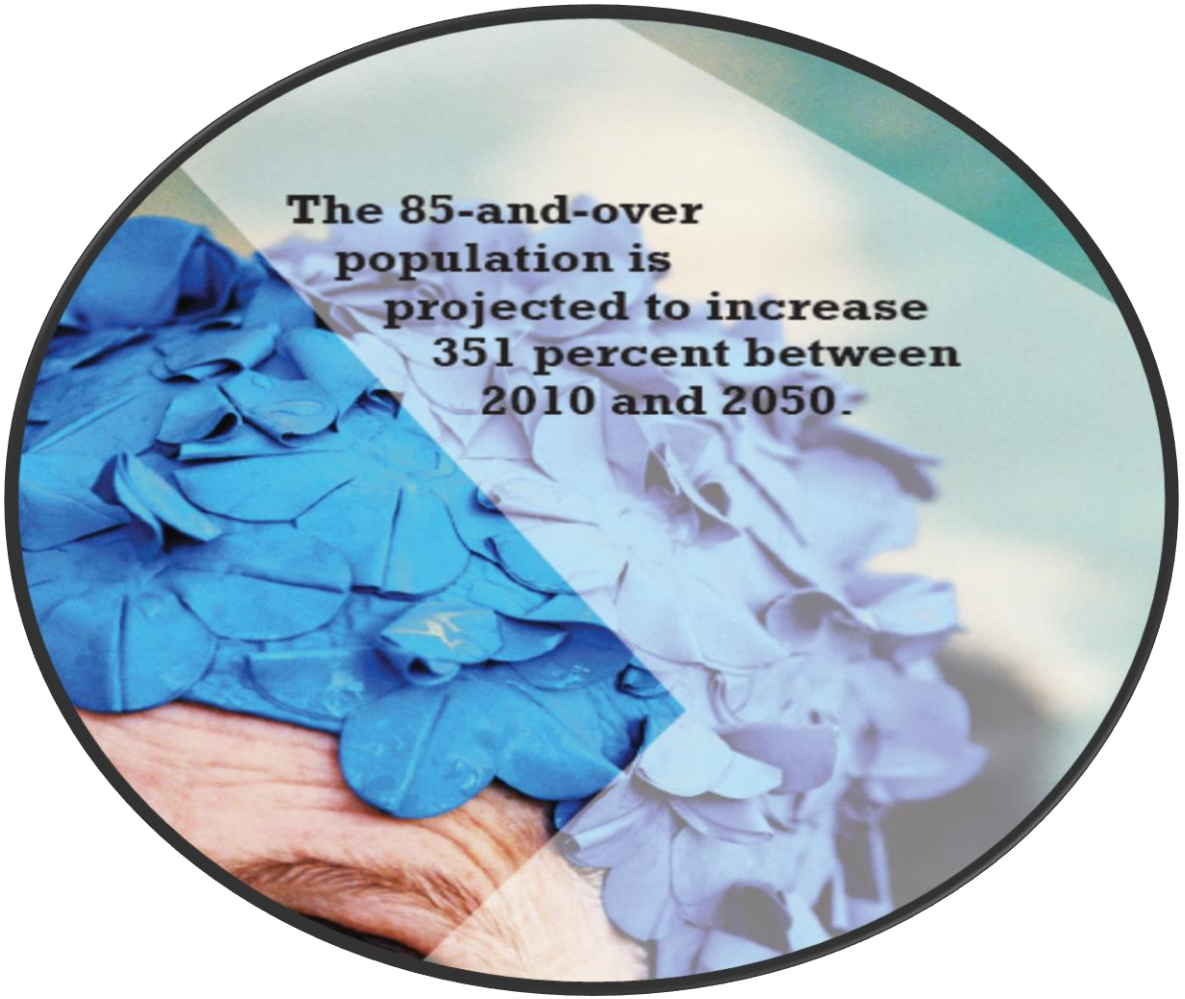
4. Changing attitudes to ageing

Old age will be reinvented. Longer life expectancy will radically alter societal perceptions and priorities related to work, leisure and health.



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5. Changing household structures and family roles

The concept of the 'household' will be more diverse and unconventional, and this will also be reflected in more fluid family roles and responsibilities.

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6. Increasing economic inequality

The disparity between rich and poor — both within and across regions — is growing.

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7. Global rise in lifestyle diseases

Across the world, rising prosperity and modern conveniences are leading to a higher incidence of life-threatening health conditions such as obesity, diabetes and heart disease.

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8. Rise in the use of mobile technology

Mobile technologies are rapidly becoming the preferred means of Internet access, especially for leapfrogging emerging markets.

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Science and technology critical

Key transformative technologies

1. Plant and animal genomics and related technologies
2. Human, animal and soil microbiota
3. Digital technologies
4. New technologies for food processing
5. Transformation in the food value chain system

Linkages between these technologies obvious

Global Opportunities (examples)

- Gut Microbiome
- Develop healthy food products for different life stages
- New automation and IT-tools in food handling
- Improve food product shelf life
- Novel ingredients
- Sell sustainability
- Smart ingredients

Increasing need for technological solutions by industry and policy makers

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But from change and challenge comes opportunity.

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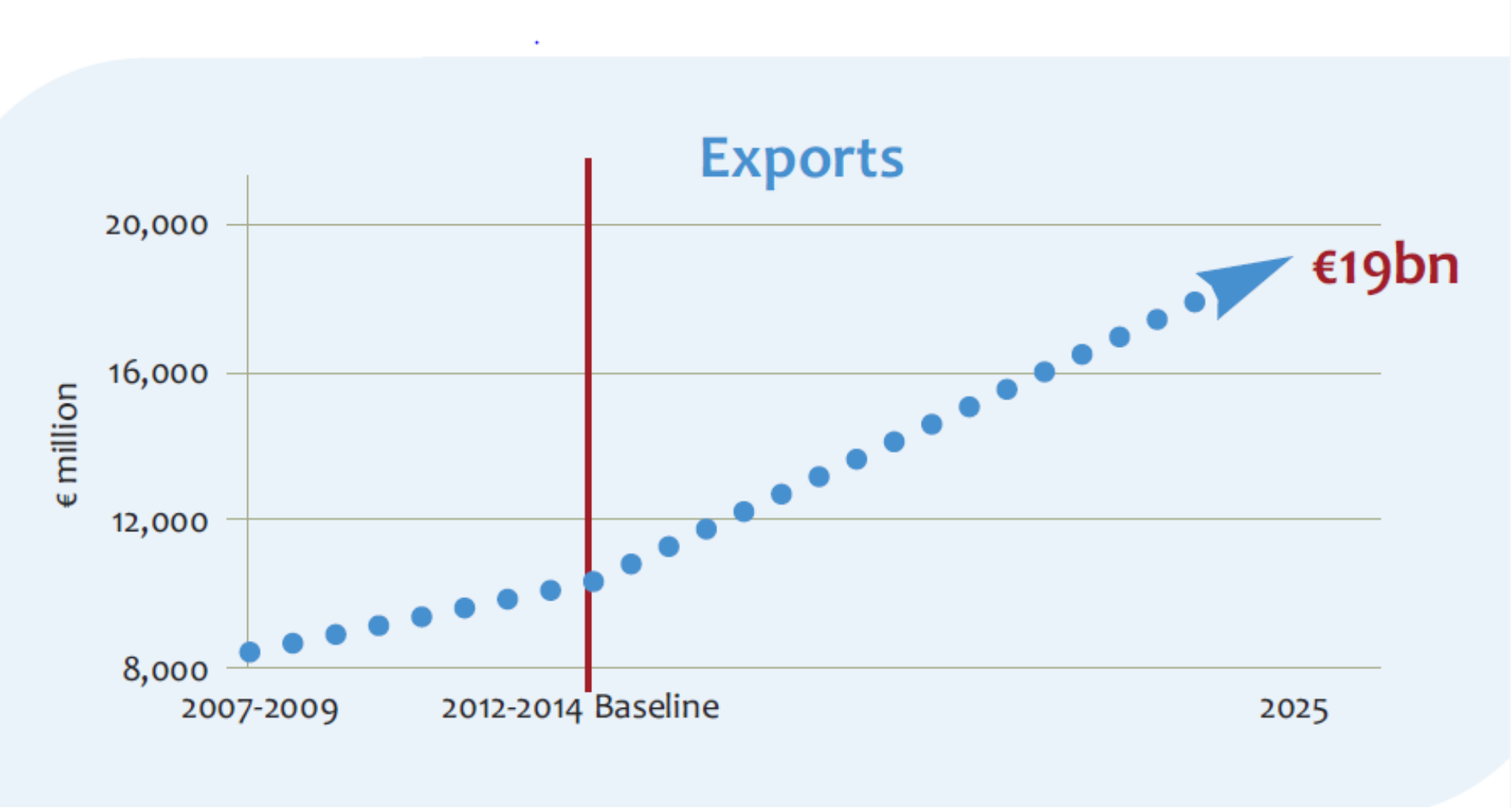
Future profitability and viability will be driven by productivity improvements through the adoption and application of cutting-edge sustainable processes and technologies.

National Strategy



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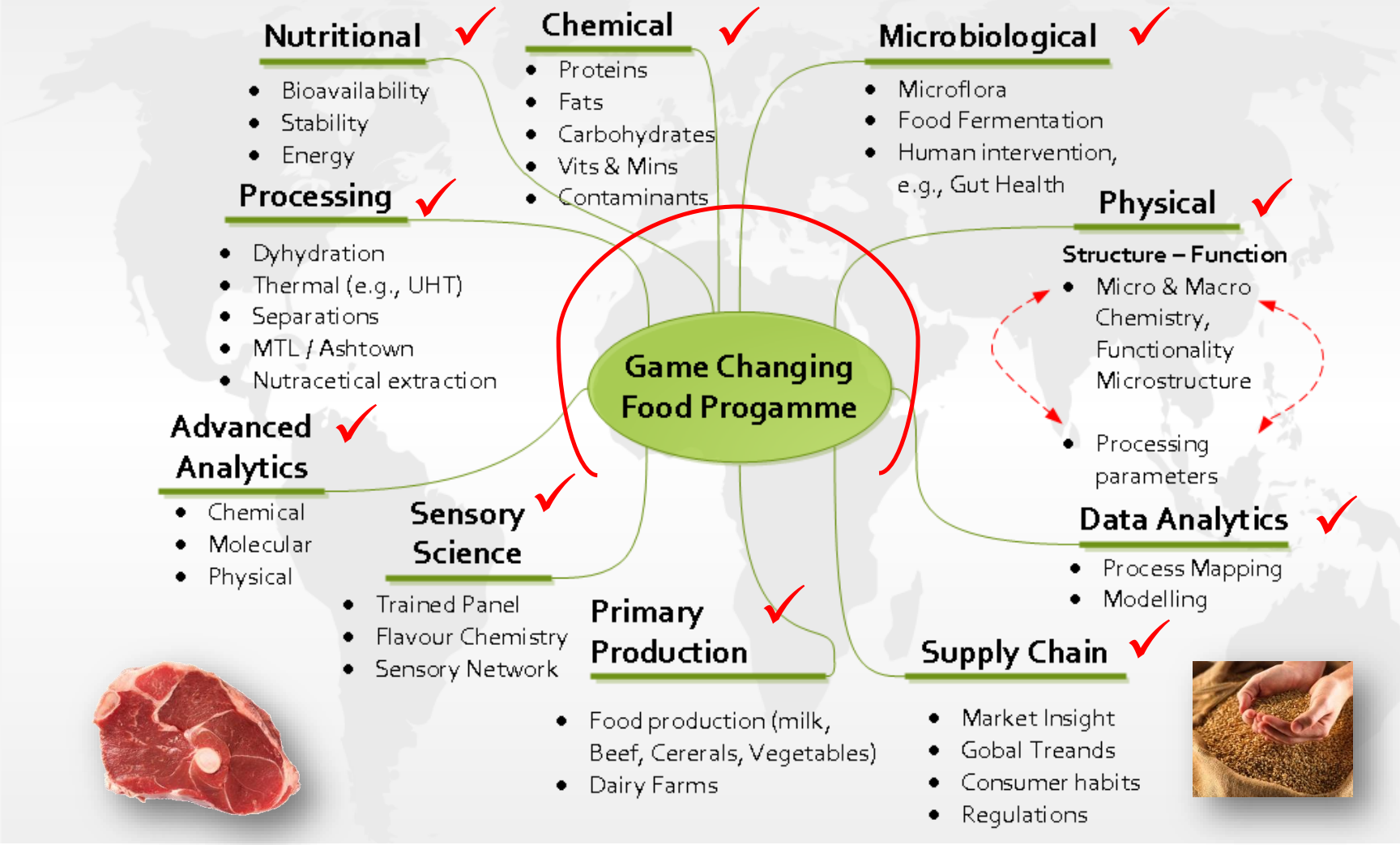
Teagasc Food Research and Innovation Programme



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Integrated Approach

On Farm

Pasture

Animal Breeding

Animal Welfare

Sustainable Systems

Off Farm

Quality

Meat safety

Markets

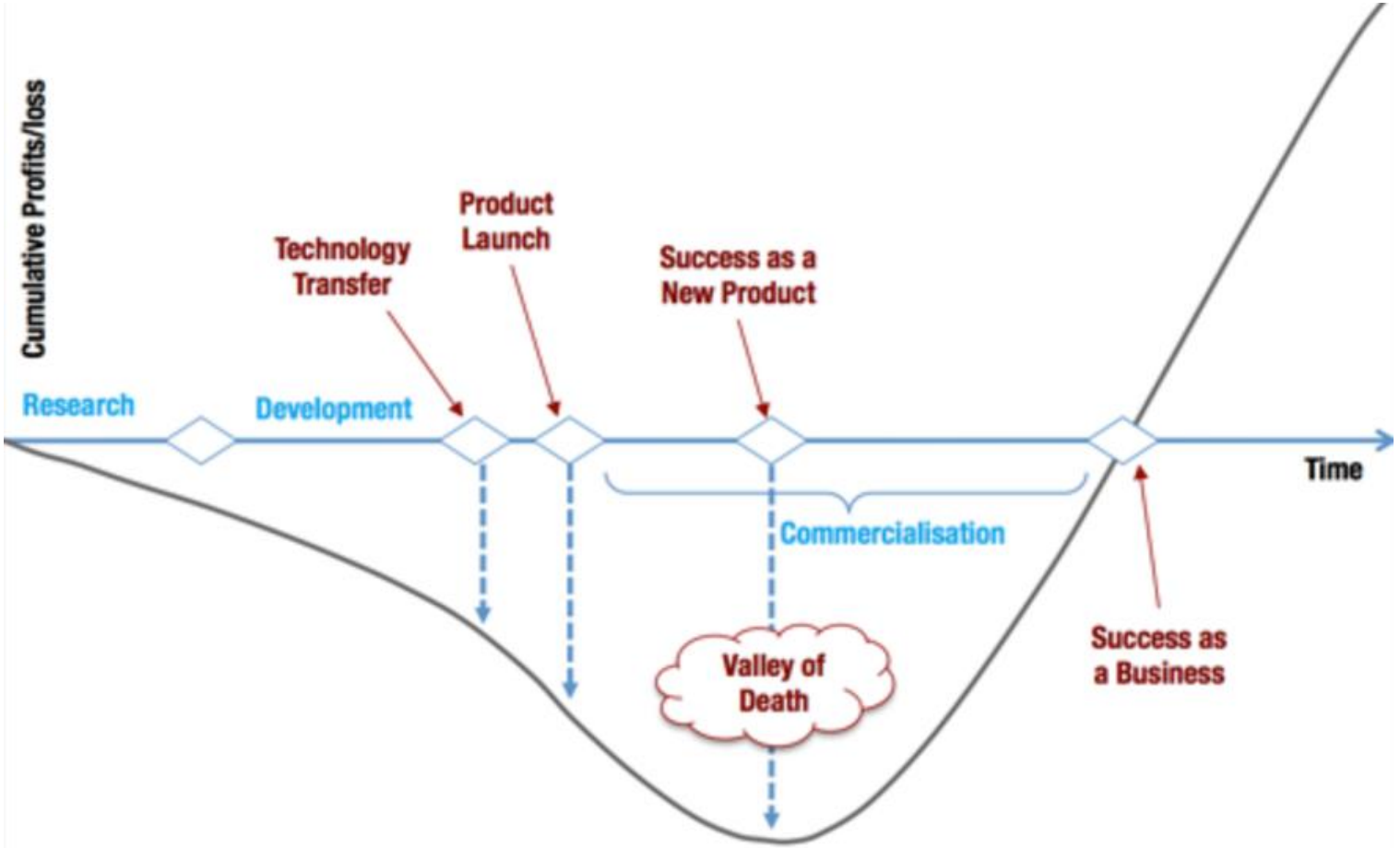
Consumer

Health

New products

Processing

Points of Focus



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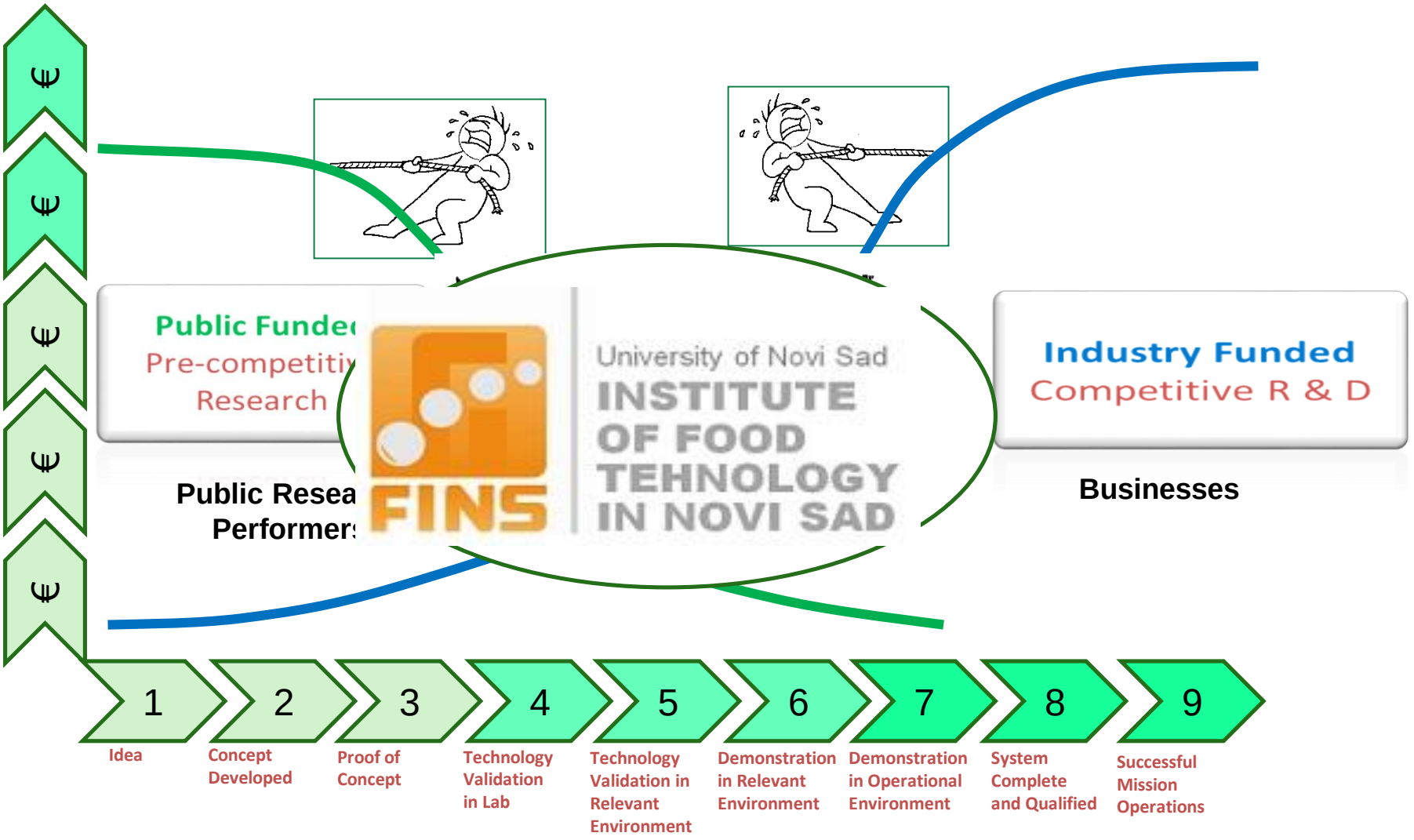
Innovation Eco-system



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Teagasc-industry engagement model

R& D → MARKETS CONSUMERS INDUSTRY NEEDS → € IMPACT




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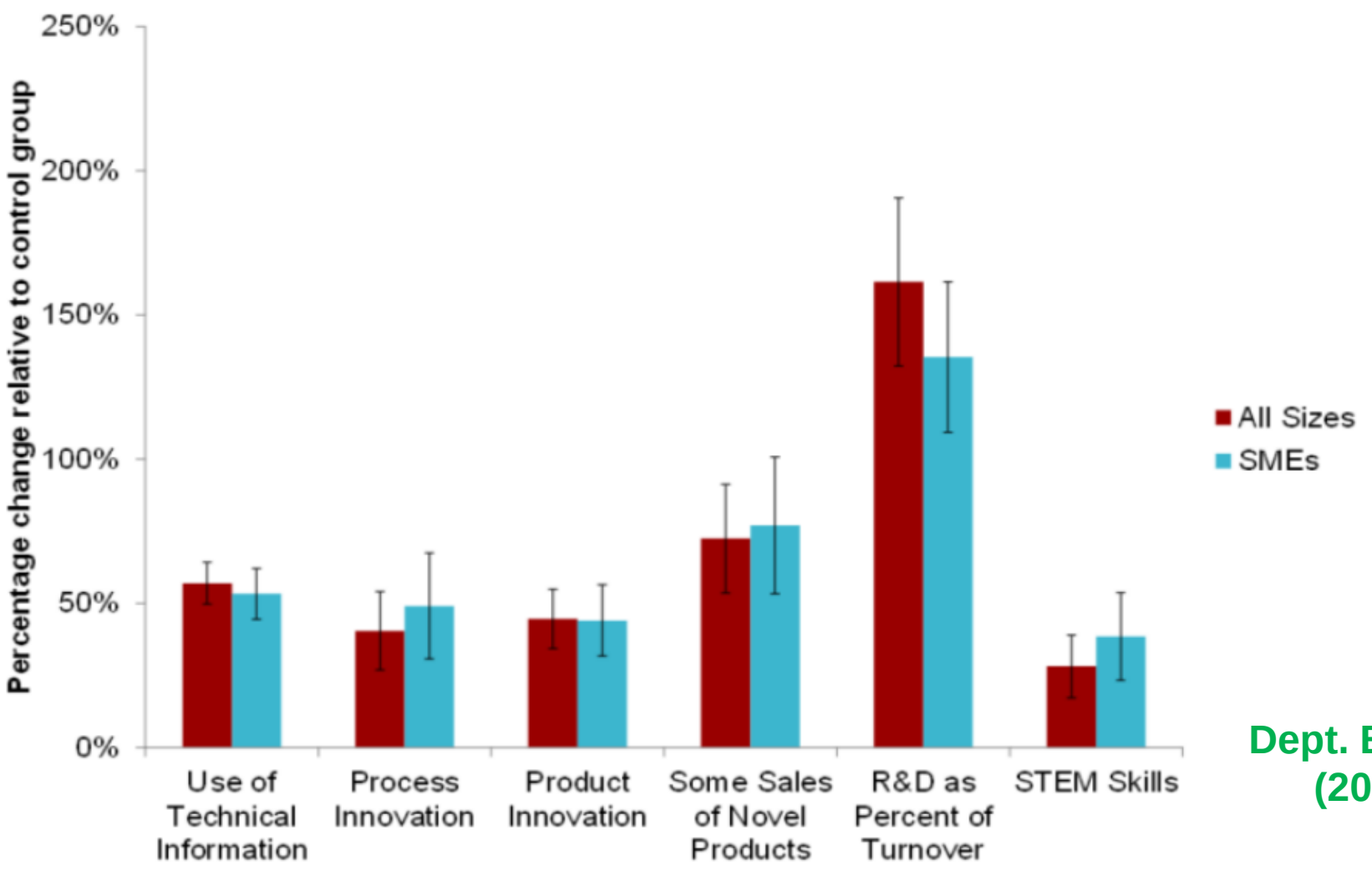
Impact of collaborative research between industry and PRO.



Dept. BIS UK (2014)

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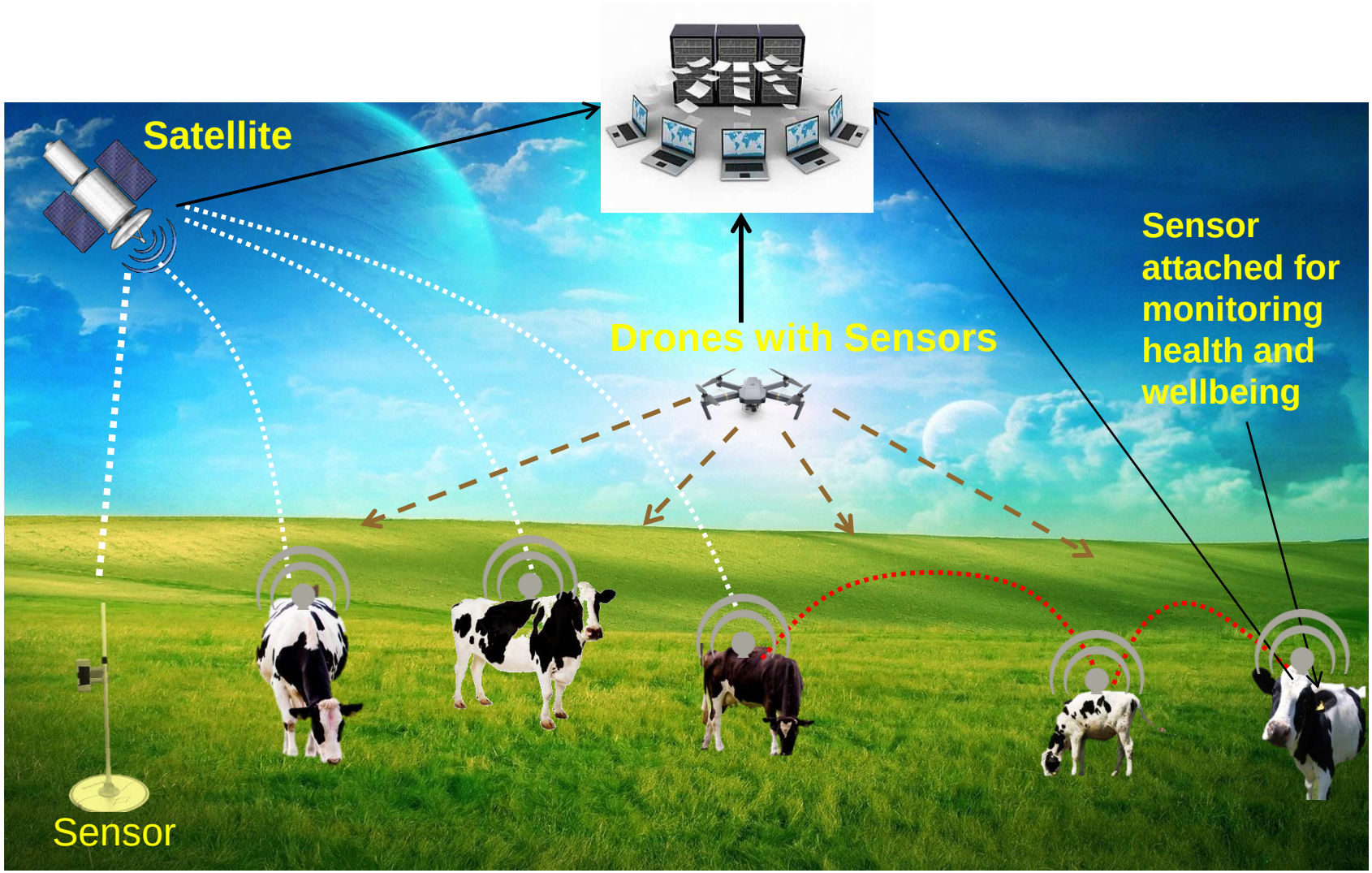
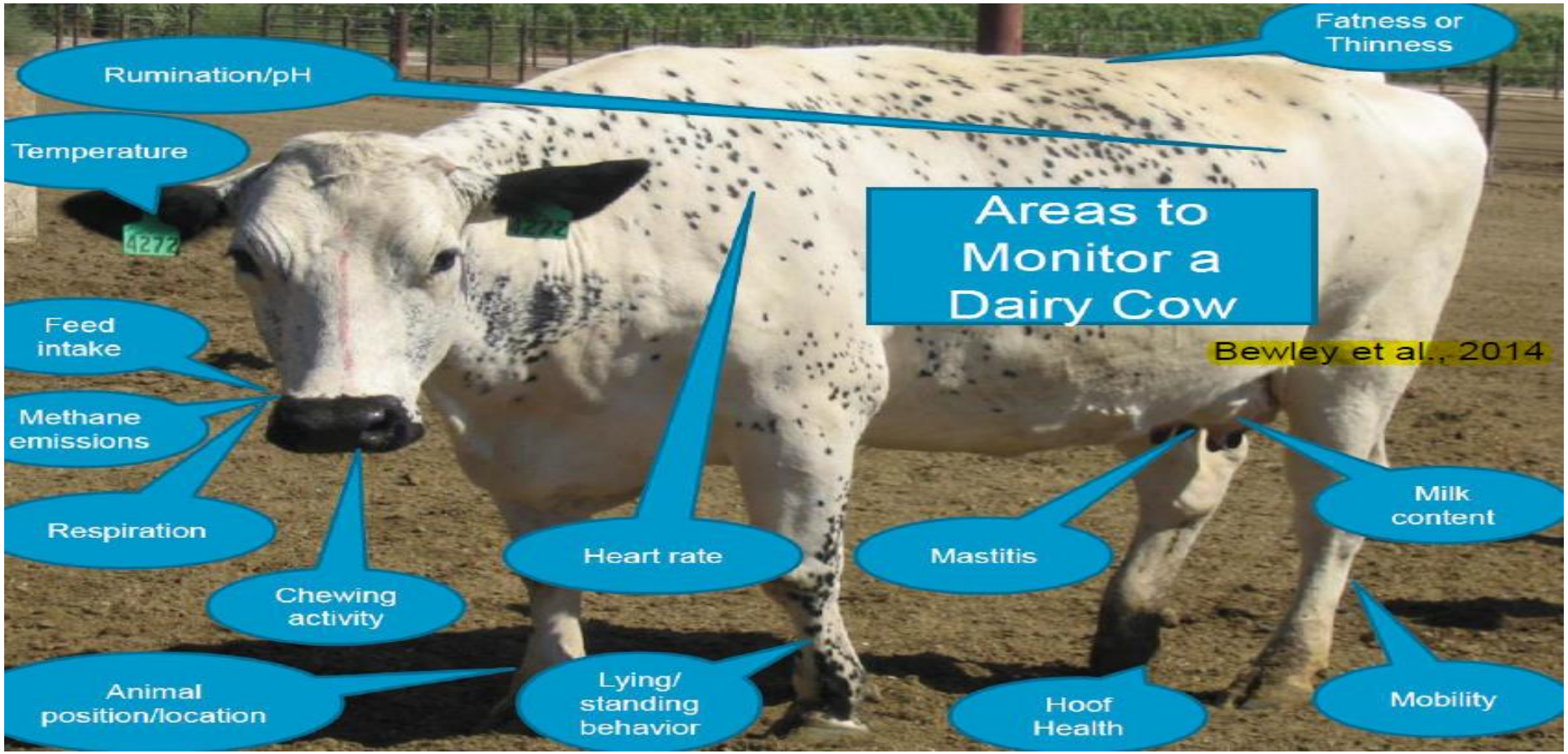
Innovative Technologies at Farm Level



Precision Livestock Farming



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Example in meat

- Animal Cleanliness
- Hide/Fleece removal
- Evisceration
- Carcass interventions
- Carcass chilling
- Aerial decontamination
- Boning out
- Meat packaging and distribution
- Meat: In pack interventions
- Spoilage bacteria impacting on shelf-life
- Quality factors impacting on shelf-life
- Shelf life prediction models

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Processing technology

Chemical additives
Chilling
Freezing
Pickling/Curing
Dehydration
Smoking
Irradiation
Aseptic Processing

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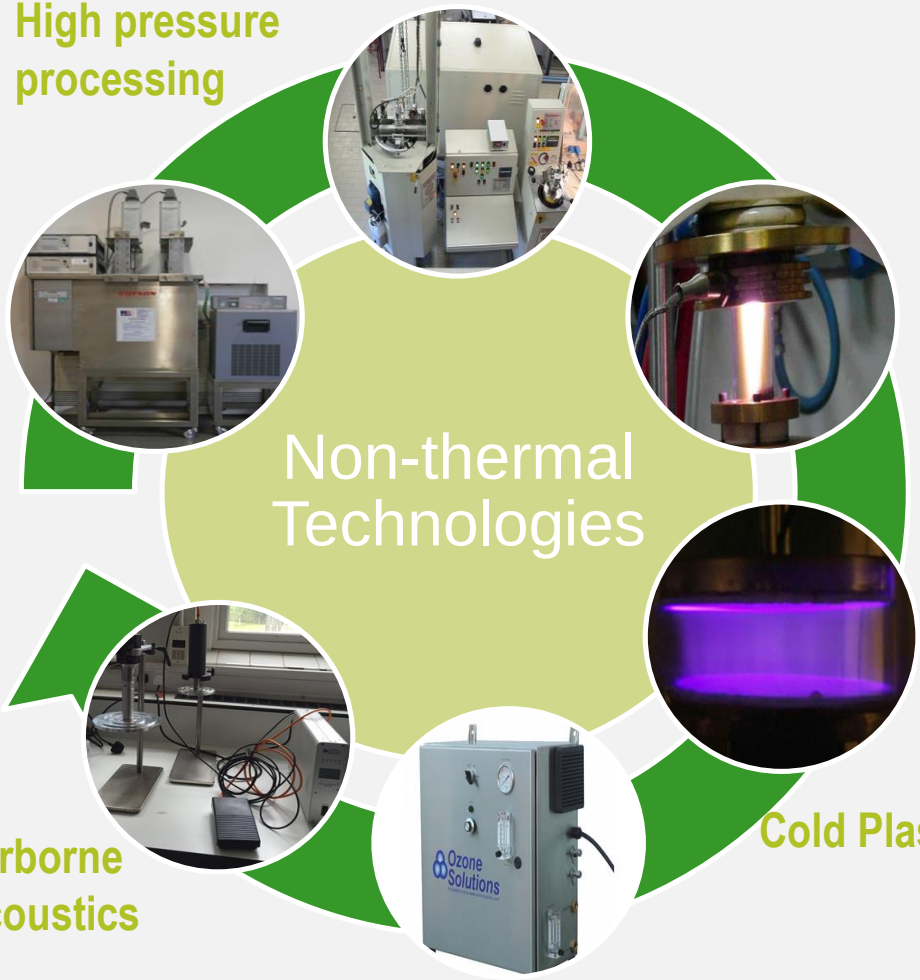
Novel food processing technologies @Teagasc Food Research Centres



- **Ensure food safety**
- **Improved shelf life**
- **Nutrient retention**
- **Environmental friendly**
- **Process efficiency**

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High Pressure Processing

Pressures of up to 1000 MPa (typical pressure range: 300 to 700 Mpa) is

Who do we trust?

Courtesy of Food RisC Project

Lack of trust – who are the weakest links?

	Trust in food chain			Trust in regulators		
Country	Farmers	Food manufacturers	Supermarkets	National government	European institutions	(E)FSA
United Kingdom	67%	43%	48%	52%	48%	68%
EU	**61%**	**38%**	**35%**	**52%**	**65%**	**73%**
France	62%	26%	27%	39%	56%	69%
Germany	43%	23%	27%	47%	51%	58%
Italy	58%	41%	47%	46%	64%	67%
Latvia	62%	26%	25%	23%	62%	60%

	Trust in informers				
Country	physician, doctors, health professionals	friends and family	information found on the internet	consumer organisations	environmental protection organisations
United Kingdom	90%	79%	35%	70%	61%
EU Mean	**87%**	**85%**	**42%**	**74%**	**70%**
France	92%	79%	29%	85%	76%
Germany	75%	82%	45%	81%	79%
Italy	75%	81%	44%	71%	69%
Latvia	76%	94%	38%	51%	57%

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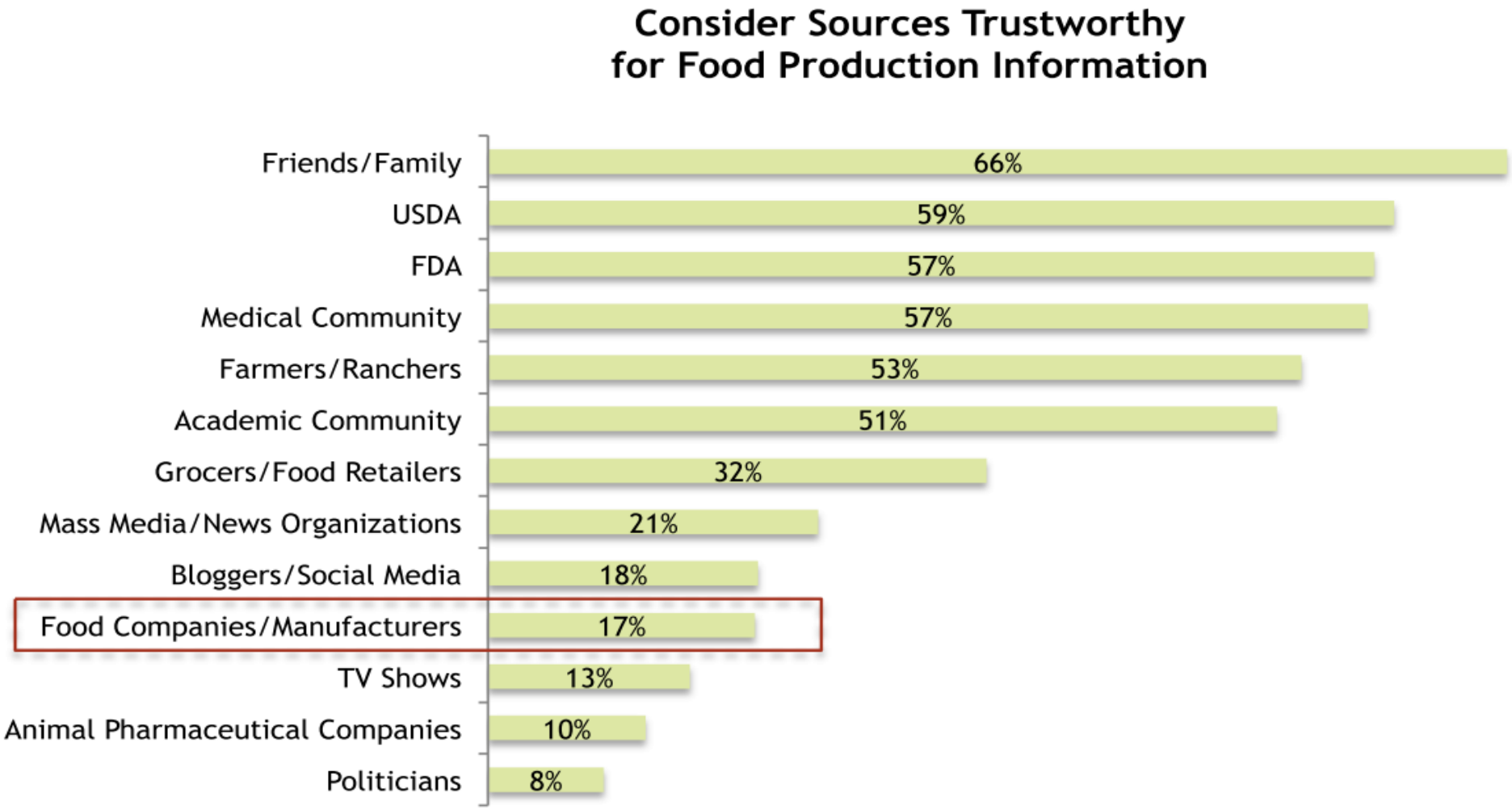
In US….



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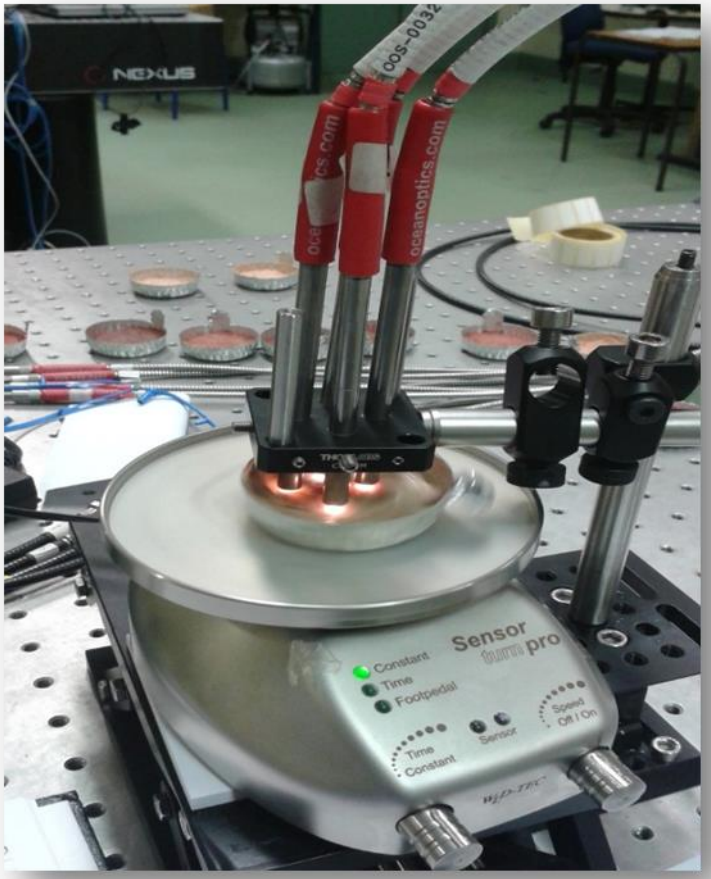
New Food Technologies (NFTs)

- NFTs are scientific and technological developments that may be adopted by industry to enhance the way food is produced or processed.
- They may or may not result in differentiated products for consumers.
- New technologies are not equally acceptable
- The public are not homogenous in their evaluations of them.
- Appreciating the determinants of public evaluations of NFTs prior to product development and market commercialisation is necessary to guide food firms' strategies and inform government policy.



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Important Factors for Acceptance

- Initial evaluations (and thus attitudes) are generally negative and not stable.
- Technologies that are viewed as tampering with nature result in more emotional responses.
- People seek products with observable and unique benefits of significance and are cautious in the face of perceived risk/ uncertainty.
- Consumer acceptance is an evolutionary views, rather than a revolutionary process.

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Food Technology Neophobia Scale (FTNS)

- **Innovations in the food industry are often not well received by the market, partly due to a phenomenon known as neophobia, which is the rejection that some people present towards new or unfamiliar foods.**

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Food Technology Neophobia Scale

Averages values and standard deviation (SD) of familiarity and willingness to try foods produced by different technologies.

Technology	Familiarity	Willingness to try
Traditional	6.2 (1.3)^{a}	5.9 (1.5)^{ab}
Pasteurisation	4.9 (2.1)^{b}	5.4 (1.7)^{b}
Organic	3.0 (2.1)^{c}	6.0 (3.6)^{a}
Genetic modification (GM)	2.0 (1.4)^{d}	3.6 (2.1)^{c}
Bioactives	3.2 (2.2)^{c}	5.7 (1.7)^{ab}
Nanotechnology	1.9 (1.4)^{d}	3.9 (2.1)^{c}

- ***D.N. Cox , G. Evans Food Quality and Preference 19 (2008) 704–710***

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Lessons from Irish Survey Results

- **Campaigns that incorporate improved convenience, naturalness, taste and benefit for the consumer could have a positive impact on consumers food choice, particularly when the message is concise and from trusted sources.**
- **Consumer acceptance is driven by risk perception rather than the technical risk estimates provided by experts.**
- **Women are more concerned, less positive, and likely to perceive fewer benefits of novel food technologies than men**

How accepting are Irish consumers of novel food technologies?

E.J. Dillon,[1*] M. Henchion,[1] S. McCarthy,[1]

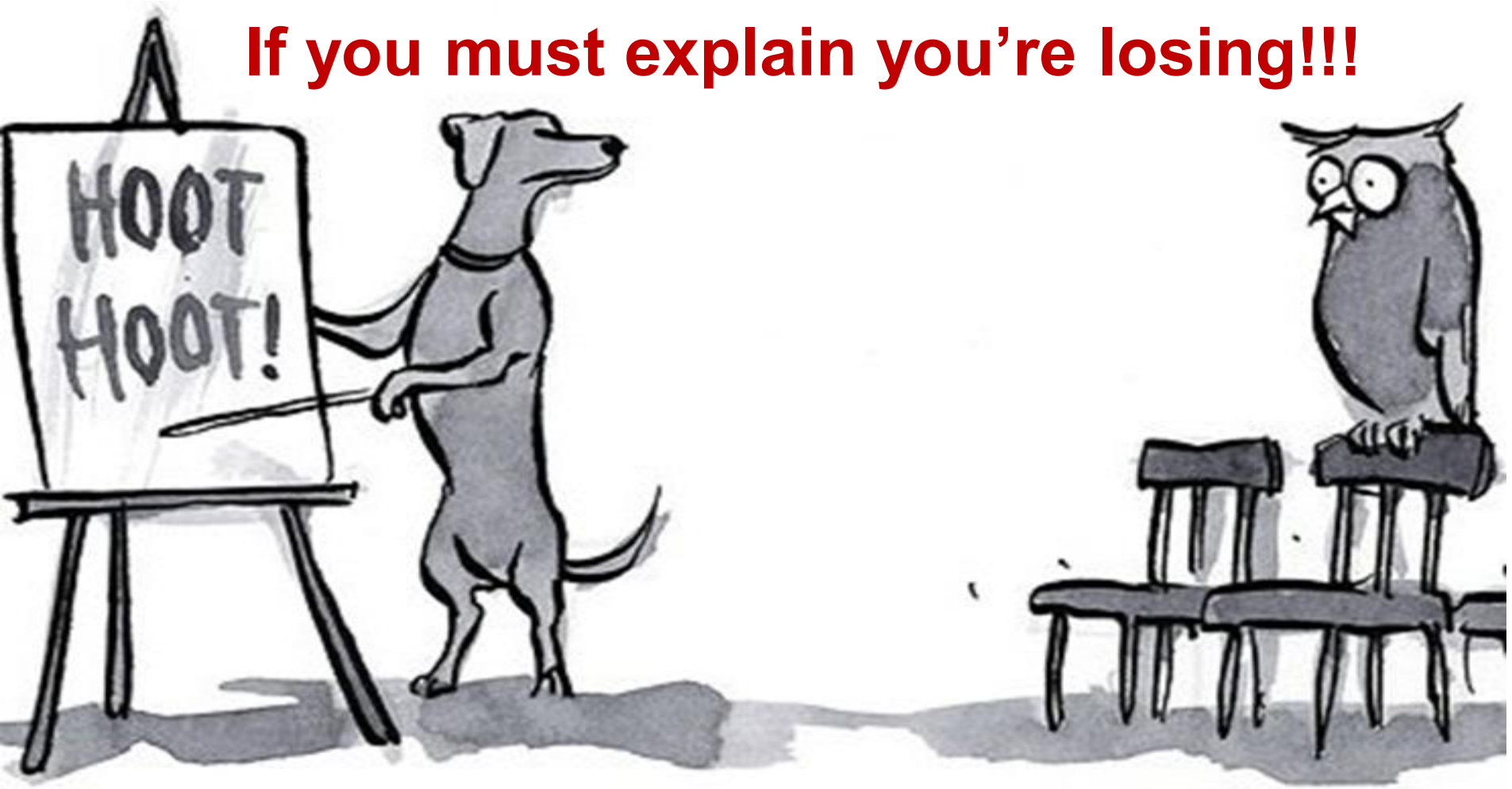
G.Greehy,[2] M. McCarthy,[2] & G. Williams[3]

[1] Dept. of Agrifood Business & Spatial Analysis, Teagasc, Ashtown, Dublin 15.

[2] Dept. of Food Business and Development, University College Cork.

Role of Labels

If you must explain you're losing!!!



possibility of translation

48-56

into positive purchase behavior.

Terminology Important eg PEF

- ‘Micro pulse’ creates better associations than pulsed electric field.
- The terminology ‘minimally processed product’ used on the label induces negative feelings in the consumers and means that the product was not ‘well processed’

Jaegar et al. Innovative Food Science and Emerging Technologies 29 (2015) 87–93

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Innovation is a key driver of growth

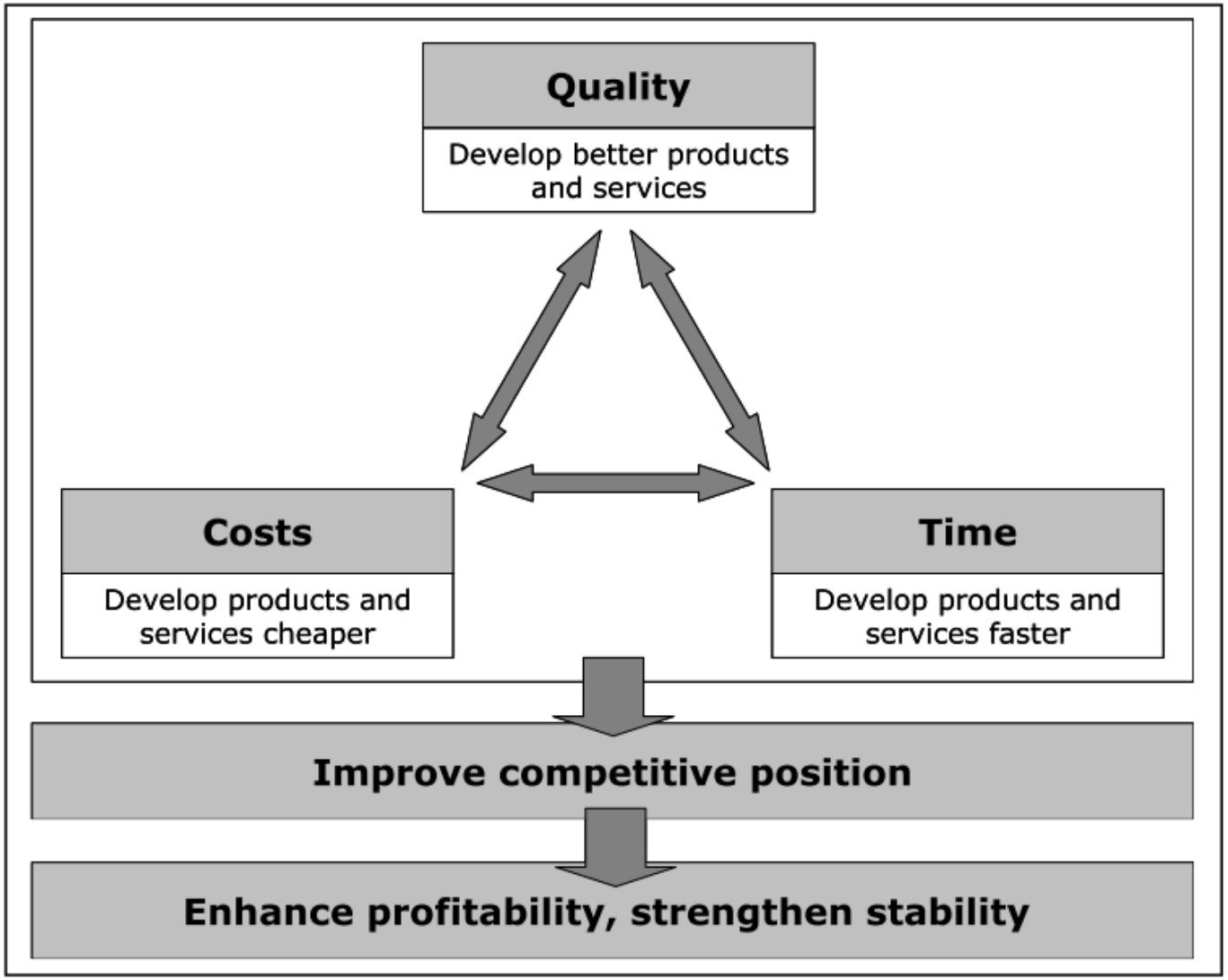
- **Innovation** – the introduction of a new or significantly improved product (good or service), process, or method
- **Entails investment** aimed at producing new knowledge and using it in various applications

Economic Imperative

- Innovation will be one of the keys to accelerating recovery and putting countries back on a path to sustainable – and smarter – growth.

- Yet the crisis itself poses a number of serious risks and challenges to the innovation ecosystem.

Why innovate??



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Requirements for Innovation

- Strong infra structures that support innovation including **human capital** and **physical resources**
- **Public and private investment**
- Linking mechanisms that help match supply and demand
- **Scientific and technological platforms**
- Well educated personnel

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Innovation Ecosystem

The innovation eco-system is a connection between the generation of knowledge and the application of that knowledge on a commercial basis.

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Specific Issues in Food Innovation

- Food is perishable
- Part of a complex chain
- Seasonable
- Consumer awareness
- Fragmented industry
- Retailer dominance
- Don’t touch my food (highly regulated)
- Conservative industry
- Low absorption capacity and low research and development spend of food sector
- Food innovation is highly contextual
- Must meet a consumer demand
- Consumer and industry conservatism

Issues that Need to be Addressed

- **Greater understanding of knowledge transfer is required between researchers and industry in order to commercialise research outcomes**
- **Potential opportunities are not always recognised by either party.**
- **Researchers and industry have different agendas where research is concerned.**
- **For researchers, success is often regarded as producing publications and winning new grants, this does not necessarily incentivise them to focus on translating their research into business opportunities.**
- **Both are approaching research with two very different mandates requiring expectations to be managed**
- **Extent of direct personal involvement (relational intensity)**
- **The relative importance of transfer channels varies**

"Capture latent value in stranded projects, and accelerate the path to market for innovation."

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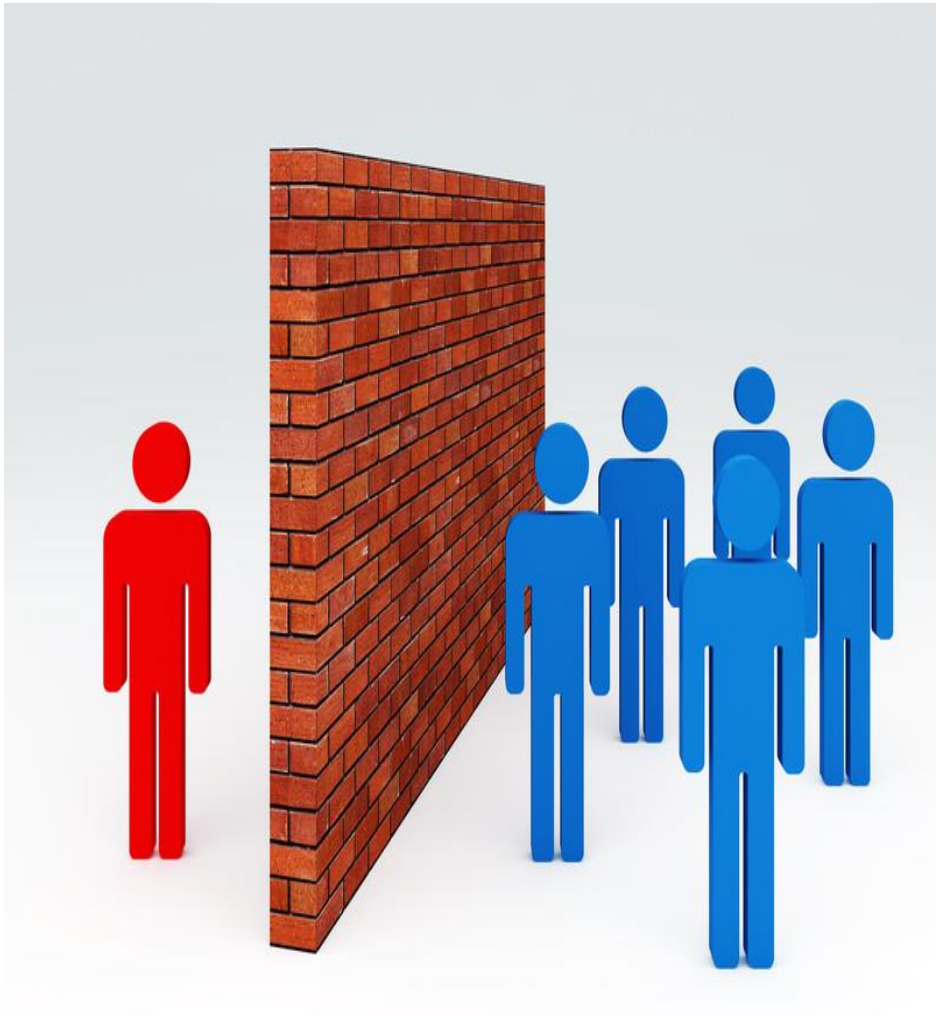
Barriers to effective TT

- Lack of spend by companies
- Talent investment
- **Absorption capacity**
- **Assimilate and understand new information**
- Cost and risk of getting involved
- Lack of time
- Innovation before its time.
- Fragmented industry and research community
- **Lack of effectiveness of interactions with scientists**
- **Lack of market knowledge**
- Lack of senior management commitment



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Key People and Supports Needed

- **Researcher – fully committed, aware of technological opportunity and our strategy, customer friendly and focused, entrepreneurial skills**
- **Industry- fully committed, solution focused, appropriate absorption capacity**
- **TTO- fully supportive, coordinated, empathic, time conscious, IP identification and management, a conduit to bring funded projects to commercialization stage, clear process, use of ICT**

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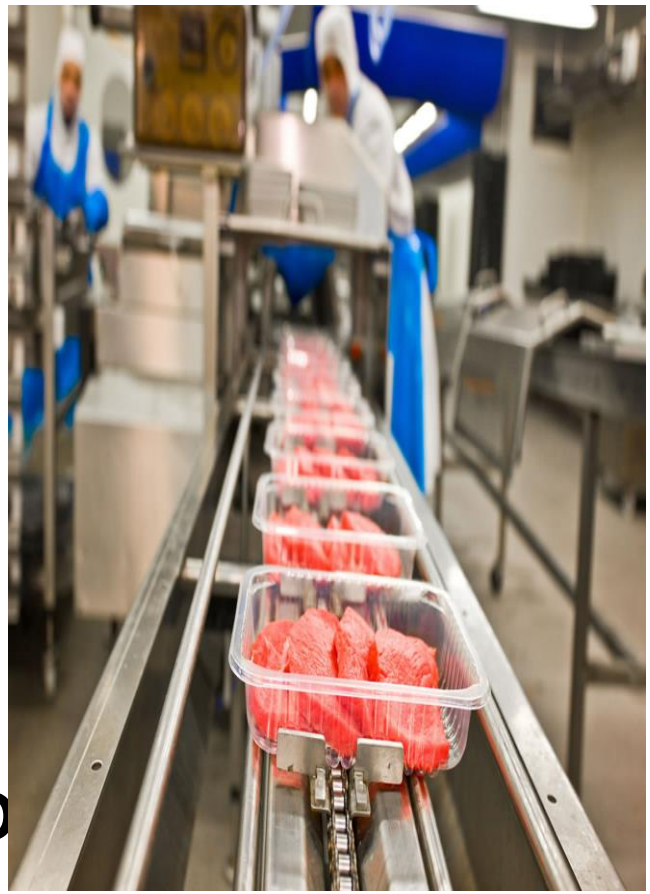
Industry Perspectives

- Financial bottlenecks
- High risks
- Shortage access to skilled personnel
- Limited internal management
- Market knowledge
- Lack of IP rights
- Complex IP negotiations with PRO



New look at TT Metrics

Mechanism of Knowledge Transfer	Measures of Quantity	Measures of Quality
Networks	# of people met at events which led to other Knowledge Transfer Activities	% of events held which led to other Knowledge Transfer Activities
Continuing Professional Development (CPD)	Income from courses, # of courses held, # people and companies that attend	% of repeat business, customer feedback
Consultancy	# and value/income of contracts, % income relative to total research income, market share, # of client companies, length of client relationship	% of repeat business, customer feedback, quality of client company, importance of client relative to their company
Collaborative Research	# and value/income of contracts, market share, % income relative to total research income, length of client relationship	% of repeat Business, customer feedback, # of products successfully created from the research
Contract Research	# and value/income of contracts, market share, % income relative to total research income, length of client relationship	% of repeat Business, customer feedback, # of products successfully created from the research
Licensing	# of licenses, income generated from licenses, # of products that arose from licenses	Customer feedback, quality of licensee company, % of licenses generating income
Spin-Outs	# of spin-outs formed, revenues generated, external investment raised*, market value at exit (IPO or trade sale)	Survival rate, quality of investors, investor/ customer satisfaction, growth rate
Teaching	Graduation rate of students, rate at which students get hired (in industry)	Student satisfaction (after subsequent employment), employer satisfaction of student
Other Measures	Physical Migration of Students to Industry, Publications as a Measure of Research Output	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Teagasc Technology Transfer Channels

- IP Exploitation (patents, licenses, spin outs)
- Collaborative Research Agreements
- Contract Research
- Strategic Partnerships
- Training
- Services
- Pilot Plant Leasing
- Partnerships
- Workshops
- Demonstrations
- Placements (in-company or in Teagasc)
- New!! Food Innovation Hub

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Food Technology & Knowledge Transfer Strategy

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Overall objective

"To implement a systematic, effective and flexible technology transfer process which supports commercial exploitation of our research outputs and scientific capability through various channels"

Central proposition : every researchers' responsibility

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GATEWAYS

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Development of a Technology Marketing Portfolio

- The Portfolio is updated on a six monthly basis and is re-issued before a Food Innovation Gateways event.
- The feedback in relation to our Portfolio from companies is very positive.
- Web based, hard copy, USB, DVD forms available.
- The potential to develop an app and also to engage in more social media are being explored.

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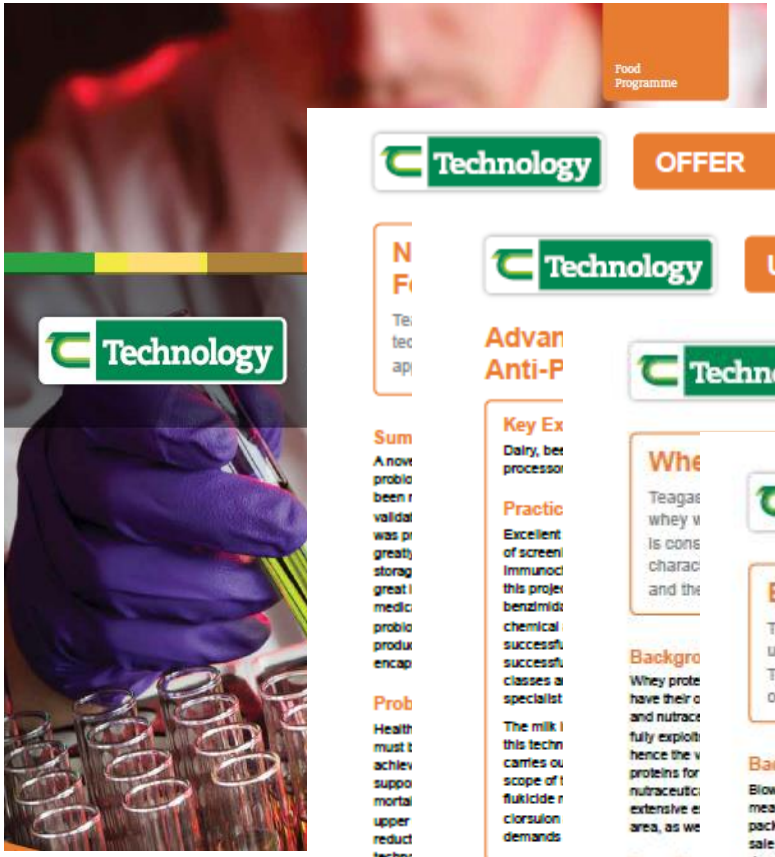

Technology OFFER

Technology UPDATE

Technology EXPERTISE

Technology SERVICE

Technology PROFILE

Dr. Martin Danaher

E-mail: martin.danaher@teagasc.ie
Phone: +353 (0)1 8059552

Education

Ph.D. in Analytical Chemistry, University College Cork 2003

B.Sc. Industrial Chemistry, University of Limerick, 1997

Career

2002–Present: Teagasc Food Researcher

1997–1998: R&D Chemist, Gerard Laboratories

1998–2002: PhD student – "Teagasc Walsh Fellow":

Expertise

- Analytical chemistry: Chromatographic separations, sample purification, mass spectrometry, biosensors and immunoassays.
- Residue analysis: Agrochemical, environmental, natural toxins and medicinal adulterants.

Selected Publications

1. O'Mahony, J., Moloney, M., McConnell, R.I., Benchikh, E.O., Lowry, P., Furey, A., and Danaher. M., (2011). Simultaneous detection of four nitrofuran metabolites in honey using a multiplexing biochip screening assay. *Biosensors and Bioelectronics* 26 (10), pp. 4076–4081.
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3. Whelan, M., Kinsella, B., Furey, A., Moloney, M., Cantwell, H., Lehotay, S.J. and Danaher, M. (2010). Determination of anthelmintic drug residues in milk using ultra high performance liquid chromatography-tandem mass spectrometry with rapid polarity switching *Journal of Chromatography A*, 1217 (27),

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Teagasc Gateways Events

- Four themed events (2 per year)

Brexit Technological Response

- Shelf life
- Add value
- Waste streams
- Implement new technologies
- Clean labels
- Lean
- Reformulation
- Diversification
- Food for life stages
- New product development

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Technology

CRM

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Customer Relationship Management (CRM)

- **The purpose of CRM is to efficiently and effectively increase the acquisition and retention of important customers by selectively initiating, building and maintaining appropriate relationships with them.**
- **It allows us to:**

· **Understand key customer groups**

· **Define what customers need and value**

· **Target customer groups**

· **Tailor products and services for customers**

· **Refine channel strategies**

· **Measure customer activity in relation to marketi**

campaigns, new product introductions, etc.

FOOD WORKS

CREATING GLOBAL FOOD ENTREPRENEURS

Bord Bia
Irish Food Board

ENTERPRISE IRELAND
where innovation means business

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THE IRISH TIMES

Wed, Mar 23, 2016

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Ornua opens new €20m cheese plant in Saudi Arabia

As well as supplying Saudi , facility will serve as hub for MidEast and North Africa region

Wed, Mar 16, 2016, 07:31 | Updated: Wed, Mar 16, 2016, 08:23

Eoin Burke Kennedy

Licence2Market award

Sunday Business Post

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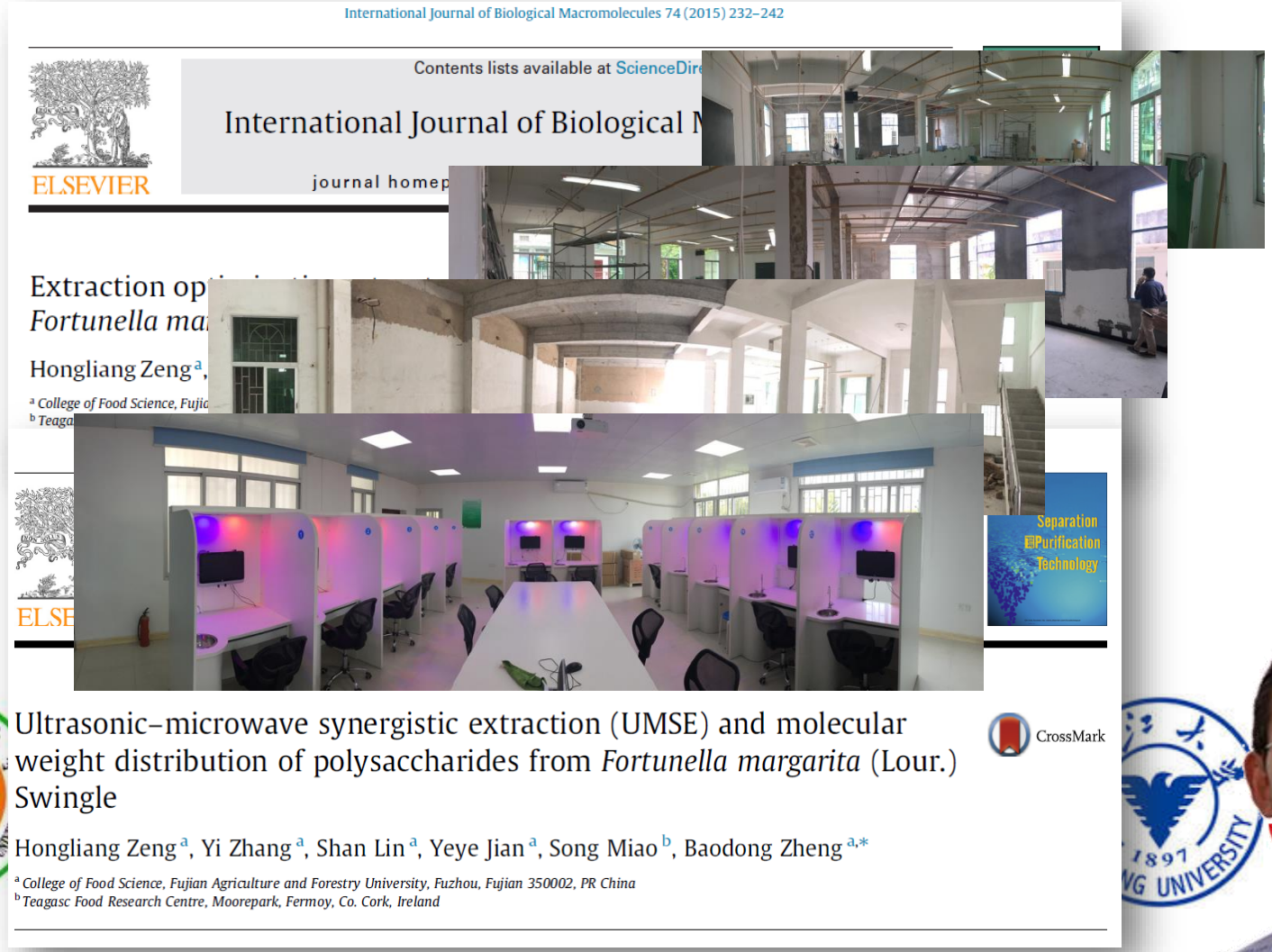
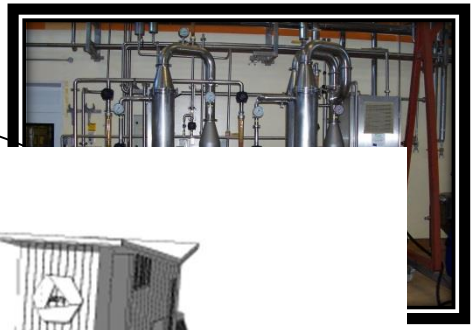
Lotto

Ornua opens €20m Cheese facility in Saudi Arabia

Teagasc Collaborating Universities in China





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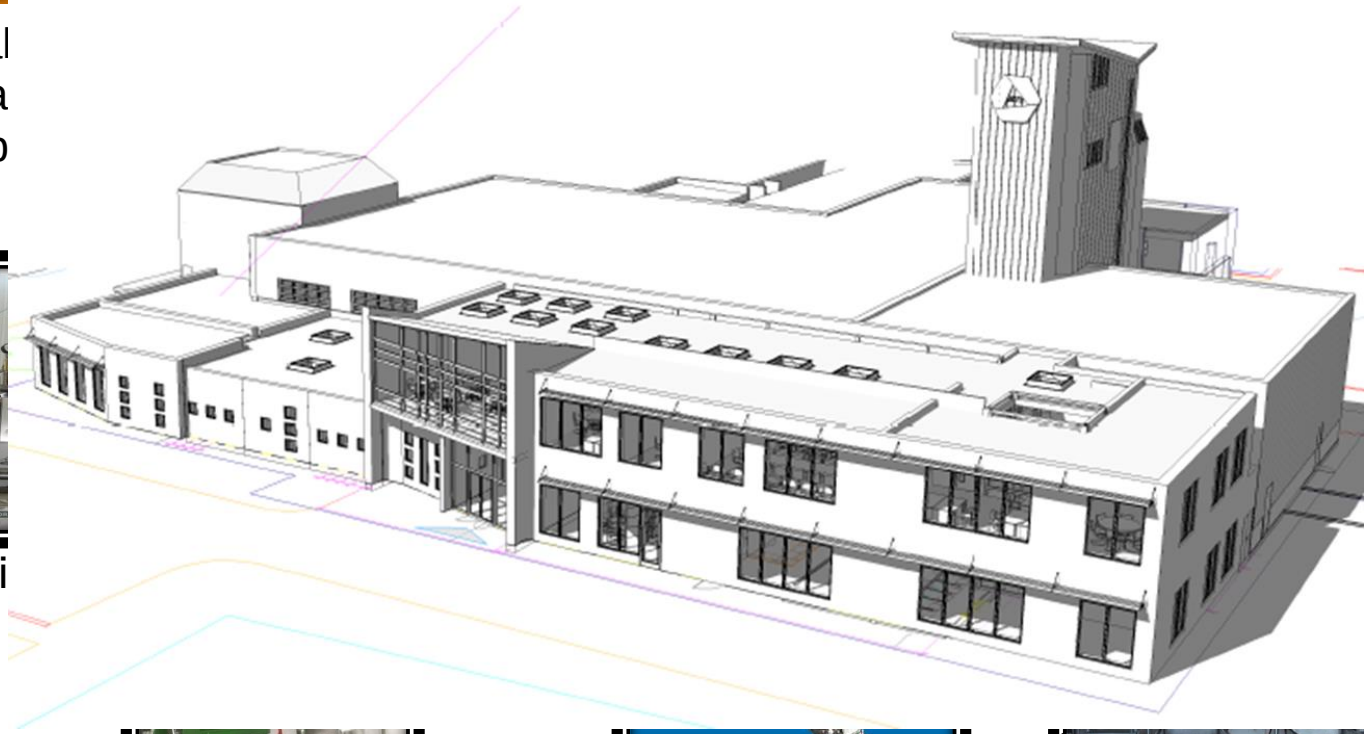
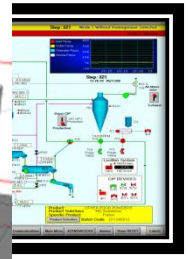
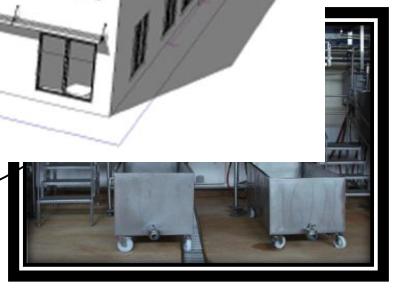


Food Applicati



nd Drying



Cheese-making

Fermentation

Ingredient development

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Issues that Need to be Addressed

- Greater understanding of knowledge transfer is required between researchers and industry in order to commercialise research outcomes
- Potential opportunities are not always recognised by either party.
- Researchers and industry have different agendas where research is concerned.
- For researchers, success is often regarded as producing publications and winning new grants, this does not necessarily incentivize them to focus on translating their research into business opportunities.
- Both are approaching research with two very different mandates requiring expectations to be managed
- Extent of direct personal involvement (relational intensity)
- The relative importance of transfer channels varies

Modern Technology Transfer Offices

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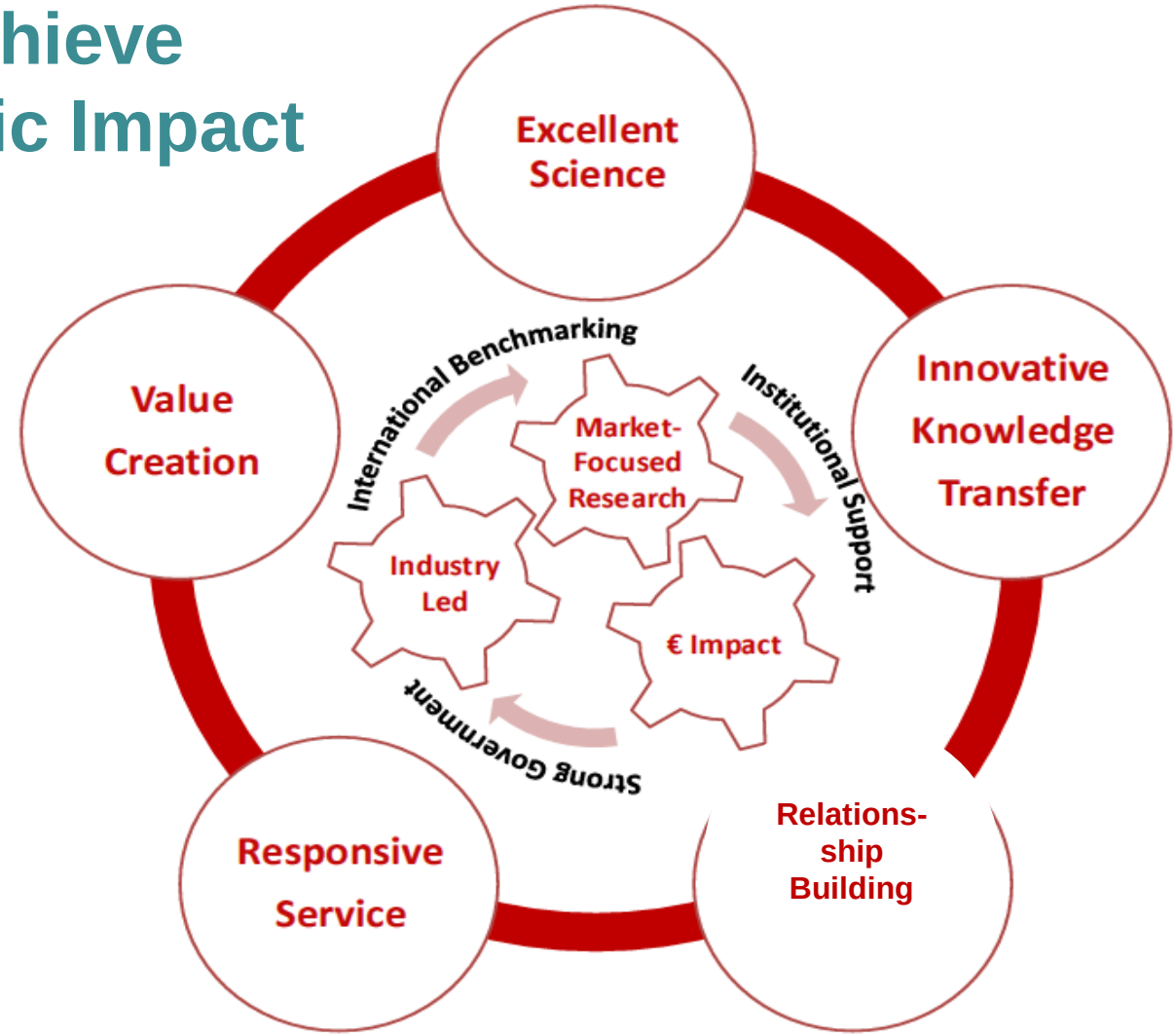
Pushing Research to Achieve Economic Impact



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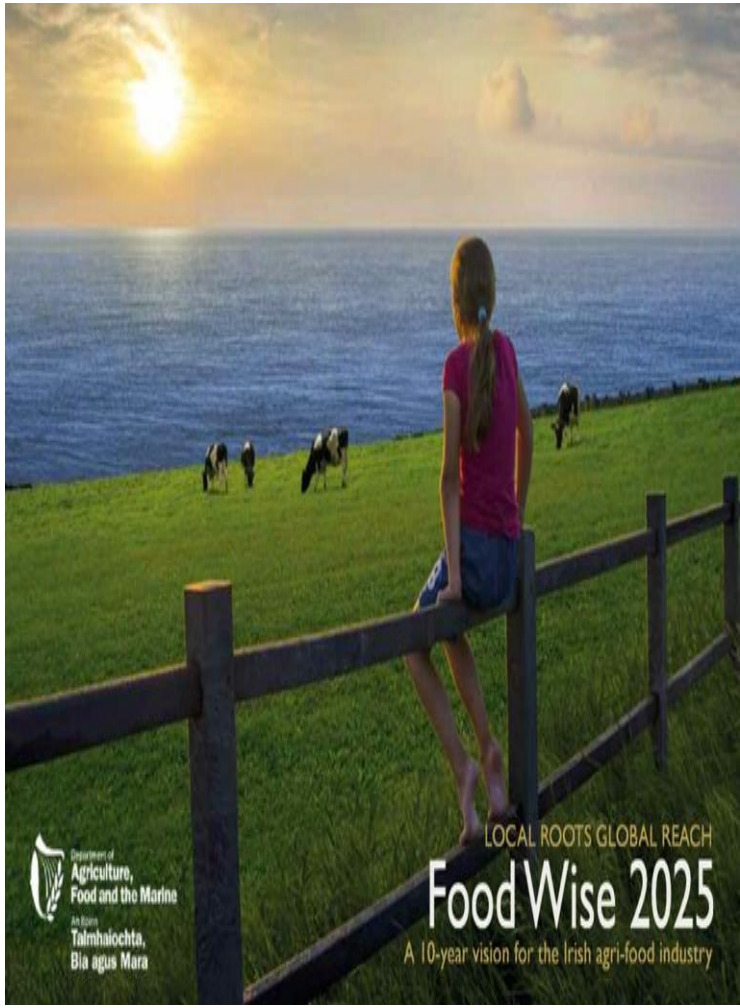
Conclusions

- Complexity in system – Gateways Portfolio, CRM
- People focused- trustworthy, measures and incentivises, leadership developent
- Dialogue initiated- Gateway events, accessibility of resources, promote awareness and successes, shared vision, increase mobility including students
- The “Valley of death” – collaborate with industry
- TTO bureaucracy – need to deliver impact, pro-active, easier to do business with, translational metrics
- National innovation landscape- collaborate with other agencies
- Senior management support and buy -in

Teagasc Innovation Actions

- Develop an industry-based student exchange scheme to enhance the scientific absorption capacity of the food SME sector.
- Teagasc to develop proposals for a Food Innovation Hub to deliver a step change in innovation activity in the food industry.
- Teagasc will lead research in collaboration with other research institutions and industry to derive applications from the significant state investment in foods for health.
- Teagasc and the dairy industry to complete the €10 million upgrade of Moorepark Technology Limited pilot plant.
- Exploit potential of genomics to add value at farm level
- Establishment of the Meat Technology Centre
- Create a virtual multi- campus centre of excellence for seafood development in Ireland.



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INNOVATION

Executive Summary

Vision

We have built a strong research and innovation base in Ireland

We will become a Global Innovation Leader

We will increase public and private investment in research and development

We will enhance the impact of research and innovation for enterprise

We will ensure that education drives innovation

We will focus research and innovation activity on social and economic development

We will support Innovation through the protection and transfer of knowledge

We will engage with the rest of the world in becoming a Global Innovation Leader

We will effectively implement this strategy to become a Global Innovation Leader

EXCELLENCE TALENT IMPACT

Ireland's strategy for research and development, science and technology

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THIS PROJECT IS FUNDED BY THE EUROPEAN UNION

Ministry of Education, Science and Technological Development

INNOVATION FUND

WORLD BANK GROUP

Innovation Serbia Project

€8.4 million, financed by the EU through Instrument for Pre-Accession Assistance (IPA)funds and administered by the WB

- **C1: Capacity building of the Innovation Fund**
- **C2: Piloting financial programs supporting enterprise innovation**
- **C3: Provision of technical assistance to selected Research and Development Institutions (RDI)**

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Conclusions

Business needs to proactively engage with knowledge providers with capability

Knowledge providers need to make it easy / easier to do so.

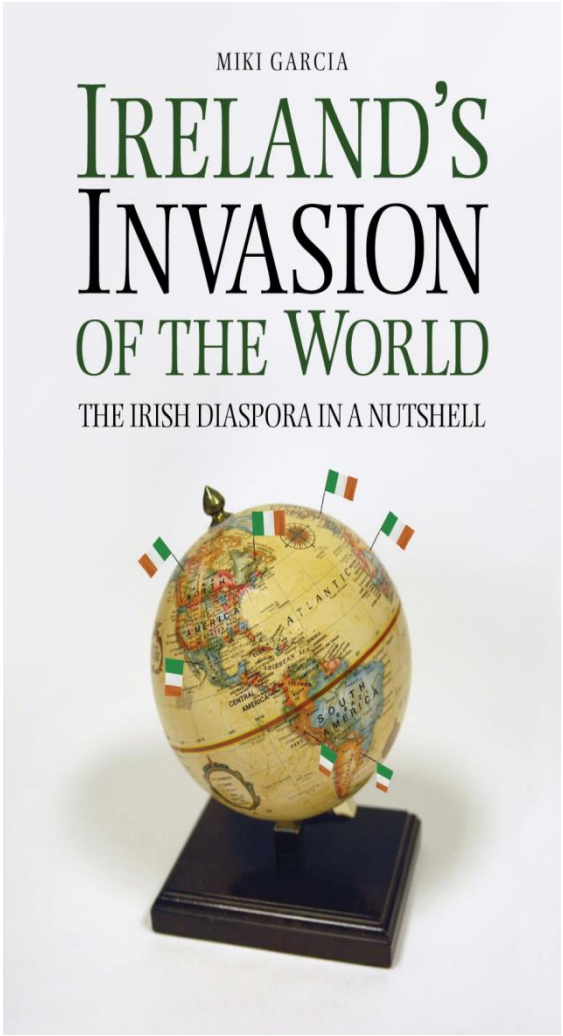
Big drivers and trends make this more urgent

Research and development landscape can be exploited

Identification of business opportunities is critical

Increased technological absorption capacity by companies is essential

Sectoral opportunities needs to be articulated especially in the PCF sector, joint agency / industry effort needed



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Conclusions

- Farmer, processor, retailer, consumers and scientists **communication must improve**
- **All players have a responsibility** to implement best practice based on good science
- It is our job to ensure that all players are aware of quality issues
- **Degree of trust, collaboration, and interaction among players sharing a common knowledge base.**
- Presence and quality of specialised education and training institutions supplying skilled human resources to work with and develop meat science.
- **Be a more proactive industry together**
- **Develop a strategic partnership with the research world at senior management level of all players**

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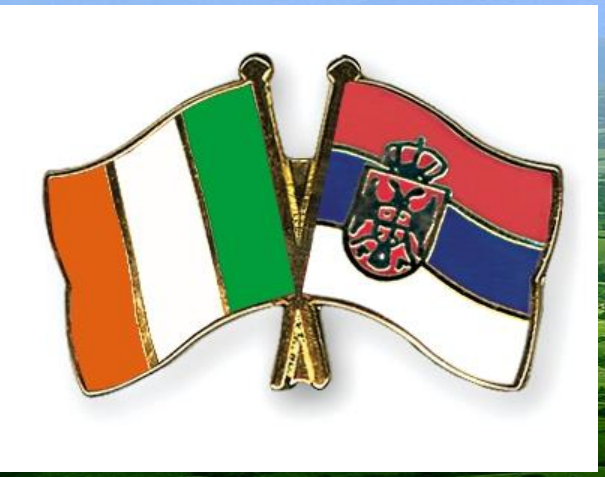
Modern Approaches to Technology Transfer for SMEs

Declan J. Troy, Assistant Director of Research,Teagasc, Ireland.



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