

# Transforming Food Production Challenge

## Alternative Proteins Roadmap Workshop

23 March 2021

Summary Report



# Alternative Proteins Roadmap Workshop Summary

The United Nations forecasts there will be a global protein deficiency of 60mn tonnes per annum by 2050. Many methods of protein production are damaging to the environment or excessively demanding in terms of energy inputs. Alternative methods of producing protein are required that can meet these rising global demands, whilst also reducing environmental impact through more sustainable production systems and practices.

The Industrial Strategy Challenge Fund Transforming Food Production (ISCF TFP) programme has made significant investments in three innovative projects (REACT-FIRST, Insectrial Revolution and AGRI-SATT) that have significant potential to address this protein deficit. An Alternative Proteins Roadmapping Workshop was held on Tuesday 23 March 2021 to develop a conversation between the ISCF TFP programme, participating funded companies and a selection of stakeholders to create a shared vision and roadmap for the UK alternative protein sector.

The ISCF TFP team and Liminal designed a workshop that encouraged and collated thoughts from participants in advance using a barriers and opportunities template with a focus on technical, commercial, regulatory and end-user & consumer issues over the short- (up to 12 months), medium- (1-3 years) and long-term (3-5+ years) timeframes. In addition, the three projects gave presentations to share their aims, objectives and sector insights ahead of breakout groups to develop a collaborative roadmap for the sector.

# Alternative Proteins Roadmap Workshop Attendees

## **REACT-FIRST Project**

- Polly Douglas (Deep Branch)
- Peter Rowe (Deep Branch)
- Joyce Tait (University of Edinburgh)
- Emily Burton (Nottingham Trent Uni)
- Ally Dingwall (Sainsbury's)
- Alan Raybould (University of Edinburgh)

## **Insectrial Revolution Project**

- Keiran Whitaker (Entocycle)
- Elaine Fitches (Durham University)
- Thomas Farrugia (Beta Bugs)
- Isabel Swinscoe (Beta Bugs)
- William Clark (Zero Waste Scotland)
- James McCulloch (AIC)
- Maureen Wakefield (Fera)

## **AGRI-SATT Project**

- Raffael Jovine (SuSeWi)
- Dicle Elif Tez (SuSeWi)
- Dmitry Aleynik (Scottish Association of Marine Sciences)
- Deniz Esra Kaya (SuSeWi)
- James Williams (Environmental Systems)
- Gideon Oberholzer (BSC Global)

## **Defra**

- Niall Bradshaw
- Victor Aguilera

## **UKRI / InnovateUK**

- Katrina Hayter
- Tom Jenkins
- Chris Danks
- Kathryn Miller
- Pelka Sanders

## **Liminal**

- Roland Harwood
- David Townson
- Peter Hutchison

## **High Value Manufacturing Catapult**

- Paul Shakspeare

## **Food Standards Agency**

- Paul Tossell

# Protein Challenges and Project Summaries

## **Protein - tradition and transformation**

Protein has been part of the human diet for thousands of years. Today, animal-derived proteins (dairy, meat and fish products) are a core part of human diets. The UK is dependent on imports of commodities such as soya and fishmeal to support the animal and aquaculture sectors. These industries have the potential to become more sustainable and resilient through increased domestic production of alternative protein sources, reducing current reliance on imports. As the world population increases to around 10 billion by 2050, pressure on land and resources will increase. Alternative proteins can mitigate against these impacts, reducing resource use and emissions in a way that acknowledges and supports meat-based diets geographically and culturally, whilst also creating an opportunity for new protein production and consumption practices.

### **REACT-FIRST Project**

Led by Deep Branch Biotechnology, will produce food for fish and poultry using carbon dioxide, applying a unique CO<sub>2</sub>-to-protein process with no requirements for arable land and minimal water usage.

### **Insectrial Revolution Project**

Led by Entocycle, Insectrial Revolution is developing a complete system demonstrator using black soldier flies to convert industrial-scale food waste from farms and factories into a sustainable insect-based animal feed and biofertiliser.

### **AGRI-SATT Project**

Led by SuSeWi, will combine data from an algae growing system using seawater to produce food in deserts, with satellite data to automate production and increase nutritional quality.

UK Alternative Proteins Roadmap March 2021		Short Term 6-12 Months		Medium Term 1-3 Years		Longer Term 3-5+ Years	
1. Commercial	Production Capacity	Lab scale production		Pilot plant production capacity		Access to large scale facilities	
	Market Development	Identify Export / Import Issues		Researching Markets		Develop Market Pull Opportunities	
2. Operations	Workforce Development	Define training and upskilling requirements for the sector		Upskilling and training programmes		Further assessment & development of upskilling requirements - roll out with relevant education institutions	
	Finance & Investment	Accessing Funding	Securing funds to demonstrate commercial viability		Communication value proposition to investors to deploy at commercial scale	Investment for Scaling (Government & Private Equity)	
3. Governance	Regulation & Legislation	Coordination between Regulators and Industry	Developing Regulatory Frameworks (post-pandemic/Brexit)	Develop QA / QC requirements assurance schemes	Develop carbon accounting framework and understand and LCA Frameworks	Carbon-trading legislation	
	Sector Strategy	Create a clear definition of the Alternative Protein sector	Creating a new industry	Establish sector-wide Trade Body (including developing cross-sector metrics and making commitment to transparency and traceability)		Develop National Alternative Protein Strategy	
4. Technical	Research & Development	Existing strains with limited productivity		Development of efficient strains		Intellectual property generation	
	Innovation Community	Engage with innovation community		Create competitive ecosystem - integrate innovation community with value chain		Continued innovation to add further value to the Alternative Protein sector	
5. Communications	Consumer Engagement	COP26 Showcase	Coordinated Messaging		Coordinated Media Engagement		Ongoing consumer dialogue - ensuring future product relevance

# UK Alternative Proteins Roadmap - Commercial (1 of 5)

## Production Capacity

**6-12 Months** - In the short term, lab scale production is limiting industry-viable tests and trials. In addition, permitted inputs and resource availability is limited due to high cost. There is a need to ensure the ability to get on site and build lab scale production capacity post-covid and ensure access to raw materials at required volumes where they are needed, as well as identifying other issues with scaling up production.

**1-3 Years** - In the medium term the priority is to scale up pilot-plant production to economically viable models. This requires securing of funds including government support to get new facilities off the ground with competition from lower-priced incumbents. New development pathways are required to fully deliver value. New processes will become increasingly “off the shelf” as more incumbents enter the market.

**3-5+ Years** - In the long term, establishing access to larger-scale facilities to produce commercial volumes will be a priority. This includes opportunities to scale successful businesses worldwide to enable production consistency. In addition, developing the by-product stream beyond protein will be important. Commercial capacity will become large enough to displace a significant percentage of imported protein.

## Market Development

**6-12 Months** - Identifying and addressing existing import and export issues. This may require more focus on local resources or the import of test materials from the EU. Opportunities exist to identify potential partners along the value chain, including established customers to accelerate routes to market, in addition to identifying market pull opportunities for horizontal value chain components (e.g. eggs/larvae).

**1-3 Years** - Researching new markets and income streams to expand into new geographies/sectors will be explored. Facilitated collaboration across value chains will help build-up further knowledge and determine the economic value for UK, helping to establish a sustainable sector. Domestic focus could create additional costs and friction if EU regulation changes.

**3-5+ Years** - Moving towards market pull opportunities from a technology push approach. Increased focus upon procurement opportunities e.g. net-zero or local food systems. Potential ‘risk’ of the overall industry’s rate of development being slowed through the acquisition of start-ups by larger companies.

# UK Alternative Proteins Roadmap - Operations (2 of 5)

## Workforce Development

**6-12 Months** - In the short term, defining the training and upskilling requirements for the alternative protein sector will be important, to enable a review of capabilities available in existing or adjacent industries. Understanding how these can be imported, adapted or scaled (e.g. people with process technology backgrounds in the petrochemical sector) will help identify whether the skill base requirements can be met.

**1-3 Years** - In the medium term, priorities include introducing new upskilling or training programmes to create a multidisciplinary skilled labour force to manage facilities. In particular, access to sufficient technicians with the right skills during scale-up phase (a potential UK weakness v other nations) was highlighted with requirements envisaged across the biological sciences, engineering and AI domains.

**3-5+ Years** - Long term, continued assessment, monitoring and development of training and upskilling requirements - and roll out with relevant education institutions and affiliated partners - will be required. Acquisition of start-ups by larger companies may also provide knowledge exchange on technical capabilities that benefit workforce development and upskilling.

## Finance and Investment

**6-12 Months** - In the short term there is a need to secure funding to demonstrate commercial viability and wider value proposition, followed by further investment required to help companies move forward and expand. Recent ODA funding constraints have negatively impacted access to some markets overseas, reducing opportunities to trial technologies with new international partners / customers.

**1-3 Years** - In the medium term, priorities include securing funds to demonstrate viability and value at commercial scale to investors to help secure further private capital investment. Funding will be required to establish larger facilities for production at economically viable scale to test new technology, or for specific parts of the value chain and vertically integrated operations.

**3-5+ Years** - Longer term, securing additional investment from both government and private equity will be a priority to scale commercially competitive businesses and technologies inside and outside of the UK. IP, generated from earlier R&D, could be sold or licenced internationally. Opportunity to change state aid support /regulations from the EU could benefit the UK alternative protein sector.

# UK Alternative Proteins Roadmap - Governance (3 of 5)

## Regulation and Legislation

**6-12 Months** - In the short term, greater coordination between regulatory bodies (FSA, DEFRA) and industry is required. In addition, there is a need and opportunity to develop new regulatory frameworks for new products and standards to support innovation whilst maintaining safety, quality and efficacy of food and feed products. Review UK vs international regulatory requirements and roadmaps.

**1-3 Years** - In the medium term, there are opportunities to develop new quality assurance and quality control requirements. The pace of regulation could limit new product development (e.g. use of gene editing) and greater autonomy may exist post-Brexit to create more agile regulation. Developing standardized systems for carbon accounting / Life Cycle Assessment frameworks will support the industry and environmental credentials.

**3-5+ Years** - Longer term, regulatory dossier requirements need to be proportionate and not detrimental for small companies to register new products (as happened with GM crops). Carbon-trading legislation could underpin the emerging industry if agreements can be put in place to prevent competitive escalation of regulatory data requirements.

## Sector Strategy

**6-12 Months** - In the short term, creating a clear definition of the alternative protein sector will help establish an integrated approach to work on plant based proteins and novel proteins (including synthetic meats), developing a strategy and approach to enhance tastes and colours, noting challenges between novel and traditional meat producers e.g. around naming of sausages for instance.

**1-3 Years** - In the medium term, a new alternative protein industry will be established, with a sector-wide trade body to support regulation and consumer engagement that is aligned with other global membership bodies. The alternative protein sector will be integrated within the wider food and agriculture sectors, including developing cross-sector metrics and making commitments to transparency and traceability.

**3-5+ Years** - Longer term, a priority will be development of a national protein strategy to coordinate activity and advance global opportunities. Continued engagement with regulatory bodies will be necessary to ensure alignment of regulations with best practice. Leadership and regime change to remove the 'alternative protein' nomenclature could become available to facilitate the transition to a 'new normal'.



# UK Alternative Proteins Roadmap - Technical (4 of 5)

## Research and Development

**6-12 Months** - In the short term, research is required to understand other high-value markets (beyond protein). In addition, research into existing strains (e.g. bacteria, insects) to increase productivity and product quality, or the development of new strains will optimise process efficiency for different raw materials / inputs.

**1-3 Years** - In the medium term, development of efficient strains will become important to establish new markets and income streams (e.g. through IP / licensing technologies). Opportunities to valorise by-product streams through the identification of compounds with additional benefit and value through biorefining etc. Collaborative R&D opportunities between centres of excellence (e.g. Leatherhead Food, Campden BRI) and alternative protein producers represent potential for new synergy in ideation.

**3-5+ Years** - Longer term, opportunities to generate intellectual property including by-product streams through biorefining approaches. Ongoing collaborative research with end users and engagement with consumers will be critical to encourage adoption of new products and technology at a commercial scale. There is a need for long term field studies to understand sustainable impacts which could drive regulation.

## Innovation Community

**6-12 Months** - In the short term, engagement with the UK alternative protein innovation community is important to build and develop a joint roadmap. This will identify stakeholders along value chain with similar challenges that could partner to develop shared facilities, resources and processes. Partnering with established companies and customers will allow for faster product development and accelerate routes to market.

**1-3 Years** - In the medium term, creating a competitive UK ecosystem that integrates the alternative protein innovation community with downstream value chain stakeholders will be important to deliver process improvements and 'economy of scale' benefits, e.g. co-locating R&D and production facilities to utilise waste streams. Further knowledge gained will help drive economic value for UK agriculture whilst establishing a sustainable sector.

**3-5+ Years** - Longer term, development of joint innovation opportunities will add further value to the alternative protein sector. Horizon scanning will assist in identifying future development opportunities beyond protein. Ongoing dialogue and studies will be needed to align consumer perception and regulation, ensuring that potential challenges are identified, understood and addressed by partners.

# UK Alternative Proteins Roadmap - Communications (5 of 5)

## Consumer Engagement

**6-12 Months** - In the short term, developing a greater understanding of consumer perceptions and developing communication of the benefits of alternative proteins (whilst avoiding the risk of 'demonising' existing protein sources like soya) can support a positive narrative around net zero, biodiversity, bioeconomy - to counter risks from negative 'frankenfood' reporting. There could also be opportunities to showcase the projects and ISCF TFP investment at COP26 to highlight environmental benefits of alternative protein, and to build on increased consumer interest - post-covid - in provenance and local supply chains.

**1-3 Years** - In the medium term, rising consumer acceptance is anticipated, but this could be challenged by a lack of product familiarity, including product benefits and an unwillingness to pay more relative to other traditional protein sources. Coordinated messaging will be important to establish multiple pathways to inform and educate consumers around the benefits of alternative proteins e.g. reduced carbon footprint. This could be reinforced through accreditation and carbon counting, as well as land and water usage.

**3-5+ Years** - Longer term, ongoing consumer dialogue will be important to ensure future product relevance. As consumer acceptance increases there is scope to establish higher-value products (e.g. through science to substantiate health claim benefits) and ongoing end user engagement and promotion to ensure uplift and relevance, leading to mainstream acceptance.

# Summary and Next Steps

- The three projects being supported through ISCF TFP investment (totalling £12.1m grant and £18.3m total project costs) are taking forward commercial scale alternative protein production to demonstrate the technical and economic viability of these systems. These projects also have a longer-term opportunity to add value beyond feed markets, through novel food products with potential for enhanced nutritional benefits and valorisation of by-product streams using a biorefining approach.
- The alternative protein industry also includes plant-based proteins, a sector with growing demand from consumers\* and significant private equity investment exceeding \$1 bn in 2020. Developing a UK alternative protein strategy, including novel and plant-based protein, would be a logical next step from the workshop. Identifying strengths across the science-base and industry will provide a framework for establishing partnerships that can support a competitive alternative protein innovation ecosystem.
- Maintaining dialogue with funders and regulators will be important to help facilitate new product development opportunities. Communication with consumers and end-users will also be critical to develop products that meet their needs and values. It will be important to also consider the technologies being used and life cycle assessment for different aspects of the alternative protein industry as this may represent potentially emotive topics for consumers.
- Reviewing the roadmap at an appropriate frequency (for example every 6-12 months) to check progress in addressing common challenges would be valuable to leverage synergies between projects. Developing a collaborative approach to identify and tackle common sector-wide issues would also help increase impact from investments. The ISCF TFP programme could facilitate this activity, supporting progress towards common aims and objectives assuming project partners are interested.

\* Revenue from the global dairy alternatives sector is projected to grow from \$21.4bn in 2020 to \$36.7bn by 2025 (CAGR of 11.4%) whilst the global plant-based meat market will increase from \$4.3bn to \$8.3bn in the same period (CAGR of 14%) - source MarketsandMarkets.

# Transforming Food Production Challenge

## Alternative Proteins Roadmap Workshop

### Appendix 1

### Summary Roadmap Templates



	<p><b>Short Term</b> 6-12 Months</p>	<p><b>Medium Term</b> 1-3 Years</p>	<p><b>Longer Term</b> 3-5+ Years</p>
<p><b>Technical and Commercial Barriers</b></p>	<p>Price point high (alternative protein) relative to existing products (soy)</p> <p>A clear definition of alternative protein to include plant based proteins and new approaches to traditional proteins such as grass refining or insects.</p> <p>Upskilling requirement -. review what capabilities in existing or adjacent industries, and how that can be scaled?</p> <p>Regulatory frameworks</p> <p>Demonstrating value (show how new materials can compete with existing on nutrition, quality, cost and footprint)</p> <p>Existing strains with limited productivity / quality potential</p> <p>Lab scale production limiting industry-viable tests / trials</p> <p>Permitted inputs (cost highly limiting) / resource availability</p>	<p>Coordinated (cross-sector) demonstration that product from new technologies are safe for the food chain</p> <p>Translating consumer sentiment into shopper behaviour. Demonstrate products are safe for the food chain</p> <p>Multidisciplinary skilled labour force required to crew facilities.</p> <p>Government support to get a new innovative technology or facilities off the ground in the face of competition from low-priced incumbents.</p> <p>Linking (private equity) investment to scaling.</p> <p>Regulatory frameworks and specification particularly for international supply chains e.g. challenges with export/import of BSF genestock. Working with regulators on funded projects</p> <p>Importance of technicians with the right skills during scale up (UK weakness v other nations) e.g. a scale up entomologist.</p> <p>Permitted inputs (cost highly limiting) / resource availability</p> <p>Development of efficient production strains and systems</p> <p>Pilot plant production capacity</p> <p>QA/QC requirements</p>	<p>Competing with other protein streams/ commodities</p> <p>Access to large scale facilities</p> <p>Lack of carbon accounting framework.</p> <p>Adoption of technology</p>

	<p><b>Short Term 6-12 Months</b></p>	<p><b>Medium Term 1-3 Years</b></p>	<p><b>Longer Term 3-5+ Years</b></p>
<p><b>Technical and Commercial Opportunities</b></p>	<p>Research to understand other high-value markets (beyond feed)</p> <p>Accessing funding</p> <p>Engage with ‘innovation community’ to build and develop proposition</p> <p>Creating a new industry - We all have similar challenges and should share resources and experiences for mutual benefit.</p> <p>Training requirement - people with process technology backgrounds (e.g. oil &amp; gas / petrochemical) have the skill base we need.</p>	<p>Better economic value</p> <p>Securing funds or access to pilot plants</p> <p>Engage with ‘innovation community’ to deliver process improvements</p> <p>Other product streams (beyond protein)</p> <p>Need to integrate value chain and innovation ecosystem.</p> <p>Studies to understand sustainability impacts.</p> <p>Intellectual property</p> <p>Amalgamation of biological, engineering and AI</p> <p>Develop cross sector metrics (e.g. for carbon trading)</p> <p>Transparency/traceability</p> <p>Translating consumer sentiment into shopper behaviour</p>	<p>Value proposition with Investors</p> <p>Continued innovation to add further value</p> <p>C-trading - would require some UK Government level legislation to provide market certainty.</p> <p>Need to understand the LCA framework - what we benchmark against. Work with regulators to get certainty e.g. in soya and fishmeal.</p> <p>Opportunity to scale successful businesses/technologies outside of the UK.</p> <p>The byproduct stream - not just about alternative proteins. Longer term research driving regulation and other opportunities.</p> <p>Intellectual property</p> <p>Transparency/traceability</p>

	<p><b>Short Term</b> 6-12 Months</p>	<p><b>Medium Term</b> 1-3 Years</p>	<p><b>Longer Term</b> 3-5+ Years</p>
<p><b>Regulatory and End User Consumer Barriers</b></p>	<p>Regulatory frameworks for new products - UK vs international</p> <p>Consumer awareness / confusion of new products</p> <p>Think and act in a coordinated way about issues and how they are linked together re regulatory compliance and consumer perceptions.</p> <p>Lack of joined up working between regulatory bodies (FSA, DEFRA) and research bodies.</p> <p>Export/import issues e.g. sea water returned as a hazardous compound.</p> <p>Poor representation of the benefits in the media at best / scare stories at worst</p>	<p>Pace of regulation limiting new process / product development (e.g. use of gene editing)</p> <p>Consumer acceptance - lack of product familiarity or awareness of benefits</p> <p>Thoughtfully investigating other international markets outside of EU and US.</p> <p>Lack of consensus on how to measure environmental impact/LCA. Robust standardised system we can use.</p> <p>Responsible innovation - consumer perceptions and regulation not mutually exclusive.</p> <p>Risk aversion in a regulatory environment</p> <p>Lack of political leadership</p> <p>Cost of commercialisation (new ingredient competing with commodities)</p> <p>Consumers not prepared to pay more</p>	<p>Recalcitrant regulation (e.g. gene editing)</p> <p>Consumer reluctance to accept new products</p> <p>Accessibility of input streams (e.g. food waste)</p> <p>Regulatory dossiers which increase data requirements that are highly detrimental for small companies (as happened with GM crops)</p>

	<p><b>Short Term</b> 6-12 Months</p>	<p><b>Medium Term</b> 1-3 Years</p>	<p><b>Longer Term</b> 3-5+ Years</p>
<p><b>Regulatory and End User Consumer Opportunities</b></p>	<p>‘Good news’ stories to tell: net zero, biodiversity, bioeconomy - positive credible stories to counter “Frankenfood” / GM reporting</p> <p>Non-GM products relatively easy</p> <p>Increased interest post- pandemic in provenance and ‘local’ supply chains</p> <p>Integrated hybrid strategy - opportunity to work on plant based proteins (&amp; synthetic meats) strategy and approach (to tastes and colours) noting challenges between novel and traditional meat producers e.g. around naming of sausages etc.</p> <p>Promote alternative proteins whilst avoiding potential demonisation of soya (as the majority is sustainable).</p> <p>Recognising COP26 and showcasing alternative feeds e.g. Food Van.</p> <p>Collective messaging - getting people engaged and happy e.g. Guardian/WWF and working with other NGO’s coverage. Could come from accreditation and carbon counting, as well as land/ water usage.</p>	<p>Positive messaging on sustainability (e.g. net-zero, better traceability)</p> <p>Greater autonomy to regulate post-Brexit</p> <p>Establish sector-wide Trade Body (e.g. to support regulation and consumer engagement) - with a view to have it not being separate just because it’s Alt. Protein</p> <p>Assurance scheme to help consumer (and feed industry) understanding/acceptance (DEFRA-endorsed)</p> <p>Industry agreement to prevent competitive escalation of regulatory data requirements</p> <p>Move towards market pull opportunities from technology market push e.g. legumes. Think about procurement e.g. Net-Zero or Local Food Systems (Schools/Hospitals etc)</p> <p>A lot of scope to develop new products for existing niches e.g. happier eggs, AMP’s</p>	<p>National Protein Strategy - global and proportionate regulatory leadership and regime(remove ‘Alternative’ to aid transition to a new norm)</p> <p>Establish higher-value products and co-products (e.g. through science to substantiate health claim benefits)</p> <p>Ongoing consumer dialogue to ensure future product relevance.</p> <p>Industry agreements in place to prevent competitive escalation of regulatory data requirements</p>



# Transforming Food Production Challenge

## Alternative Proteins Roadmap Workshop

Appendix 2

Workshop Slides



# Workshop Agenda

09:30 Welcome and Overview

- Roland Harwood - Liminal
- Katrina Hayter - UKRI
- Tom Jenkins - UKRI

09:40 Project Introductions

- Polly Douglas - Deep Branch
- Keiran Whitaker - Entocycle
- Raffael Jovine - SuSeWi

09:55 Paul Shakspeare - High Value  
Manufacturing Catapult

10:05 Questions and Briefing for Breakouts

10:10 Roadmap Breakout Group 1 –  
Technical and Commercial Issues

11:00 *Break*

11:10 Paul Tossell – Food Standards Agency

11:15 Roadmap Breakout Group 2 – Regulatory  
and End-user & Consumer Issues

12:00 Present Back

12:15 Discussion

12:25 Next Steps

12:30 *Close*

# Alternative Roadmap Workshop Objective

To co-create a shared vision and roadmap for the UK alternative protein sector to inform future activities for the ISCF Transforming Food Production challenge programme and participating companies. The focus will be upon challenges and opportunities for establishing a competitive UK alternative proteins sector over the:

- short-term (up to 12 months),
- medium-term (1-3 years) and
- long-term (3-5+ years) timeframes

With a focus on:

- Technical and Commercial Issues, and
- Regulatory and End-user & Consumer Issues.

# Project Introductions



1. **Polly Douglas - Deep Branch**
2. **Keiran Whitaker - Entocycle**
3. **Raffael Jovine - SuSeWi**

# Polly Douglas

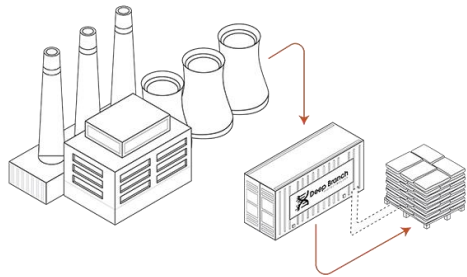
## Deep Branch

# REACT-FIRST

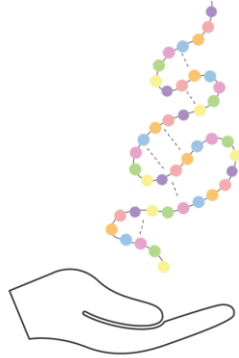
# PROJECT OVERVIEW

March 2021

# REACT-FIRST



Fermentation process using CO<sub>2</sub> and hydrogen

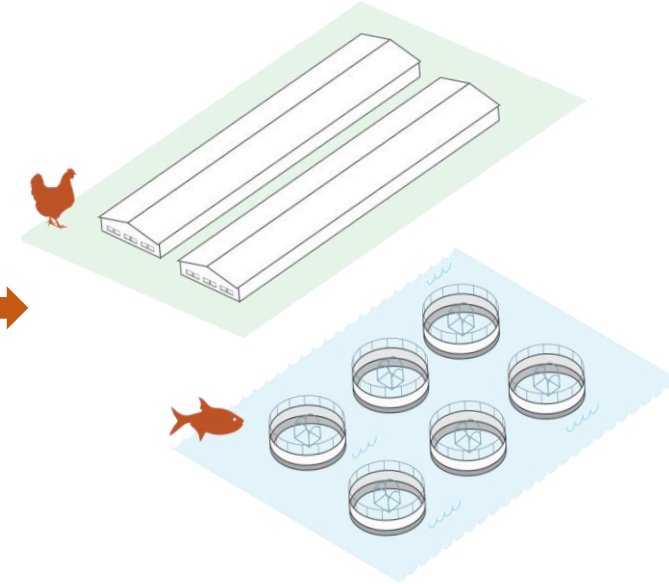


**Pröton**

High-protein ingredients



Proton™ combined with other ingredients for complete animal feed



Sustainable animal products

## Key Partners

### Carbon Recycling & Biotech



### Animal Feed & Trials

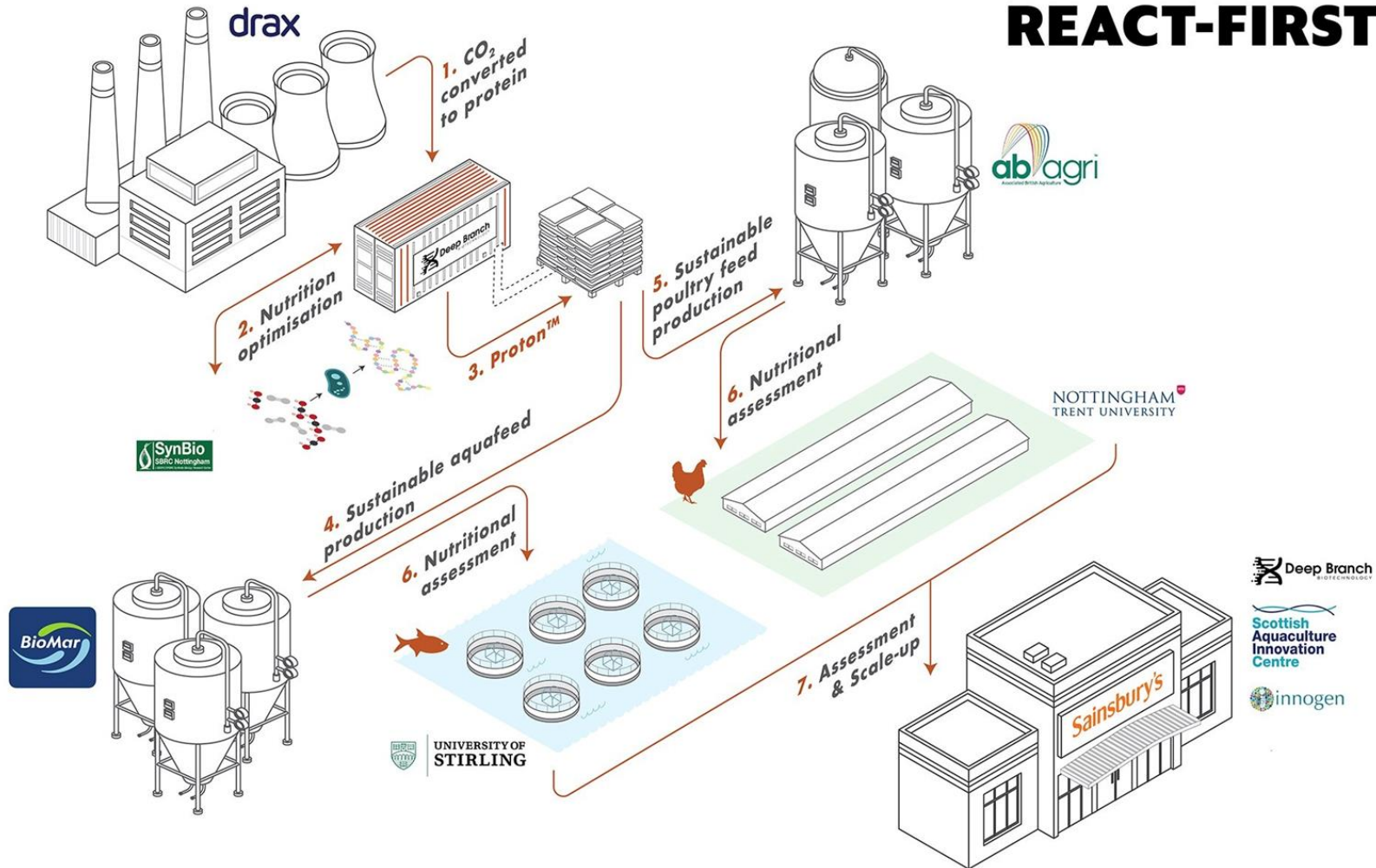


Nottingham Trent University

### Innovation & Consumer Acceptance



# REACT-FIRST



- Prove the technology
- Strain optimisation
- Fermentation scale up & optimisation
- Proton™ Production
- Feed formulation
- Feed trials
- Life cycle assessment
- Techno-economic analysis
- FEED study
- Consumer Study

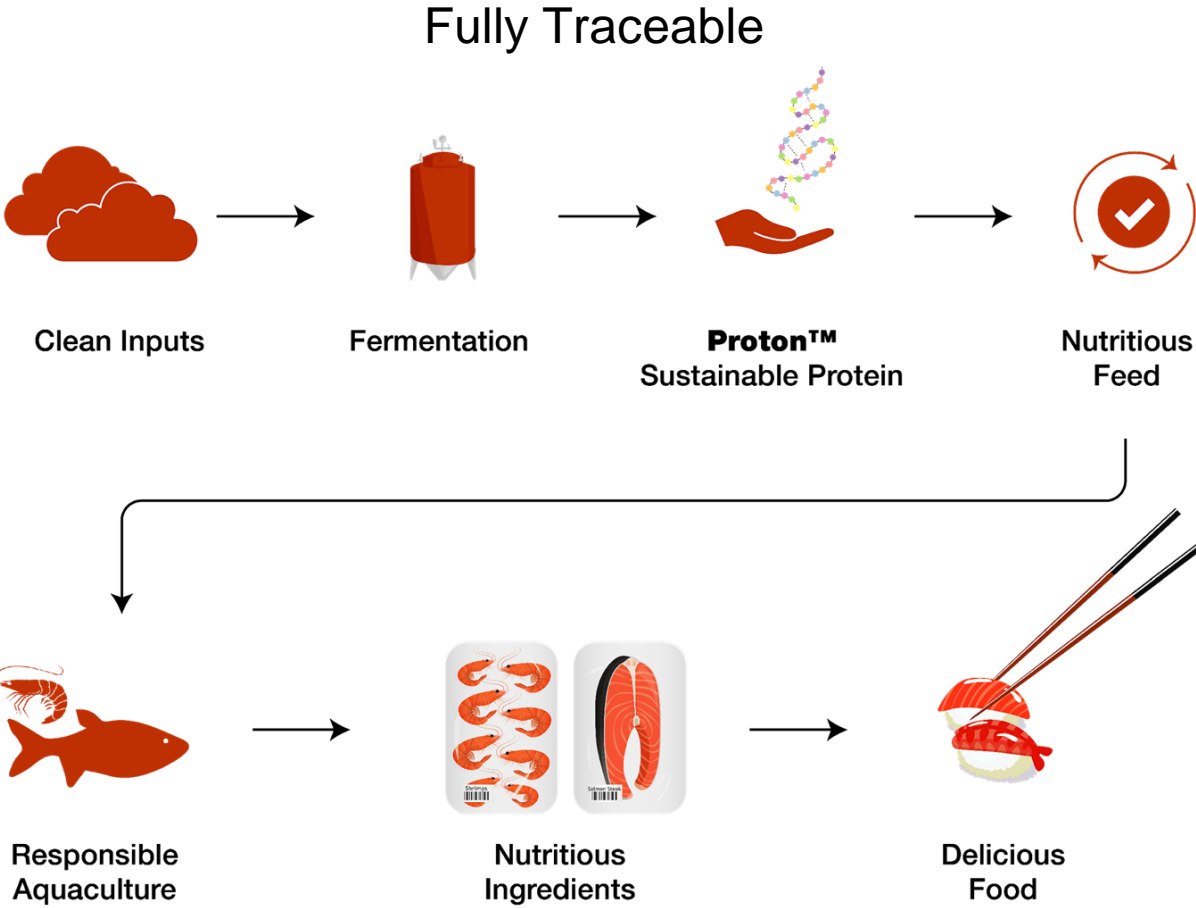


# Outcomes

Carbon Reduction-  
Footprint & Transport

Data driven protein  
production

New tools to assess  
carbon intensity,  
water usage & land  
usage by novel  
agricultural  
technologies



Sustainability- reduced  
reliance on marine  
ingredients & soya

Increased  
consumption of  
sustainably produced  
food, with little impact  
on behaviours

# Keiran Whitaker

## Entocycle

# THE INSECTRIAL REVOLUTION

**Innovate UK** ISCF - TFP  
Future food  
production systems

Application No. 47278





**1.3 Bn Tonnes of food wasted**

**60 million tonne protein deficit by 2050**

Chemical fertilisers - **2.5%** of global **emissions**

# CREATE A NEW HIGH VALUE UK-FOOD PRODUCTION INDUSTRY



## INSECT FARMING

- **Transformational** & ambitious project
- **Scale Insect Farming** production (resource efficient & low emission)
- Make the **UK World Leaders** (production & export)

# NEW SCALED UK INSECT FARMING INDUSTRY



UK Leading BSF  
Companies &  
Institutions



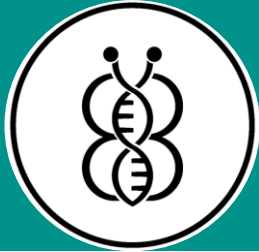
Full Value  
Chain  
Involvement



Sustainable  
Protein &  
Biofertilisers



# COMPLEMENTARY BSF EXPERTISE



Beta Bugs

ENTOCYCLE



entomics



Genetics &  
Breeding



Scale-up &  
Automation



Extraction &  
Valorisation

Outputs **underpinned** by Academic Research

# COMMERCIAL TRACTION



Aquaculture & Feed  
Ingredients



Salmon Feed-Mill  
& Farms

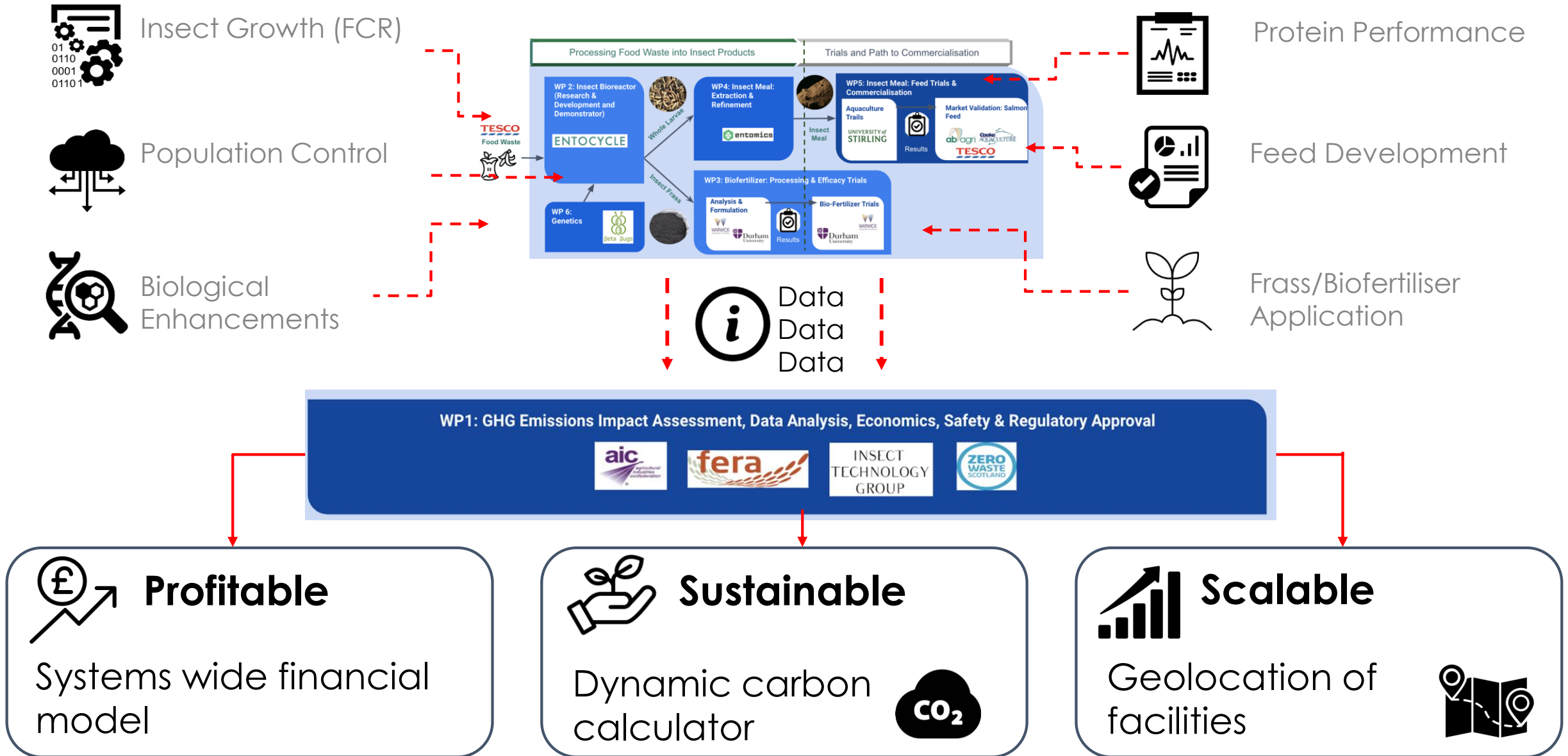


Waste Supply and  
Final Consumer





# BIOCONVERSION DATA PLATFORM



# STRONG HISTORY OF COLLABORATION

Successfully worked together one-on-one  
and Excellent Feedback

Innovate UK



Combine our skills to **deliver** this **ground-breaking** project

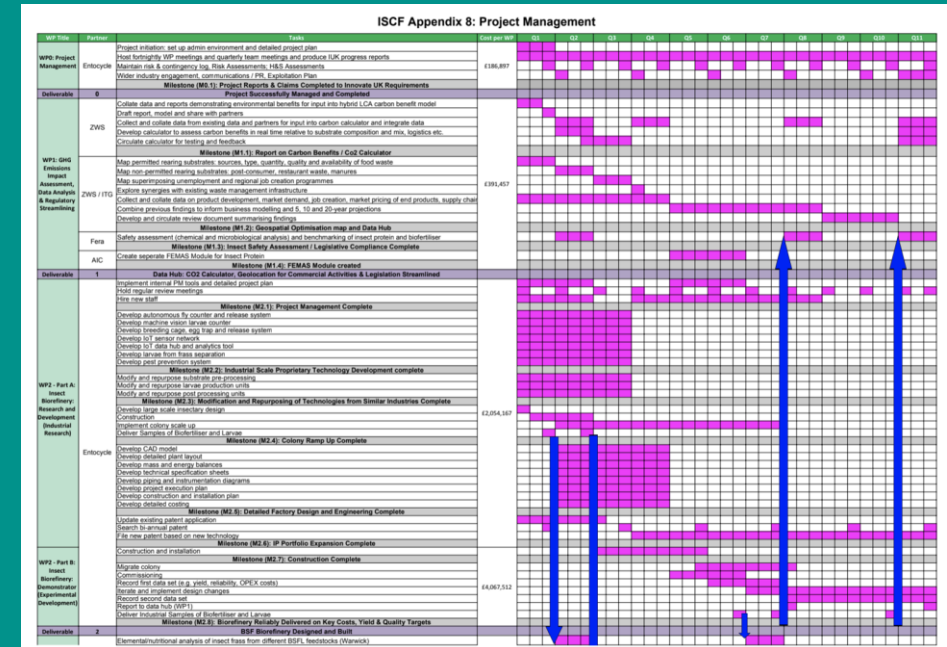
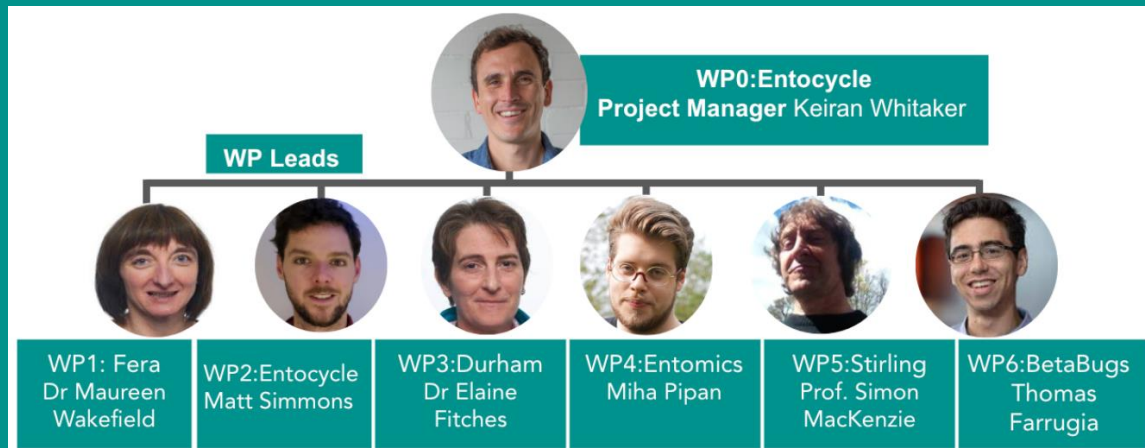


- 2 years - Bi-monthly meetings
- x2 Reports to Government

# EXPERIENCED LEADERSHIP

## Dedicated Project Management WP & WP Leaders

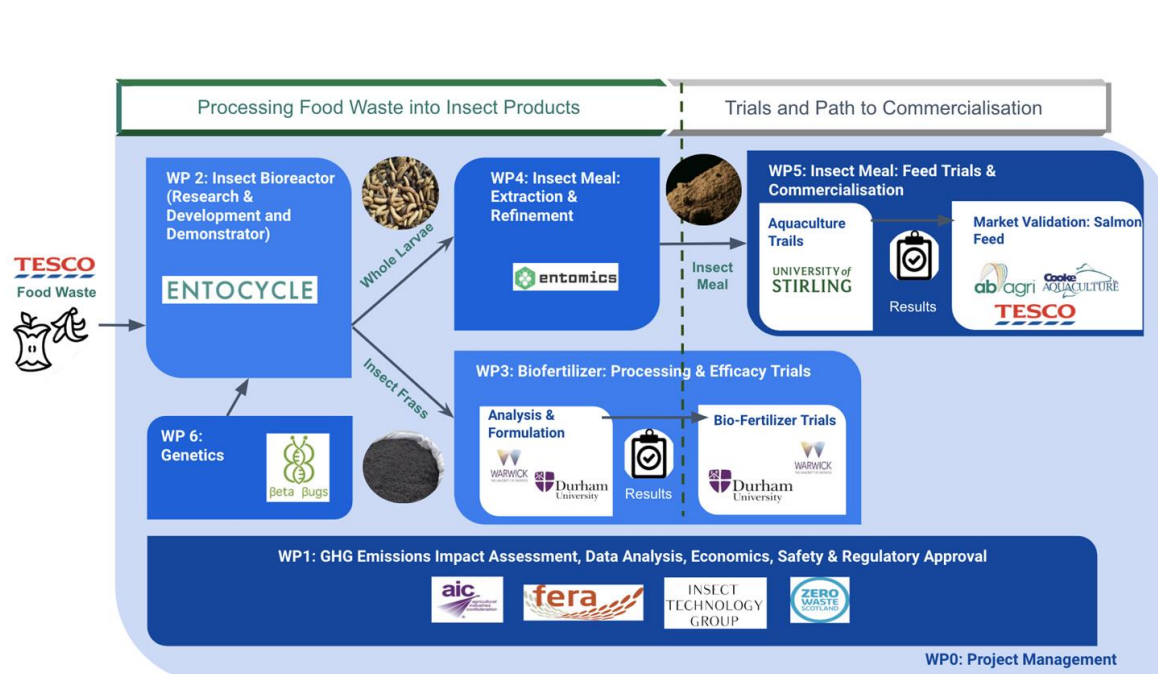
- All team members have led projects
- Worked together
- Team behind the legislation change of insect in the UK/EU



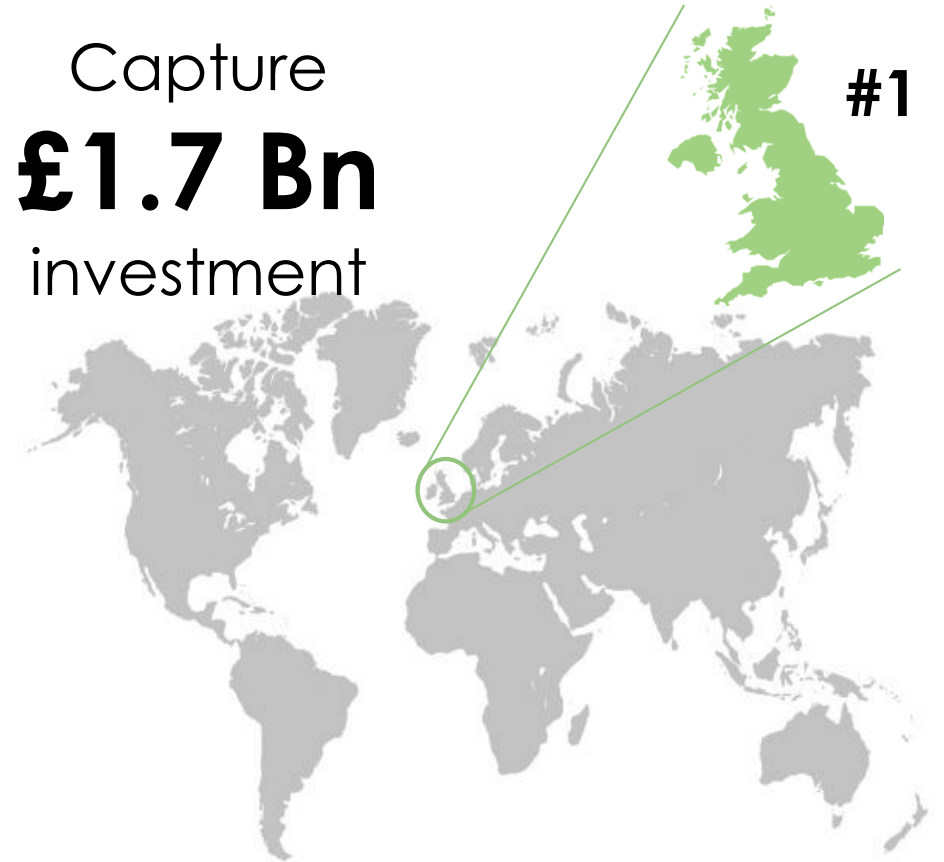
## Detailed Project Management Gantt Chart

- Milestones, Deliverables & Dependencies
- IP sensitive WPs
- Dedicated communication tools

# CONSORTIUM, BIGGER TOGETHER



Capture  
**£1.7 Bn**  
investment



Individually, **experts** in our own fields

**Together** we can:

- Establish the UK as a **global leader**
- Stimulate an **entire new industry**
- Creation of 3300 Jobs (STEM)
- Exploit New IP
- Export Products and Tech
- £400m in Revenues

# Innovate UK

Application No. 47278

## THANK YOU



ENTOCYCLE



INSECT  
TECHNOLOGY  
GROUP

UNIVERSITY of  
STIRLING



**TESCO**



**Raffael Jovine**  
SuSeWi

Slides available on request.  
See final slide for contact details.

# Sector Insights



**Paul Shakspeare**  
High Value Manufacturing Catapult



# HVM Catapult

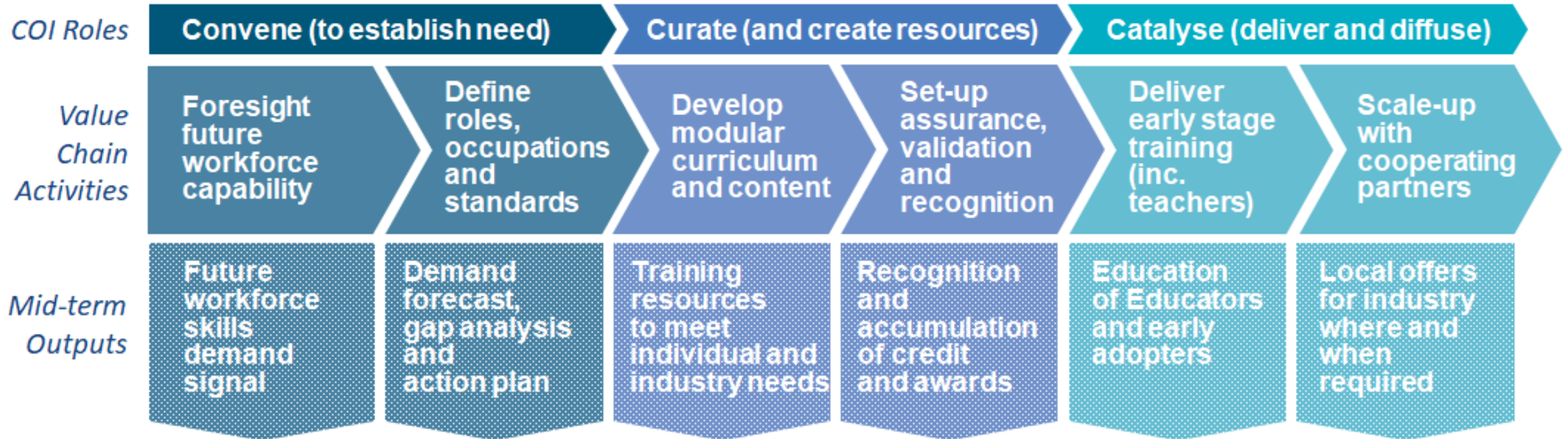
**UK GVA IMPACT = *Technology* + *Workforce* + *Supply Chains***

“Supporting the development of a UK **pipeline** of well-trained people with skills aligned to future manufacturing technologies”

*right skills, right place, right time*



# Skills Value Chain – accelerating emerging skills



## Future Skills Needs:

Begin planning for workforce needs related to emerging technologies while the technologies are in development, rather than waiting until technologies are fully developed and deployed

*Forecast*

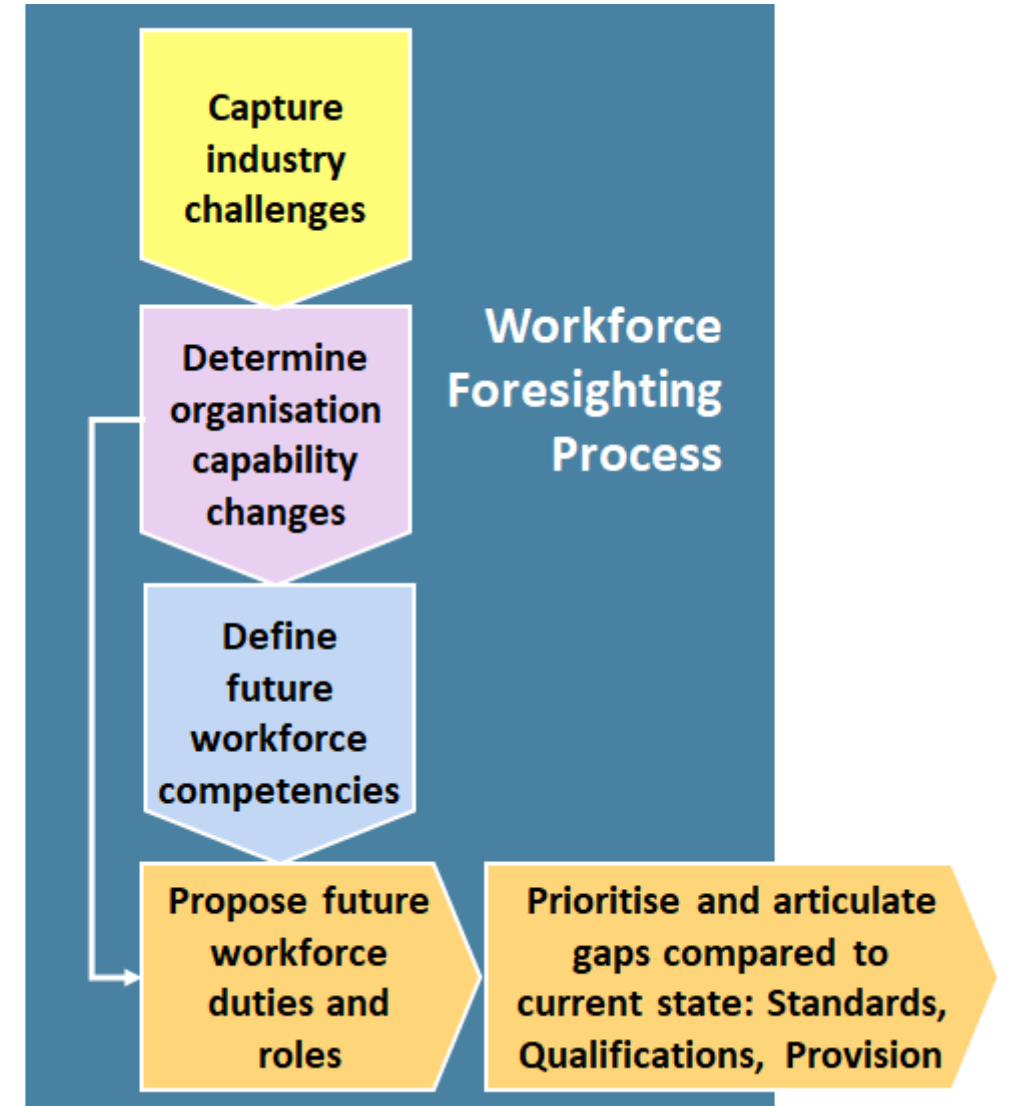
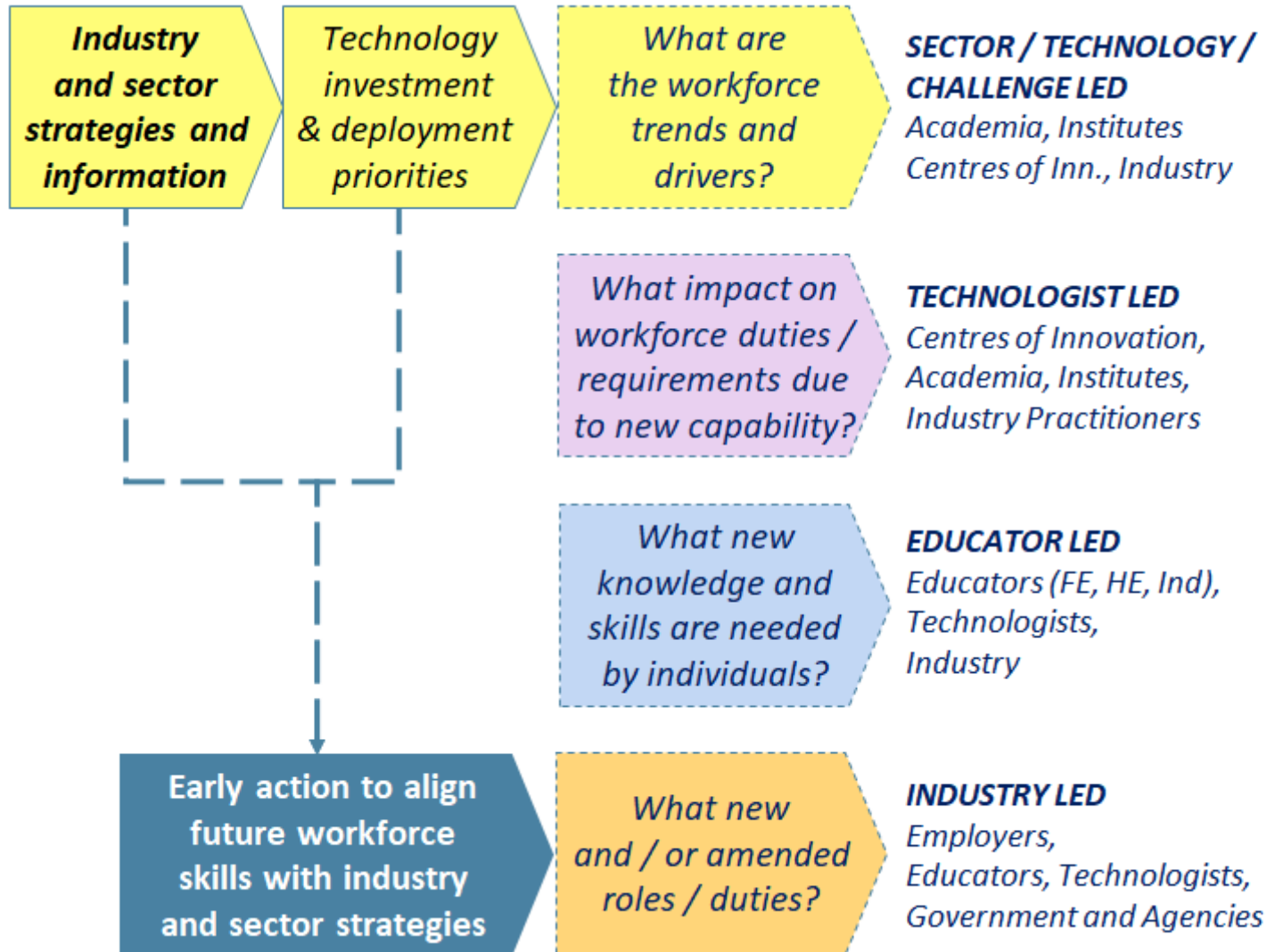
*Prepare*

*(One to Few)*

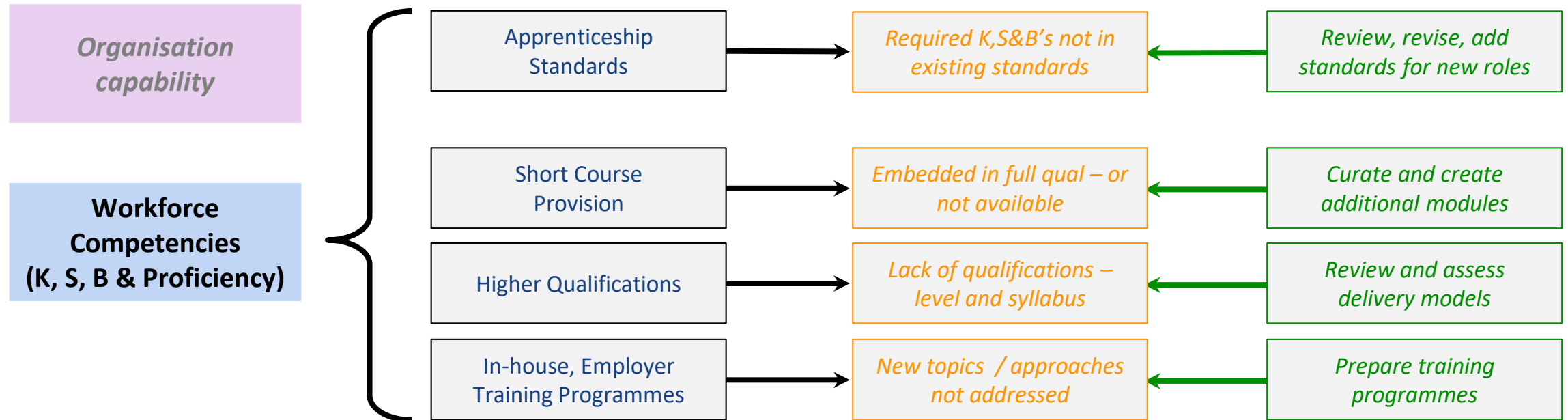
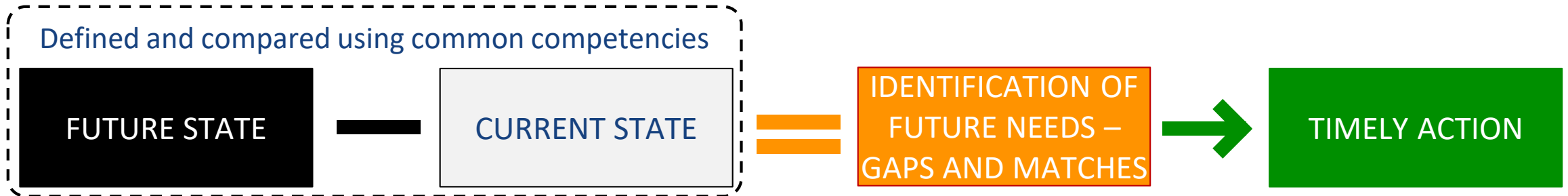
*Deliver*

*(Few to Many)*

# Foresighting – connecting technology strategies to workforce action



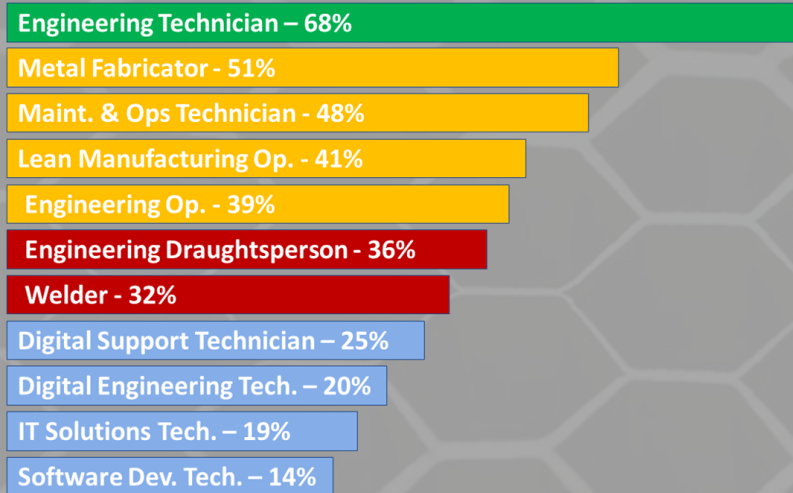
## Foresighting – gap and match analysis



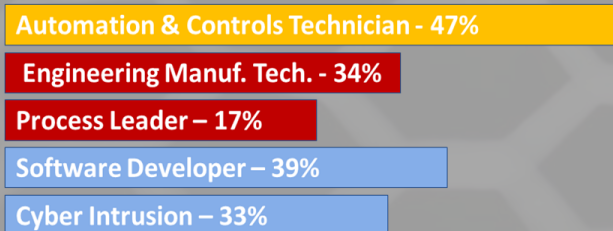
Various 'Current State' functions are able to expressed using common competencies library, then compared with future state to identify and prioritise actions.

# IDT – example mapping future competence set fit vs IFATE Standards

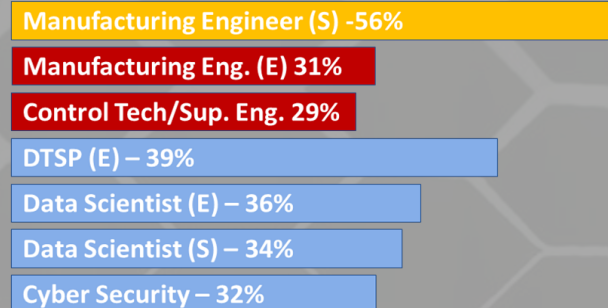
Foresight Future Competence - Full Set – Level 2/3



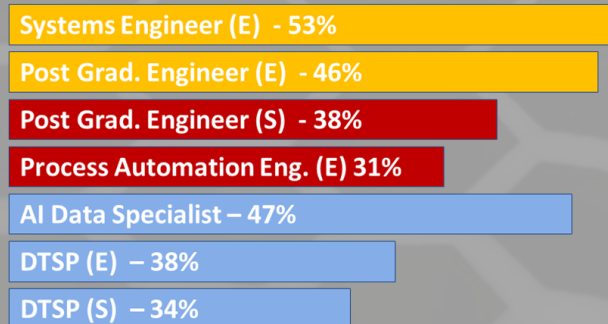
Foresight Future Competence - Full Set – Level 4



Foresight Future Competence - Full Set – Level 6



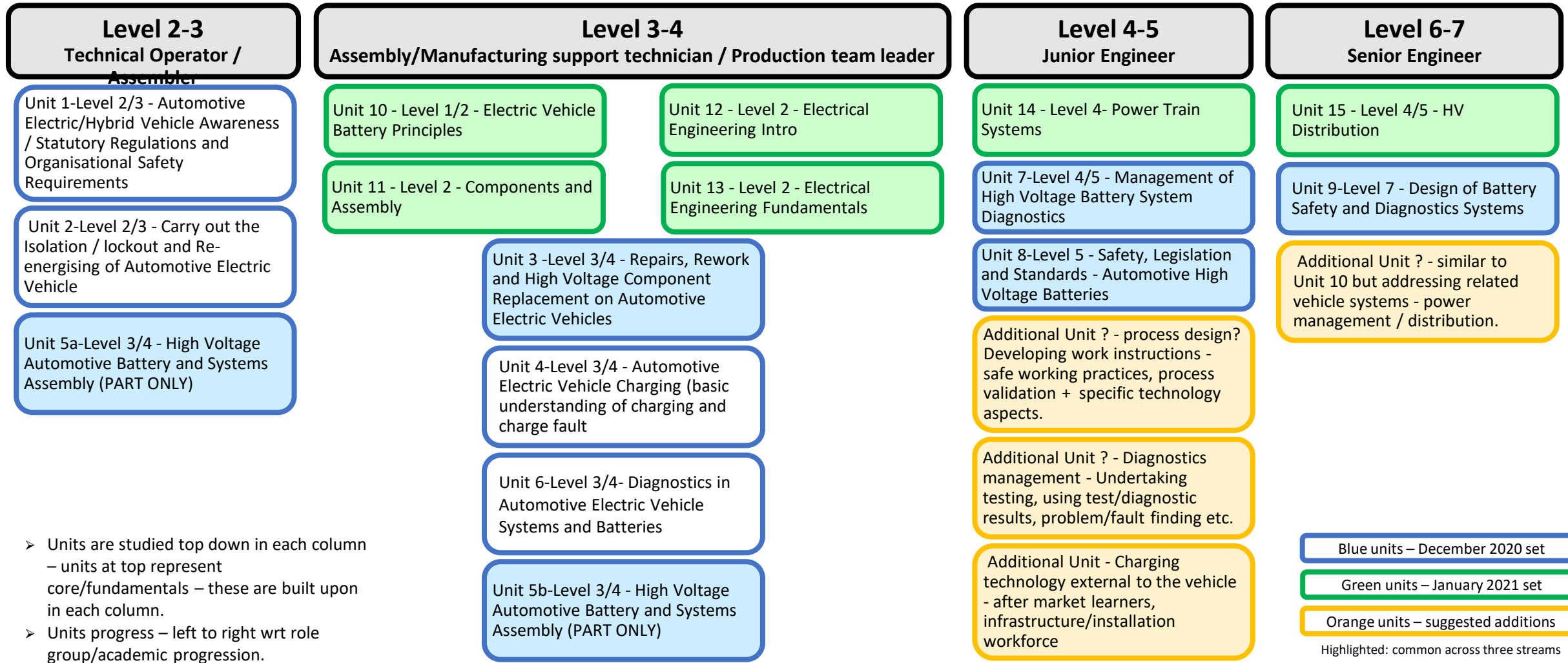
Foresight Future Competence - Full Set – Level 7



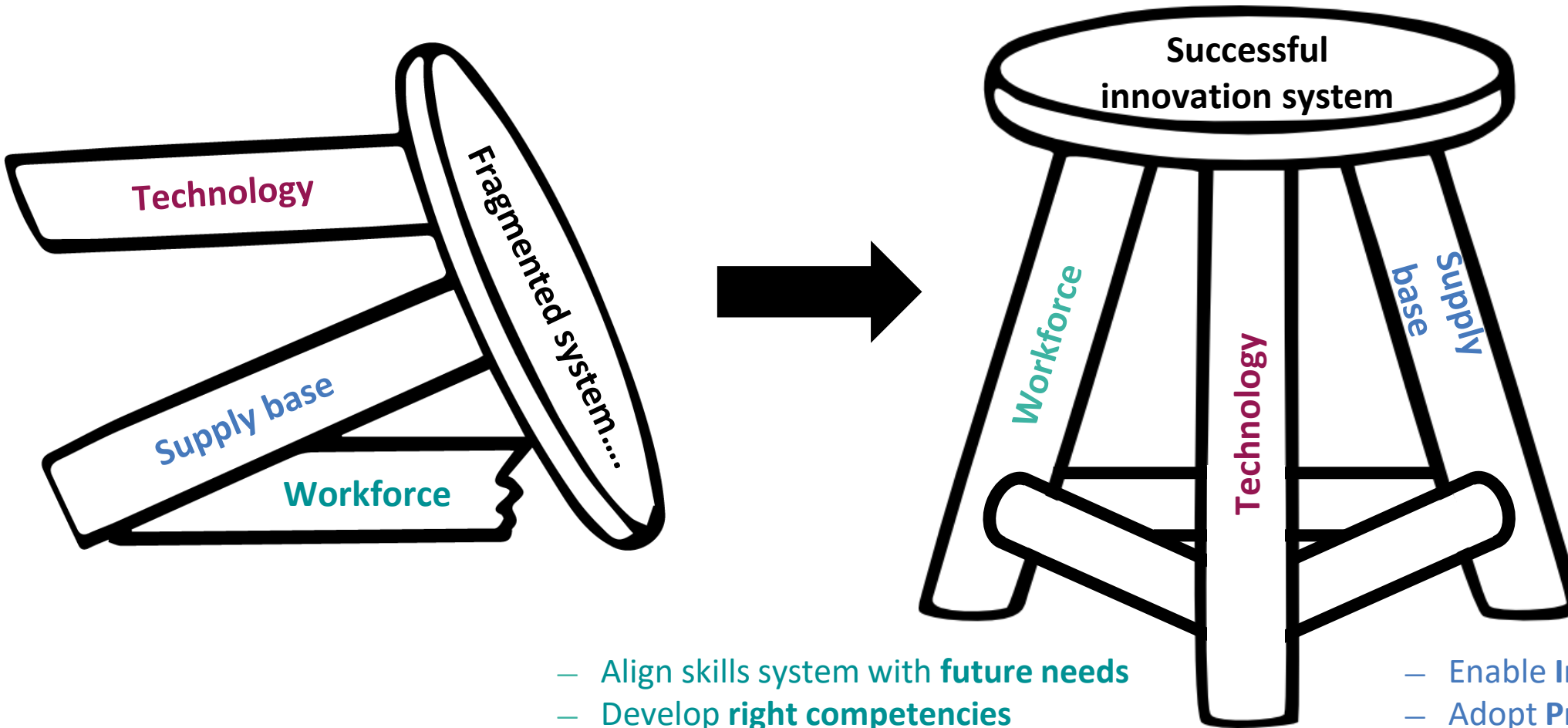
**L6 & L7 - Two new competency sets (roles) emerge:**

- Enterprise / Strategic (E)
- Systems / Operations (S)

National Electrification Skills Framework  
Automotive Electrification – Battery Systems – Provisional CPD/Upskilling Units



## Innovation systems – connecting the legs



- Align skills system with **future needs**
- Develop **right competencies**

- Enable **Innovative** organisations
- Adopt **Productive** capabilities

- Foresight and **deliver innovation**
- **Anchor innovation** in UK

# Sector Insights



**Paul Tossell**  
Food Standards Agency



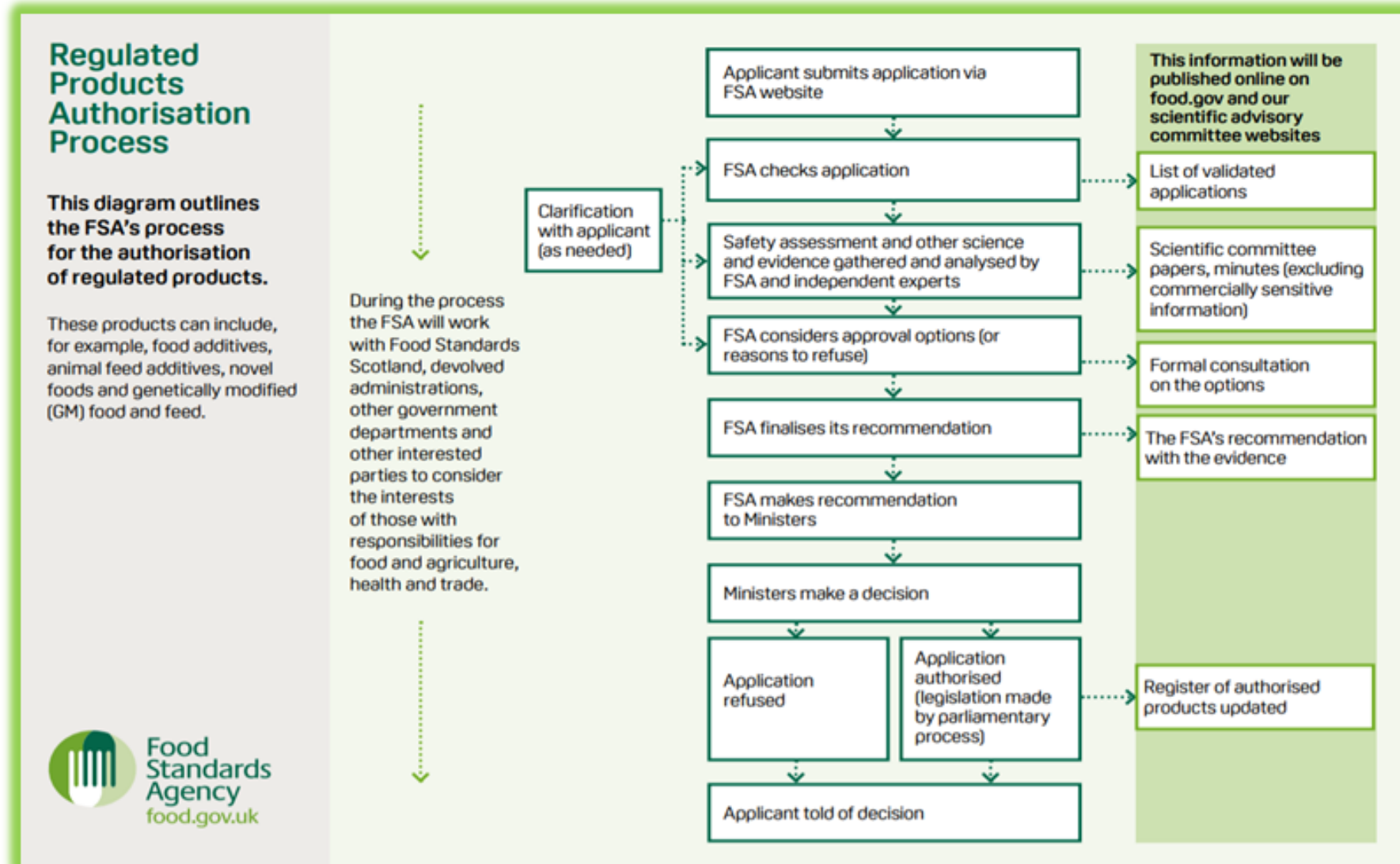


# Regulation of feed and novel food products

Paul Tossell  
Head of Radiological, GM, Novel Food and Feed  
Additives Team, FSA  
March 2021



# Risk Analysis – Regulated Products



# Novel food full application process

## Submission

- Application submitted to the FSA and FSS via e-portal. Validation of the application before it is formally accepted.

## Assessment

- Assessment by FSA/FSS with input from the ACNFP – Opinion in 9 months if no further information is needed

## Authorisation

- FSA have 7 months from a positive opinion to draft legislation to update the List of novel foods which consists of a specification and conditions of use. – Final agreement by UK ministers

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## Feed & Feed Additives

- First question - Feed or Feed Additive (definitions)
- If Feed
  - Feed Register
  - Feed Catalogue (up to 2 year process) – validation process by industry organisations
- If Feed Additives
  - Feed trials (external verification)
  - Analytical considerations
  - 6 month Risk Assessment Process (external committee)
  - 3 month to Draft regulations, then consult & finalise (via SI)

Other controls? E.g. Insects permitted by not under ABP & TSE rules

Thank You



**Tom Jenkins** (BSc, PhD, FRSB)

Deputy Challenge Director – Transforming Food Production

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