

# NAPIC Partner Engagement Workshop Report

November 2024





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# Introduction

This report provides an overview of the National Alternative Protein Innovation Centre’s [1] first Partner Engagement Workshop held in Leeds on 29th November 2024. The report will provide an introduction to NAPIC and the purpose of the Partner Engagement Workshop. The main component of the workshop was discussion groups focussed around NAPIC’s six Innovation Challenges, and the primary purpose of this report is detailing these discussions.

## National Alternative Protein Innovation Centre (NAPIC)

The National Alternative Protein Innovation Centre (NAPIC), launched in August 2024, is a pioneering Innovation and Knowledge Centre (IKC) supported by a £38 million investment. Funded by BBSRC, Innovate UK, and a diverse network of national and international partners—including academia, industry, regulators, and the third sector. NAPIC aims to drive innovation in the alternative protein sector, highlighted as a key sector to achieve national and global health and environmental targets and ensure food security [2, 3].

NAPIC capitalises on the world-class interdisciplinary research strengths and innovation leadership of our four co-leading institutions (University of Leeds, James Hutton Institute, Imperial College London, and University of Sheffield) located across the UK geographies (Figure 1).

NAPIC will tackle the pain points from producer to consumers to enable translation of cutting-edge alternative protein technologies into new products and processes.

NAPIC will create a highly dynamic open innovation ecosystem that addresses the needs of present and future consumers for tasty, nutritious, safe, affordable and accessible alternative proteins products while reducing anxiety about ultra-processing. NAPIC will support a just-transition for food systems stakeholders into the evolving alternative proteins market through ‘Responsible Research Innovation (RRI)’.

Built on four interdisciplinary knowledge pillars, PRODUCE (James Hutton Institute led), PROCESS (Imperial College London led), PERFORM (University of Leeds led) and PEOPLE (University of Sheffield led) covering the entire value chain of alternative protein supply, NAPIC will be the UK’s growth engine to create a blended protein economy. Being a true catalyst to accelerate the discovery-innovation-commercialisation roadmap of alternative protein, NAPIC will enable an efficacious and safe translation of new transformative technologies unlocking the benefits of alternative proteins across sectors such as food, feed, services, equipment, and other protein technologies. NAPIC will focus on valorizing the natural kingdom to derive proteins from diverse sources (e.g., plant, algae, fungi, bacteria, aquatic plants), precision and biomass fermentation, cultivated meat and new alternative production systems (insects, novel aquaculture) (Figure 1).

NAPIC is structured around four core activity streams co-created with national and international alternative protein stakeholders:

1. Innovation Challenges
2. National Knowledge Base
3. Workforce of the Future
4. Innovation Facilities

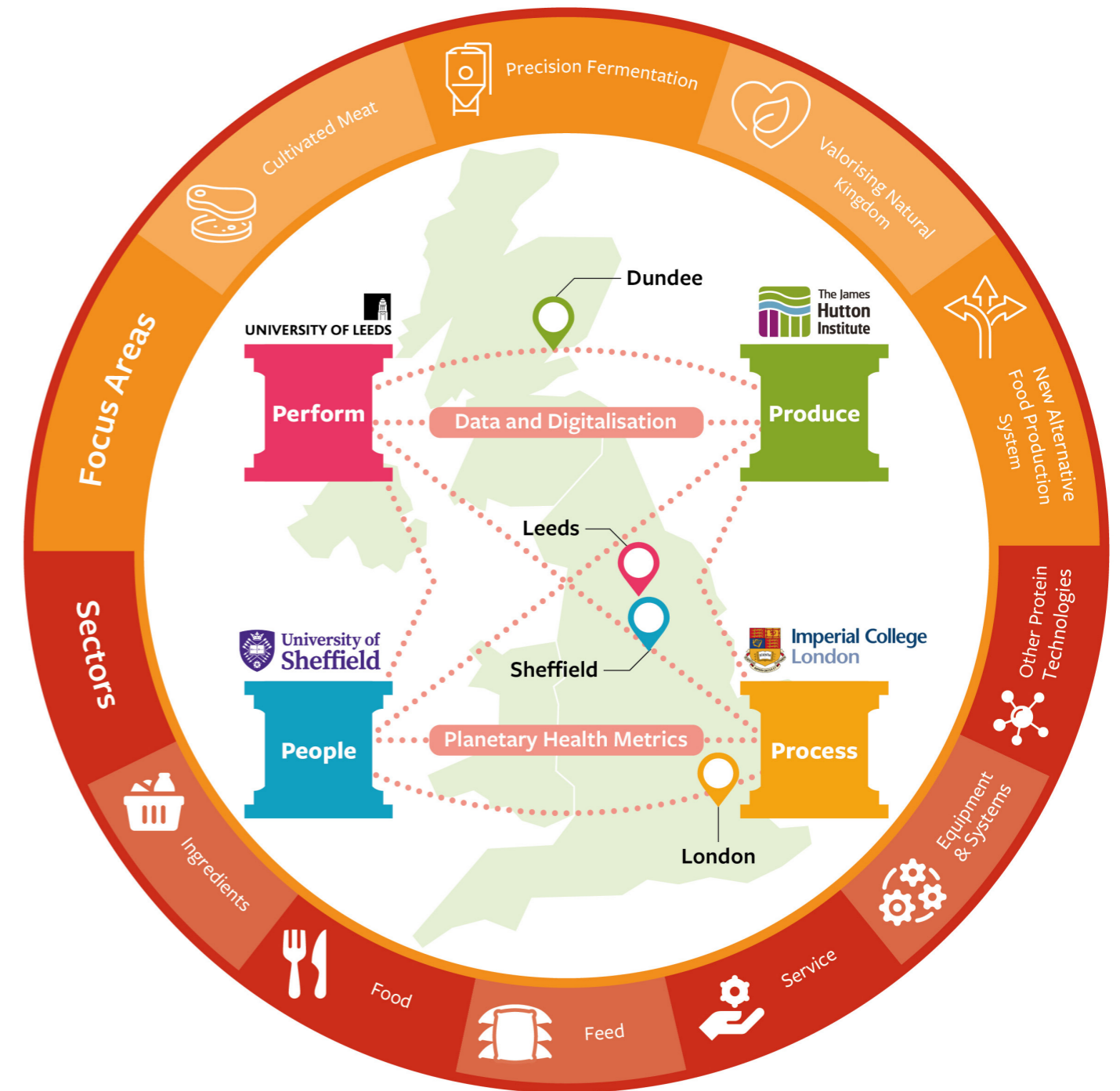
NAPIC was co-created through a series of workshops (January 2024), and facilitated discussions, engaging with over >80 industry stakeholders, investors and third sector to shape its vision, approach, engagement mechanism, and policy goals. These workshops highlighted that NAPIC’s strength lies in its collaborative and interdisciplinary approach, integrating consumer engagement, regulation, and innovation. Stakeholders highlighted benefits such as knowledge sharing, targeted R&D, and regulatory support but raised concerns about funding, scalability, and project prioritisation.

For engagement, stakeholders favoured networking, co-funded research, and broader outreach, including retail and media. They emphasised the need for clear IP management, flexible timelines, and international collaboration.

NAPIC aims to influence policies on alternative proteins, focusing on regulations, labelling, sustainability, and energy policies. Stakeholders stressed the importance of consumer education, regulatory clarity, and global alignment.

NAPIC will engage with policymakers, including the Food Standard Agency (FSA), The Department for Environment Food and Rural Affairs (DEFRA), and trading standards bodies, to simplify processes and build a robust evidence base. Collaborative efforts aim to harmonise sustainability claims, address long-term challenges like trade policies and food security, and showcase economic and environmental benefits. Clear communication and credible scientific evidence remain central to these efforts, ensuring NAPIC’s alignment with both domestic and global policy objectives.

NAPIC currently has 106 UK industry partners, 13 international industry partners, 37 UK research partners, 24 international research partners. This has grown by over 60% since it began in August 2024.



**Figure 1.** NAPIC’s Interdisciplinary Knowledge Pillars (PRODUCE, PROCESS, PERFORM and PEOPLE, 4Ps) and Focus areas covering all alternative protein industrial sectors.



Figure 2: Partner Engagement Workshop.

### NAPIC – First Partner Engagement Workshop

The purpose of the workshop was to unite key stakeholders from across the alternative protein sector to gain a comprehensive understanding of their challenges, needs, and aspirations from NAPIC. The sessions were designed to ensure stakeholders felt represented in the development of NAPIC. Discussions focused on the Innovation Challenges emerging from the co-creation workshops (January 2024) and how the NAPIC community could address these via a robust knowledge base, fostering innovation, and upskilling the community. By actively engaging participants, the workshop sought to understand the changing nature of innovation challenges and maximise NAPIC's impact on industry, academia, regulation, funding, and society as a whole.

### Overview of attendees and their interest in Innovation challenges.

Attendees spanned a wide range of job types across all career stages, including roles in food science, nutrition, biotechnology, sustainable food systems, and bio-manufacturing. Participants included Professors, Researchers, CEOs, Managing Directors, and Business Development Managers, as well as professionals in food innovation, sustainability, R&D, and Agri-Systems. The event also brought together policy advisors, patent attorneys, and investors, reflecting the diverse expertise shaping the industry. For a list of contributors please see page x

### Report structure

The remainder of this report is structured into the six innovation challenges:

1. Unlocking Natures Potential
2. Protein Discovery
3. Structuring for Functional and Nutritional Benefits
4. Enabling Sustainable Bioprocessing at Scale
5. New Metrics and Standards for Product Quality and Environment
6. Acceptability and Accessibility

Each innovation challenge is split into the four questions discussed at each table:

1. What does this innovation challenge mean to your organisation?
2. How can the NAPIC community address this innovation challenge?
3. How can the NAPIC community address this innovation challenge by building a national knowledge base?
4. How can the NAPIC community address this innovation challenge through upskilling the community?

## Innovation Challenges

**1.**

**Unlocking Natures Potential**

**2.**

**Protein Discovery**

**3.**

**Structuring for Functional and Nutritional Benefits**

**4.**

**Enabling Sustainable Bioprocessing at Scale**

**5.**

**New Metrics and Standards for Product Quality and Environment**

**6.**

**Acceptability and Accessibility**



# Innovation Challenge 1

## Unlocking Nature's Potential



### What does this innovation challenge mean to your organisation?

This innovation challenge presents significant opportunities for organisations to address inefficiencies within the food system, particularly through investment in areas such as bioengineering, precision agriculture, and the development of new technologies. A key focus is diversifying protein sources, which involves identifying novel sources and creating a comprehensive protein database. It was clear that although there are diverse protein sources in nature, little has been explored, except proteins primarily derived from a select few plants, fungi, algae, and seaweeds.

Waste valorisation, such as enzyme recovery, and the exploration of insect proteins are also critical areas of interest. However, regulatory barriers, including the need for information and standards, pose challenges to diversification. Understanding equivalence and establishing minimum regulatory requirements to build trust, while learning from other regulatory frameworks, are essential steps.

Collaboration facilitation is another vital aspect, enabling shared insights and advancements. Organisations must also prioritise understanding the nutritional value of protein sources, defining adverse effects and safety considerations of food, this includes studying the physicochemical, nutritional, and biological properties and variations of existing crops and ingredients.

Finally, development of innovative manufacturing processes is crucial to realising the full potential of nature's diverse resources in the alternative protein landscape.

### How can the NAPIC community address this innovation challenge?

The NAPIC community can play a pivotal role in addressing this innovation challenge by fostering advancements in research, regulation, education, and collaboration. Key areas of focus include improving the fundamental understanding of peptide fragments, allergenicity, and bioactivity, which form the basis for safe and effective alternative proteins.

**Regulatory innovation:** Hosting regulatory community workshops and creating a regulatory roadmap are essential for bridging the gap between innovators and regulations. Streamlined processes should balance safety and innovation, adopting best practices from other countries while avoiding over-regulation that might stifle progress.

**Consumer-centric approaches:** Educating consumers about the benefits of a diverse range of alternative proteins, addressing concerns around taste, texture, and appearance, and enhancing transparency are critical steps. Understanding consumer requirements and fostering openness to novel food options will drive acceptance and adoption.

**Scaling and facilities:** Addressing challenges in pilot-scale production by providing access to food-safe facilities and creating a database of available resources is essential. This ensures novel products can be developed and scaled effectively.

**Supply chains and agriculture:** Efforts should include identifying new crops, such as lupins, for food producers to grow, incorporating crop rotation, and aligning supply chains with market demands. Developing new markets that are both lucrative and viable will maximise opportunities for alternative proteins.

**Technological and collaborative advancements:** Advancing technologies, such as enzyme recovery and insect protein utilisation, requires regulatory clarity and collaborative research. Building databases of protein sources and fragments, facilitating collaborations, and fostering diversity in protein types will ensure a broad spectrum of solutions.

**Education and upskilling:** Sharing best practices, upskilling capabilities in food science and technology, and offering training programmes will ensure the community is equipped to meet the demands of the sector. Developing short- and long-term perspectives for food standards and ingredient standardisation is also critical.

**Sustainability and innovation:** Efforts should include utilising new and/or underutilised feedstock, exploring new technologies, and finding innovative uses for waste, such as insect frass. Aligning these with environmental goals ensures the sector's long-term sustainability and economic viability.

### How can the NAPIC community help to address this innovation challenge through building a national knowledge base?

A national knowledge base should include creating an expert database to identify key thought leaders and consultation experts who can guide and advise. Additionally, a facilities database would centralise information on available resources, enabling efficient access to infrastructure for research and development. Connecting and steering networks across academia, government, and EU-funded projects will further facilitate collaboration and resource sharing, fostering innovation and progress.

### How can the NAPIC community help to address this innovation challenge through upskilling the community?

To support the development of expertise and leadership in the sector, NAPIC should create opportunities for placements and internships, allowing emerging professionals to gain hands-on experience. Early career development initiatives should include leadership and skills training programmes to prepare individuals for influential roles within the sector. Policy training and fellowships can enhance understanding of regulatory landscapes, while communication training will equip professionals with the tools needed to effectively convey complex ideas to diverse audiences. Technical skill development is needed in analytical testing so that standard tests (e.g., digestibility, solubility) can be done on a range of cultivars (particularly for protein from crops). These efforts will ensure the community remains adaptable, knowledgeable, and equipped to meet future challenges.



## Innovation Challenge 2 Protein Discovery



### What does this innovation challenge mean to your organisation?

The concept of protein discovery is not clearly understood across the community, highlighting the need for clarification and a refined definition.

The challenge is multifaceted, with organisations interpreting it in different ways, such as:

- Discovering new protein molecules for use in food and feed products (focusing on the molecules themselves).
- Developing new protein formulations or blends for food applications (focusing on functionality and formulation).

The term: “discovery of protein molecules that give the right functionalities,” has been suggested as a more precise way of describing this challenge. Key considerations and barriers include:

- **Sustainability and perception:** Participants noted the potential of novel proteins like those derived from grass, emphasising net-zero goals. However, consumer perceptions, particularly around nutritional value, remain a significant hurdle.
- **Methodology alignment:** Standardised methods for characterising alternative proteins are critical.
- **Scale-up challenges:** Transitioning from lab-scale research to production quantities (100-500 kg) necessary for testing is a major bottleneck.
- **Getting it right the first time:** There is a strong belief that first impressions with consumers are crucial, as products failing to meet expectations may not receive a second chance.

- **Affordability and price sensitivity:** Developing cost-effective solutions is a key driver for consumer acceptance, requiring clear understanding of market segments and price points.
- **Resource allocation:** With the alternative protein sector being broad, NAPIC’s limited resources necessitate strategic prioritisation of innovation efforts.
- **Efficiency and collaboration:** Understanding existing industry efforts can help direct resources effectively and avoid duplicative work.

Broader implications and insights:

- **Facilitating discovery:** Exploring how current and novel green technologies can support the identification of new proteins and overcome associated innovation barriers.
- **Safety and acceptance:** Addressing safety concerns and ethical considerations, including the implications of AI use in protein research.
- **Terminology and communication:** Reframing terms like “alternative protein,” which may have negative connotations, to focus on specific sources (e.g., pea, lentil, soybean). Consistency in terminologies such as “blended protein” and “hybrid products” is also important.

- **Cultural shift:** Promoting consumer openness to diverse protein sources while educating the public on the long-term necessity of alternative protein options for sustainability.
- **Transparency:** Building trust through clear and open communication across the complete chain about the benefits and limitations of novel proteins.
- **Exploring new applications:** Potential applications in cosmetics and other industries were discussed, highlighting the broad scope of protein discovery.

### How can the NAPIC community help to address this innovation challenge?

One important step is mapping the manufacturing assets already available in the UK. Consolidating this existing knowledge will provide valuable insights into current capabilities and gaps within the industry.

Educating consumers is also a crucial aspect of addressing this challenge. Consumers need to better understand the nutritional aspects and the nature of alternative proteins. A challenge in this area is the trust consumers place in information, as they often turn to large, established companies for guidance. However, information provided by industries can sometimes be perceived as self-serving. To mitigate this, third-party organisations should be involved to provide an independent and credible voice to lead the education of consumers.

Another recommendation is to create a registry of what has not worked in the field. While valuable, this initiative faces the challenge that many industries may view such information as trade secrets and may be reluctant to share it. There is an opportunity to explore whether consultants or advisors can help avoid repeating efforts by drawing on existing knowledge. Additionally, the possibility of sharing pre-competitive knowledge among stakeholders could benefit the entire sector.

The importance of a multi-disciplinary approach to innovation cannot be underestimated. NAPIC should assist in identifying and bringing together complementary expertise across various sectors. It is essential to learn from other protein industries and parallel industries to broaden perspectives and avoid reinventing the wheel.

Branding is highlighted as a critical element in the success of alternative protein products. A consumer-centric design process should be adopted to ensure the product resonates with consumers from the start. Consumer trends evolve quickly, and the industry must be agile to capture emerging preferences. Sending clear, consistent messages about the health and nutritional benefits of alternative proteins is key to building consumer awareness and engagement.

Moreover, there is a need to encourage a broader shift in diet to prepare for future challenges. This includes emphasising the limitations of certain protein sources, such as plant proteins, which may lack micronutrients or face digestibility issues. The focus should be on promoting new food products rather than

mimicking existing meat-based options, shifting the narrative away from imitation towards innovation.

From a commercial perspective, it is crucial to recognise that consumers have diverse needs, and trying to meet all of them can result in smaller profit margins. Therefore, prioritising products that are easier to bring to market or have a quicker development cycle could offer valuable “easy wins” for the sector.

Finally, funding for agile research remains limited, with only £4 million available. This means that careful prioritisation is necessary to determine where efforts should be focused. Regulatory approval remains a significant issue, and NAPIC must facilitate discussions and processes to ensure that regulatory hurdles do not impede innovation.

### How can the NAPIC community help to address this innovation challenge through building a knowledge base?

To address this innovation challenge, the NAPIC community can help by building a comprehensive national knowledge base that captures key information about the available protein sources across the country. This includes identifying what proteins are available and where they are produced, understanding the functionality and nutritional profile of these proteins after processing, and mapping out the specific applications for different proteins in food production. A key part of this knowledge base is to also understand how these proteins behave in various food products and their potential for innovation.

To ensure this knowledge is useful, NAPIC can host events that bring together stakeholders from academia, industry, and consumers to foster trust and share insights. By engaging with consumers, NAPIC can also provide accessible information on food labels, such as explaining E numbers, the difference between ultra-processed and processed food, and the nutritional value of alternative protein sources. It is important to go beyond just nutritional values and include an in vivo understanding of how these alternative proteins behave in the human body.

While mapping the landscape of available proteins, it will be essential to also understand who is producing what proteins and at what scale. This information should be included in the knowledge base, as well as data on the functionality of each protein (e.g., whether a protein has gelling, foaming, or other relevant properties for food applications). However, a significant challenge is the potential reluctance of manufacturers to share proprietary information, which could hinder data collection. Despite this, NAPIC can strive to compile publicly available research data and provide a platform for sharing positive and negative results from industry and academia. It is important to assess the willingness of stakeholders to contribute to this database and identify the users who will benefit from it.

## How can the NAPIC community help to address this innovation challenge through upskilling the community?

The NAPIC community can play a pivotal role in addressing this innovation challenge by focusing on upskilling key stakeholders across the food innovation landscape. One of the critical gaps identified is the difference between lab-scale pilots and industry-scale production, with a need for development in bridging this gap. Training initiatives should focus on developing skills to transition from lab-scale research to real-world applications, which often requires adjusting to industry needs and scale.

Additionally, there is a significant need for data scientists who understand the complexities of food and food science, so they can effectively contribute to research that aligns with the industry's requirements. Engaging with development chefs is also crucial, as they will be at the forefront of using new ingredients in food production. By fostering relationships with chefs and providing them with the tools and knowledge they need, NAPIC can ensure that new ingredients are incorporated effectively into food products.

To minimise resources and maximise impact, it is important to pool the training and upskilling resources of various partners. By working collaboratively, NAPIC can ensure that the training provided is aligned with the real-world needs of the food sector, ensuring that graduates and professionals are equipped to meet the evolving demands of industry.

There is also an opportunity to explore novel processing technologies, as traditional methods may not be suitable for some new ingredients. Upskilling should include educating stakeholders about alternative processing techniques that can be used with new proteins and other food innovations. This includes understanding that when ingredients are replaced, the existing processing infrastructure may not always be compatible, and new approaches may be needed.

Up-scaling is another frequently mentioned challenge, and NAPIC can play an important role by providing guidance and training in scaling up food production processes. One suggestion is to create a database of industry needs, which could help prioritise research and development efforts. NAPIC can also provide training in conducting high-quality research to ensure that future professionals are well-equipped to contribute to the sector.

Finally, engaging with students early in their careers is crucial, and educating them about the food science and technology field, including the emerging role of alternative proteins, will prepare them to meet the future demands of the industry. Partnerships with organisations like those in the insect protein space, who are training people to farm insects, could be a valuable resource for training programmes and hands-on experience.





## Innovation Challenge 3 – Structuring for Functional and Nutritional Benefits



### What does this innovation challenge mean to your organisation?

This innovation challenge represents a significant opportunity for organisations to enhance product offerings by focusing on improving nutritional quality and functionality. Key objectives include ensuring products provide a complete amino acid profile comparable to animal proteins, enhancing digestibility and nutrient bioavailability, and mitigating anti-nutritional factors that inhibit nutrients absorption.

This challenge is as a chance to leverage diverse expertise to identify and address knowledge gaps collaboratively. For example, understanding the functionality of ingredients such as dairy and eggs is essential for our bakery and pastry partners, as these ingredients play critical roles in product quality, flavour, and processing dynamics. Exploring innovative methods—such as protein activation, fermentation, and enzyme utilisation—will enable us to create complex yet economically viable formulations. Concurrently, we are committed to resource efficiency, including the effective use of waste streams to promote circular systems, and advancing the acceptability of crops like fava beans for consumption in the UK.

This challenge also highlights the importance of a multi-disciplinary approach to bridging the gap between early-stage protein innovations and market-ready products. By focusing on scalable manufacturing and sustainable practices, NAPIC can develop low-carbon, consumer-friendly protein solutions that align with modern dietary trends and environmental goals.

Key areas of focus include:

- **Enhanced product development:** Structuring proteins to serve diverse functionalities, such as egg replacements, while creating tailored products that meet specific consumer needs.
- **Sustainability goals:** Utilising pre-consumer food waste (often called food loss) and manure in primary production to build eco-friendly food systems. These efforts not only benefit consumers but also provide incentives for stakeholders such as producers, who can gain through mechanisms like carbon credits.
- **Scalability and infrastructure needs:** Addressing the mid-scale manufacturing gap is critical for transitioning from prototype to market-ready products. Developing the necessary infrastructure will be a cornerstone for ensuring industry competitiveness.
- **Collaboration across sectors:** Building connections between regulators, manufacturers, chefs, and researchers is essential to align goals, streamline development processes, and ensure market needs are met effectively.

### How can the NAPIC community help to address this innovation challenge?

The NAPIC community plays a pivotal role in addressing this innovation challenge by fostering collaboration, supporting stakeholders, and driving industry-wide progress. Its contributions can be categorised into several key areas:

#### Solving the challenge

NAPIC can act as a collaborative network, bringing together academia, industry, and regulators to devise effective solutions. By avoiding siloed efforts, it provides a unified voice that represents the sector's collective interests.

#### Facilitating networking and collaborations

NAPIC serves as a hub for connecting producers, chefs, manufacturers, and researchers. By fostering partnerships and enabling the exchange of expertise, it ensures co-development of innovative solutions. Additionally, it can link stakeholders to global initiatives, integrating insights and strategies from international hubs.

#### Supporting start-ups and SMEs

Start-ups and small-to-medium enterprises (SMEs) face unique challenges in navigating the complex landscape of alternative protein development. NAPIC can provide targeted guidance, lowering barriers to entry and empowering smaller organisations to contribute meaningfully.

#### Infrastructure support

Access to shared resources and scale-up facilities is critical for bridging the gap between research and market-ready products. NAPIC can play a key role in providing this infrastructure, enabling stakeholders to test and refine their innovations.

#### Policy advocacy

NAPIC can collaborate with regulatory bodies such as EFSA/FSA/ Singapore Food Agency/PIC to streamline approval processes and align standards. By reducing regulatory barriers, it can help accelerate the commercialisation of alternative proteins and related innovations.

#### Encouraging sustainable practices

Promoting the use of by-products like yeast in innovative applications (e.g., growing vegetables or producing alternative proteins), is vital for creating circular systems and reducing environmental impact.

#### Navigating consumer perceptions

Consumer acceptance is critical for the success of alternative proteins. NAPIC can help stakeholders craft messaging that emphasises the nutritional and functional benefits of proteins, avoiding terms like “alternative” that may evoke biases. Transparency and education about nutritional density, amino acid profiles, and digestibility are key.

#### Facilitating funding and market readiness

NAPIC can align stakeholders to pursue funding opportunities and provide tools for market readiness, such as pilot testing facilities and streamlined commercialisation routes. By supporting scalability,

it ensures innovative ideas transition smoothly from concept to consumer products.

Feedback to Stakeholders

- **Emphasise core innovations:** Use terms like “nutritional quality,” “complete amino acid profile,” and “digestibility and bioavailability” to articulate the value of innovation efforts.
- **Promote collaborative success:** Highlight the role of diverse expertise and teamwork in driving impactful solutions.
- **Align with industry needs:** Focus on areas such as ingredient functionality, cost-effective solutions, and sustainable practices to resonate with both industry and consumers.
- **Leverage NAPIC's unique role:** Showcase how NAPIC facilitates networking, promotes sector unity, and supports SMEs, demonstrating its importance as a central platform that aids innovation challenge delivery.
- **Encourage active engagement:** Use action-oriented language to inspire participation, such as “solving the challenge,” “facilitating networking,” and “mapping global initiatives.”

### How can the NAPIC community help to address this innovation challenge through building a national knowledge base?

#### Purpose and accessibility

The knowledge base should be designed with a broad audience in mind, using clear, non-technical language to ensure accessibility. It should serve as a pragmatic tool, emphasising real-world applications rather than theoretical possibilities, and avoiding reliance on buzzwords to foster accurate perceptions and effective marketing.

#### Mapping and strategic insights

By mapping the current landscape, the knowledge base can illuminate how various products impact the sector, identify who is working on specific areas, and uncover investment opportunities. It will help stakeholders focus on tangible, investable products while steering attention away from less viable options.

Before its establishment, a strategic approach is needed to address the broader implications of replacing animal proteins with alternative proteins, including nutritional, economic, and environmental impacts. This foundational understanding will help fill knowledge gaps and promote sector-wide benefits.

#### Content and features

##### Centralised repository

The knowledge base should include:

- Expertise areas and contacts to facilitate networking.
- Methodologies and protocols, such as those for in vitro testing and protein structuring.
- Case studies documenting successful innovations and nutraceutical benefits.



## Best practices and frameworks

It should provide detailed insights into:

- Effective collaborations between stakeholders.
- Funding strategies that have yielded results.
- Industry practices that support sustainable and scalable innovation.

## User-friendly resources

To ensure accessibility, the database should feature:

- Clear, non-technical language.
- Glossaries explaining technical terms.
- Visual aids like infographics and process maps for ease of understanding.

## Platform for collaboration

NAPIC could enhance the database by integrating an online platform hosted on its website. This platform would allow stakeholders to:

- Share knowledge and best practices.
- Discuss innovations and challenges.
- Engage in community-driven problem-solving.

## Pragmatic focus

The knowledge base should emphasise practical insights, capturing what has worked in the past and areas that are unlikely to succeed, particularly considering climate change and sustainability priorities. By doing so, it can guide stakeholders toward productive avenues for innovation.

Through the establishment of this knowledge base, NAPIC can unify the sector, foster collaboration, and drive impactful advancements in the field of alternative proteins and related innovations.

## How can the NAPIC community help to address this innovation challenge through upskilling the community?

### Demystifying fundamental knowledge

One of the first steps is addressing confusion within the sector by decoding complex information. This can be achieved in partnership with organisations like the Good Food Institute, to raise awareness among investors and stakeholders. By simplifying technical concepts, NAPIC can make the innovation landscape more accessible and engaging.

### Focusing on key areas of upskilling

- Water recovery and sustainability  
Promoting knowledge of water recovery techniques during food processing is essential to meet sustainability goals. Partnering with technology companies can provide foresight into emerging technologies that support these objectives.

- Commercial savvy for SMEs  
Many SME's lack a business-oriented mind-set. NAPIC can develop commercial programmes to help these businesses create clear value propositions and refine their pitches for investors and partners.
- Pilot facilities and practical training  
The absence of pilot facilities is a significant barrier. NAPIC can address this by providing access to such resources, enabling companies to advance their innovations. Workshops and practical sessions for the current workforce, along with traditional educational courses in nutrition and food technology, can build foundational and advanced skills in the food science domain.
- Food education advocacy  
There is a pressing need to reintroduce food education in schools. By advocating for its inclusion, NAPIC can help build a pipeline of knowledgeable future professionals for the industry.

### Proposed initiatives for upskilling Targeted training programmes

- Develop micro-credential programmes focused on:
  - Food safety standards, aligned with European Food Standard Authority and Food Standards Agency regulations.
  - Scaling protein innovations effectively.
  - Applying techno-functional methodologies for protein structuring.

### Workshops and roadshows

- Host events that educate stakeholders on:
  - Techno-functional protein applications.
  - Developing consumer-centric products.
  - Leveraging sustainability initiatives such as carbon credits.

### Testing and validation capabilities

- Equip stakeholders with in vitro testing skills to validate product safety and efficacy, bridging the gap between research and market-ready solutions.

### Cross-disciplinary collaboration

- Engage chefs, food producers, and manufacturers in workshops to explore innovative uses of food molecules, waste, and by-products, fostering a circular and sustainable approach to food production.

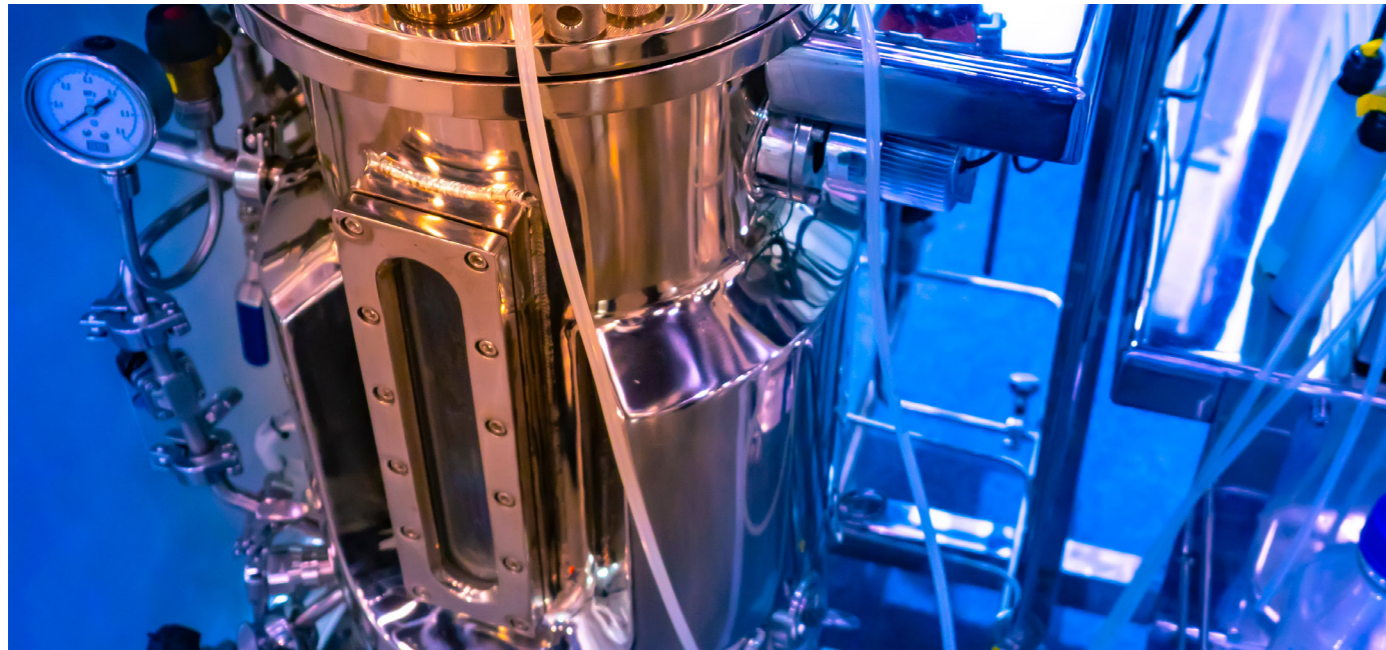
### Digital learning resources

- Create a suite of e-learning modules, webinars, and online forums to provide continuous education, accessible to stakeholders across academia and industry.





## Innovation Challenge 4 – Enabling Sustainable Bioprocessing at Scale



### What does this innovation challenge mean to your organisation?

This innovation challenge represents a pivotal opportunity for our organisation to address the critical bottlenecks in scaling sustainable bioprocessing. It involves navigating complex issues such as facility access, investment dynamics, and the integration of sustainability with financial viability.

Understanding and addressing the needs of the companies NAPIC supports is essential. Each organisation is at a different stage of development, which complicates collaboration and scalability efforts. Balancing the availability of investment with the increasing demand is a core challenge. Start-ups often face a funding gap, where they cannot secure capital due to the inability to demonstrate scalability. Demonstration plants are crucial to bridge this gap, offering proof of concept without requiring companies to invest heavily upfront.

Academia plays a key role in identifying the requirements for scaling cell cultures and adapting existing equipment for large-scale use. However, academic labs often lack access to large-scale facilities, which limits progress. The absence of food safety standard facilities at scale further constrains development. Only select Contract Manufacturing Organisations (CMOs) meet these stringent requirements. Vertical farming facilities and modular solutions offer potential pathways to fill this “in-between” scale gap, providing interim solutions that are larger than lab-scale but not yet commercial-scale.

Ensuring facilities are financially self-sustaining is ideal but not always feasible. In such cases, the focus shifts to evaluating broader benefits such as sustainability, environmental impact reduction, and

long-term industry advancements. The main driver of this challenge is minimising the environmental footprint while ensuring scalability and economic feasibility.

Building partnerships through NAPIC is vital to tackle intimidating challenges like integrating biology, feedstock, and supply chain dynamics. Bridging the language gap between academia and scale-up operations is necessary for smoother transitions and effective collaboration. A unified understanding of the common denominators among companies can facilitate shared solutions and minimise redundancies.

Introducing automation, AI, and sensor technologies—such as those used for monitoring harvesting or plant health—can significantly improve process efficiency and scalability. Advanced sensor systems could provide real-time data to optimise development and ensure compliance with food safety and security standards.

Addressing the unknowns surrounding alternative proteins is critical. While safety and security must remain a priority, regulations must also consider industry needs to foster innovation without stifling progress.

This challenge underscores the importance of collaboration, investment in scalable facilities, and innovative solutions to bridge the gap between lab-scale research and commercially viable processes. By addressing these multifaceted issues, NAPIC can drive forward a sustainable and scalable bioprocessing ecosystem that meets industry and consumer demands.

### How can the NAPIC community help to address this innovation challenge?

#### Fostering collaboration between academia and industry

NAPIC can act as a bridge between academic institutions and industry to facilitate the translation of early-stage research into scalable industrial applications. By linking stakeholders and identifying technology readiness levels (TRL) for scale-up, the community can accelerate the commercialisation process.

#### Optimising processes across the supply chain

Understanding how upstream processes affect downstream operations is critical to ensuring sustainability goals are met. NAPIC can help identify unique selling point (USP) design parameters that align with downstream processing (DSP) needs, promoting efficiency and reducing environmental impact.

#### Defining common standards and central propositions

To streamline collaboration, NAPIC can gather a critical mass of stakeholders to determine a common basis for requirements across the sector. This includes identifying a central proposition for bioprocessing initiatives and quantifying their impact.

#### Improving access to facilities and funding

Access to better facilities and data is essential for reducing reliance on less sustainable solutions. NAPIC can support funding initiatives, including those enabling start-ups to provide product samples, thereby reducing investment risks. It can also facilitate the use of existing catapult facilities for scaling up innovations, redeploy underutilised biotechnology resources, and conduct audits of available infrastructure to identify gaps.

#### Building open-source knowledge and sharing success stories

Creating an open-source knowledge database can enhance transparency and collaboration. Sharing success stories and case studies can inspire innovation and provide valuable insights into overcoming challenges.

#### Addressing scalability bottlenecks

Scalability remains a significant hurdle for many companies. NAPIC can offer expertise in know-how transfer, scaling processes, and navigating regulatory frameworks. This includes addressing cost challenges and improving efficiency compared to traditional methods and identifying supply chain bottlenecks.

#### Policy advocacy and workforce development

NAPIC can engage with policymakers to align government strategies and subsidies with industry needs. Additionally, the community can address workforce challenges by providing specialised training, enhancing university-industry partnerships, and making the sector more attractive to new talent.

#### Facilitating circular economy practices

Encouraging circular economy initiatives, such as by-product valorisation, can improve sustainability while unlocking new opportunities for innovation. NAPIC can bring start-ups and companies together to explore collaborative solutions in this area.

#### Supporting start-ups through mentorship and joint ventures

Mentorship programmes and leadership support for start-ups can accelerate growth and innovation. NAPIC can partner with organisations to facilitate mentorship and foster joint ventures between companies, including pre-competitive collaborations that address shared challenges.

#### Raising investor awareness and promoting knowledge exchange

By organising forums for sharing challenges and solutions, NAPIC can improve investor awareness and confidence in the sector. This can help start-ups and companies overcome barriers to scale and attract necessary funding.

Through these targeted initiatives, NAPIC can create a robust ecosystem that enables sustainable bioprocessing at scale, driving innovation, reducing environmental impact, and fostering economic growth across the industry.

### How can the NAPIC community help to address this innovation challenge through building a national knowledge base?

The NAPIC community can address the challenges of scaling plant-based manufacturing by developing a national knowledge base (with international input and reach) that integrates technical, economic, and collaborative insights. This resource would serve as a centralised platform to guide stakeholders in navigating the complexities of scale-up while promoting innovation and sustainability.

#### Facilitating scale-up collaboration

- Establish a “scale-up club” comprising small groups of manufacturers working on similar challenges, such as allergens or microbial processes.
- Bring established companies and start-ups together to share knowledge, approaches, and best practices, fostering mutual growth and innovation.

#### Providing technical, sustainability and economic tools

- Develop in silico models of target proteins to streamline the scale-up process.
- Create economic models for start-ups to help assess feasibility and plan for investment and scalability.
- Utilise digital twins to simulate processes from science to market, reducing risk and optimising resources.

### Building a comprehensive database

- Create a national knowledge database of food molecules and their properties, applications, and scalability potential.
- Include insights on bioprocess scale-up techniques, circularity strategies for valorising waste and by-products, and best practices for reducing environmental impact.
- Highlight what not to do by documenting lessons learned and pitfalls to avoid.
- Compile a list of national facilities for scale-up that are accessible to all stakeholders.
- Develop a NAPIC member directory outlining areas of expertise to streamline collaboration.

### Integrating consumer and regulatory perspectives

- Enhance transparency by integrating consumer feedback, especially for projects funded by BBSRC/IUK, to align with public expectations.
- Map the purpose of bioprocesses (e.g., protein production, functional ingredients) to better inform both consumers and regulators.
- Identify and document risks to aid regulators in developing frameworks that facilitate innovation while ensuring safety and compliance.

### Supporting start-ups and driving innovation

- Provide funding for start-ups to conduct feasibility studies and demonstrate food safety.
- Promote circular economy initiatives by including opportunities for waste valorisation and by-product utilisation in the knowledge base.

### Connecting the industry

- Explore whether an existing food industry database exists where NAPIC can contribute knowledge or build a complementary resource.
- Highlight customer insights by linking consumer knowledge with scientific development to ensure market alignment.

By developing this national knowledge base, the NAPIC community can provide the tools, resources, and connections necessary to overcome scale-up challenges, foster innovation, and achieve sustainability goals in plant-based and alternative protein manufacturing.

### How can the NAPIC community help to address this innovation challenge through upskilling the community?

#### Fostering cross-disciplinary expertise

- Facilitate the transition of life science professionals into the food sector and include engineers (chemical and process) in alternative protein development.
- Offer cross-disciplinary training opportunities, such as training biologists in data science or teaching protein structure and functionality to engineers.
- Provide science and technical training for chefs and culinary scientists to enhance flavour development and ingredient functionality expertise.

#### Integrating diverse industries and roles

- Encourage cross-industry learning by inviting professionals from sectors like pharma to share insights and best practices.
- Host roundtables to discuss shared challenges, such as regulation and scalability, fostering mutual learning between industries like food and pharma.
- Engage marketers in the NAPIC community to better align scientific advancements with consumer needs and preferences.

#### Supporting career pathways and industry collaboration

- Foster relationships between academia and industry to enhance employability and ensure the practical application of research.
- Enable student placements and internships to bridge the gap between knowledge and application, highlighting the tangible impact of research.
- Establish a centralised hub for graduates offering mentoring, upskilling workshops, and career guidance.

#### Promoting advanced training and competency development

- Provide training on evaluating and implementing new technologies, either directly or through partnerships with organisations like the Good Food Institute (GFI).
- Develop a competency framework to standardise skill development and align workforce capabilities with industry demands.
- Address challenges in employee retention by aligning salary and career expectations with those in competitive sectors like pharma.

#### Building collaborative ecosystems

- Encourage interdisciplinary scientists and experts by creating platforms for cross-sector collaboration and shared learning.
- Highlight the importance of mentorship and knowledge transfer, ensuring that expertise is disseminated effectively across the sector.





## Innovation Challenge 5 – New Metrics and Standards for Product Quality and Environment



### What does this innovation challenge mean to your organisation?

The challenge of developing new metrics and standards for product quality and environmental sustainability represents a pivotal opportunity and a significant hurdle for organisations in the alternative protein sector.

The following key themes highlight its implications:

#### Current standards and gaps

- There is a knowledge gap in assessing environmental impacts for alternative proteins, especially when extrapolating metrics from early-stage development to large-scale production.
- Ethical considerations, such as defining the ethical treatment and processing of insects, remain unresolved.
- In the pet food industry, quality standards vary globally, but sustainability remains unregulated and unstandardized. Economic allocation methods, which evaluate environmental impacts, sometimes disadvantage alternative proteins like insects compared to conventional solutions like chicken. This is because traditional protein sources often utilise by-products from human food production, minimising waste.
- A troubling trend is the increased use of high-quality meat cuts for pet food, driven by marketing rather than sustainability considerations.

#### Need for new metrics and measures

- Developing new metrics is essential to accurately assess sustainability and environmental impacts. These measures must account for various stages of production and processing, including the carbon intensity of products like plant-based milk.
- Consumer communication is a critical challenge. Metrics need to clarify processes like cultivated meat production and navigate tensions around ultra-processed foods (UPF) and genetically modified organisms (GMO).
- Harmonisation of global standards is needed to address regulatory disparities, such as those surrounding fermented whey protein in the US and Europe.

#### Consumer engagement and labelling

- Traffic light systems (e.g., Nutri-Score, Eco-Score) could simplify consumer understanding of sustainability metrics and encourage informed purchasing decisions.
- Transparent labelling is vital for building consumer trust, especially in areas like allergens, GMO, and the environmental footprint of ingredients.

- Terms like “alternative protein” may appear off-putting to consumers, necessitating the use of language that conveys naturalness and clarity.

#### Industry collaboration and policy advocacy

- Collaborative efforts are essential to avoid “reinventing the wheel.” Learning from existing EU projects and international practices (e.g., in Singapore and the US) can accelerate progress.
- A community-driven approach to lobbying and policy advocacy strengthens the sector’s voice in influencing regulations, particularly for bio-economy and Carbon Dioxide labelling initiatives.
- Establishing a level playing field in standards—for example, ensuring synthetic ingredients like rennet in cheese are labelled consistently—will foster fairness across sectors.

### How can the NAPIC community help to address this innovation challenge?

The NAPIC community is well-positioned to address the challenges of developing new metrics and standards for product quality and environmental sustainability through the following strategies:

#### Developing new standards

- Create new regulatory and quality standards by integrating data from experimental research and predictive models. These standards can help bridge the gap between scientific innovation and practical application.

#### Facilitating communication

- Many alternative proteins face stringent regulatory approval processes. NAPIC can play a pivotal role by acting as a liaison between industry and regulatory bodies, facilitating open communication to streamline these processes and improve clarity for stakeholders.

#### Adopting a global perspective

- To stay competitive and forward-thinking, NAPIC should analyse global trends in alternative proteins, recognising regional differences in environmental priorities and consumer behaviour. Learning from diverse markets can help refine standards and practices.
- Advocate for the sector through a unified NAPIC voice, leveraging lobbying power to shape policy and drive industry alignment.

#### Learning from historical precedents

- The history of GMO regulation in Europe offers valuable lessons for how public perception, regulation, and market dynamics can shape the adoption of novel food technologies. NAPIC can use these insights to anticipate potential challenges and proactively address them.

By focusing on these key areas, the NAPIC community can support the development of a robust framework for new standards and facilitate the adoption of sustainable and innovative solutions in the alternative protein sector.

### How can the NAPIC community help to address this innovation challenge through building a national knowledge base?

The NAPIC community can support the development of a robust national knowledge base to address the challenges of alternative protein innovation by focusing on the following areas:

Balancing transparency and intellectual property (IP)

- Establish clear guidelines on what data will be public and what remains proprietary, ensuring regulatory transparency while respecting the competitive interests of companies.
- Publicly share critical data on hazards and allergens to reduce duplicative experiments and animal studies, supporting ethical research practices.

#### Facilitating access to resources

- Encourage larger companies to open their facilities to smaller players, fostering collaboration and recognising the primary competition as traditional animal-based solutions, not within the alternative protein sector.
- Create a centralised knowledge database of facilities, including shared knowledge on successful strategies, standards, and sustainability metrics as the lack of such a resource currently limits industry efficiency.

#### Standardising experimental and evaluation methods

- Share experimental procedures to optimise testing and reduce inefficiencies.
- Develop and disseminate standardised methodologies to evaluate product quality and environmental performance, aiding regulators, and investors alike.
- Develop tools to measure and improve process efficiency, with a focus on sustainable practices.

#### Learning from international leaders

- Analyse approaches in countries advancing faster in this field, such as Singapore and the US, particularly their progress in cultivated meat and regulatory frameworks.
- Collaborate with established organisations such as the Singapore Food Agency, British Retail Consortium, and other international entities to align global standards.
- Utilise traffic light systems and international comparisons to align consumer messaging with global best practices.

#### Defining standards for novel challenges

- Identify elements unique to alternative proteins that are not addressed by current food standards, including allergens, off-notes, and off-flavours, and work to integrate these into a knowledge base.
- Create frameworks for ethical standards and sustainability metrics, ensuring the data is easily accessible and actionable.

### Acting as a central knowledge hub

- Capture safety profiles, allergens, and sustainability data to act as a centralised repository for industry-wide learning.
- Facilitate collaboration with existing organisations and projects, serving as a knowledge broker to build upon already identified information and avoid redundancy.
- Develop a database leveraging computational science and machine learning to model data and identify gaps, enabling efficient solutions to challenges hindering progress. Engage in public education campaigns to raise awareness of the environmental impacts of alternative proteins and address misconceptions.

### How can the NAPIC community help to address this innovation challenge through upskilling the community?

#### Addressing skill gaps in scale-up

- Scale-up remains a significant challenge due to a lack of expertise in the commercialisation process and technical skills for alternative protein manufacturing.
- Investors often hesitate to fund start-ups because:
  1. Technological differentiation is insufficient from existing solutions.
  2. Capital requirements are prohibitively high.
- Providing targeted training and mentorship in these areas can enhance the sector's investment-readiness.

### Bridging the knowledge gap between food science and bio-science

- Encourage interdisciplinary learning by integrating food science and bio-science disciplines, particularly in the use of bio-reactors for food production.
- Develop specialised Master of Research (MRes) courses and workshops to train professionals in the application of bio-science for food technologies.

### Promoting transparency and knowledge sharing

- Create a system to share public dossiers on cell lines, detailing food safety data and best practices, while protecting proprietary information where necessary.
- Learn from the insect protein community, which has developed models for sustainable and collaborative data sharing.
- Encourage businesses to openly share non-competitive information to foster innovation across the sector.

### Upskilling the existing workforce

Focus on continuous education for the current workforce, offering training in:

- Food technology applications
- Nutrition science and health
- Safety standards and regulatory compliance

### Enhancing industry competitiveness

- Equip companies with tools and knowledge to develop comprehensive food safety dossiers, ensuring global competitiveness.
- Provide resources to navigate the complex commercialisation landscape, making start-ups more attractive to investors.





## Innovation Challenge 6 – Acceptability and Accessibility



### What does this innovation challenge mean to your organisation?

#### Consumer demand and trust

- There is a significant need to generate consumer demand for emerging proteins such as cultivated meat, insect-based products while normalising these as viable food sources.
- Building trust in alternative proteins is critical, as many products are stigmatised due to their association with ultra-processed foods.
- The public's perception of products, particularly cultivated and insect proteins, often includes biases without first-hand experience or understanding.

#### Addressing nutritional needs and diversity

- Products must meet the nutritional needs of diverse segments of the population, including young, elderly, and vulnerable groups.
- Consideration of different circumstances and cultural backgrounds is essential; a product does not have to cater to all to be successful but should have targeted acceptability.

#### Food system transition and sustainability

- Supporting stakeholders in transitioning from traditional agricultural practices to decarbonised systems is a key challenge.
- There is competition for renewable feedstock among industries like biofuels, anaerobic digestion, and alternative proteins, complicating resource allocation.

#### Mimicry and accessibility challenges

- Consumers still expect products that mimic meat, but these often face challenges such as high price points and limited flavour appeal.
- The absence of food-grade growth components for cellular meat and a disconnected supply chain hinders scalability and affordability.

#### Data and knowledge accessibility

- Global data on alternative proteins is often restricted by paywalls, limiting accessibility for stakeholders.
- Ensuring data is open and accessible can foster collaboration across academia, industry, and consumers.

#### Brand building and social engagement

- A lack of consumer awareness calls for the creation of relatable role models or a public face for alternative proteins on social media.
- Collaboration with social scientists is crucial to merge brand building with consumer acceptance strategies.

#### Learning from insect proteins

- Insect proteins provide an opportunity to study how to present alternative foods through imagery and learning from the culinary practices of different cultures.
- Despite their potential, insect proteins are not vegan or vegetarian but fit into existing protein ecosystems.

#### Taste and sensory experience

- Engagement with taste and sensory experts is essential to address challenges like flavour and texture, ensuring products are both acceptable and competitive.

#### Opportunities for innovation

- Partnering with producers to de-carbonise systems and address on-farm challenges.
- Developing proteins which replicate those that current exist through innovative production methods.
- Exploring new food models and methods to produce alternative proteins at scale.

### How can the NAPIC community help address this innovation challenge?

#### Building collaborative platforms

- Establish a platform for discussion and innovation to foster collective solutions and ensure studies and performed following similar methods to enable bench marking.
- Avoid competition for limited funding, which can dilute impact. Instead, harness collective power for significant results, ensuring strategic management (e.g., through Senior Management Team) to streamline efforts.
- Collaborate on public engagement initiatives to promote alternative proteins, emphasising the need for diverse product offerings to cater to varying consumer preferences.

#### Product innovation and adoption

- Develop hybrid protein products, such as combining insect and plant-based proteins, to maximise nutritional and functional benefits.
- Leverage the food service industry as an entry point for new products, where consumers may be more open to experimenting in a group setting compared to individual shopping.
- Explore experimentation initiatives in controlled environments such as Schools to influence early adoption.
- Launch prizes and competitions, potentially in collaboration with cultural hubs such as, the Science Museum, to drive innovation and public interest.

#### Leveraging science and behavioural insights

- Utilise scientists and behavioural studies to inform product design and understand consumer psychology, particularly for vulnerable populations.
- Partner with influencers and branding experts to create appealing narratives.
- Academic partners can bring rigor to studies to generate clear, data-supported outcomes and build a national evidence base for alternative protein adoption.

#### Analogies and gradual transitions

- Learn from successful adoption stories (e.g., sushi) to identify effective strategies for normalising alternative proteins.
- Focus on decarbonising traditional agriculture through sustainable feed for dairy and poultry as an initial step. This smaller leap can build public confidence and pave the way for acceptance of alternative proteins.

#### Optimising resource use and standardisation

- Encourage networking among stakeholders to ensure the full use of inputs and produce a range of products efficiently.
- Conduct analyses of renewable organic feedstock, exploring location-based value addition and showcasing demo sites to demonstrate potential.
- Develop a database for alternative protein-related information, including standardised food ingredient definitions, production techniques, and impact metrics.

#### Cultural and behavioural change

- Address challenges in food culture through targeted initiatives, leveraging collaborations, coordination hubs, and networks.
- Promote behaviour change campaigns that highlight the environmental and societal benefits of alternative proteins.
- Challenge traditional perceptions of food and normal food culture through education and marketing.

#### Policy and retail partnerships

- Partner with retailers and food service providers to improve accessibility and visibility of alternative proteins.
- Work with policymakers to establish standardised regulations and ingredients, ensuring consistency and transparency across the industry.

#### Other considerations

- Adapt to the variability of climate change, focusing on resilient production systems.
- Explore European approaches, such as using 100% of fish waste/by-products, as a model for maximising resource utilisation.
- Investigate cultural shopping habits (e.g., weekly UK shopping vs. daily European shopping) to understand their impact on ultra-processed foods and consumer behaviour.

### How can the NAPIC community help address this innovation challenge through building a National Knowledge Base?

#### Define and maintain a National Knowledge Base

- Clearly articulate what constitutes a national knowledge base—a centralised repository of knowledge, tools, and resources to support innovation and adoption of sustainable food solutions.
- Ensure the knowledge base is regularly updated to remain relevant and valuable, avoiding obsolescence.

### **Build consumer trust through transparency**

- Use the knowledge base to communicate transparently with consumers, fostering trust and understanding of sustainable food products.
- Provide clear and standardised information on digestibility, taste factors, and nutritional value, addressing key consumer concerns.

### **Reframe the narrative around proteins**

- Reconsider terminology, moving away from “alternative proteins” to terms like “sustainable proteins”, “sustainable food”, or “sustainable ingredients”.
- Recognise that labelling matters and ensure that names and descriptions reflect the holistic benefits of these products while aligning with consumer understanding.

### **Foster holistic understanding of nutrition**

- Encourage a shift from a focus on 1:1 replacements of traditional proteins to a holistic approach to balanced diets.
- Support the development of recipes and resources like cookbooks to demonstrate the versatility and practicality of sustainable foods.

### **Standardise terminology and communication**

- Develop a common means of communication for the industry, enabling key stakeholders to lead in standardising terminology, labelling, and claims.
- Reduce confusion and potential disputes by ensuring consistency in labelling enforcement and advertising claims, aligning industry and consumer expectations.

### **Promote collaboration and education**

- Use the knowledge base to educate stakeholders on sustainable food innovations, from industry players to consumers.
- Provide examples and case studies of success, focusing on accessible and understandable language to demystify complex concepts like GMOs or lab-based processes.

### **Avoid overwhelming consumers**

- Focus efforts strategically; while it is impossible to tackle all challenges at once, prioritise key areas to build confidence in sustainable foods.
- Be mindful of consumer perceptions, particularly around sensitive topics like GMOs, to avoid unnecessary resistance or fear.

### **How Can the NAPIC community help to address this innovation challenge through upskilling the community?**

#### **Address potential negative impact of education**

- Recognise that education might have unintended consequences. While it is essential to raise awareness, there is a risk that education could inadvertently trigger fear-based responses, which are often more powerful than health-focused messages.
- To avoid negative backlash, it is crucial to approach education with an emphasis on empowerment and positive engagement, rather than focusing solely on potential risks.

#### **Upskilling NAPIC members in public communication**

- Provide training to NAPIC members on how to effectively story tell and communicate with the public and consumers.
- Equip members with skills to engage through the right channels, whether through workshops, schools, or media outlets.
- Look to successful international examples such as the Netherlands, where the government initiated a positive biotech debate that framed biotechnology as a potential for good rather than as a threat.

#### **Global knowledge sharing and collaboration**

- Promote global sharing of knowledge, recognising the value of partnering with the right collaborators, and facilitating cross-border collaboration.
- Encourage the creation of databases to document and align metrics used by the industry, such as protein solubility. This can help resolve inconsistencies in how different companies measure the same characteristics, aiding more reliable comparisons of alternative proteins.

#### **Themed events for knowledge sharing**

- Organise themed events to facilitate deep dives into specific challenges, fostering targeted learning, and collaboration within the NAPIC community.
- Use these events to connect members with the right skills and expertise to drive progress in specific areas, particularly where customer-led design is essential.

#### **Tailor upskilling to the needs of alternative proteins**

- While there may not be a need for broad upskilling, focus should be on making the right connections between individuals and the necessary skills for specific alternative proteins.
- Tailor the conversation and approach to the type of alternative protein in question, recognising that different solutions may require different kinds of expertise.



Question for all six innovation challenges	Key themes emerged
<b>What does this innovation challenge mean to your organisation?</b>	<p><b>Opportunity identification:</b> Highlights the potential for addressing inefficiencies in the food system through bioengineering, precision agriculture, and technological advancements.</p> <p><b>Diversification of protein sources:</b> Calls for exploring underutilized protein sources and building a comprehensive protein database.</p> <p><b>Focus on waste valorisation:</b> Emphasizes enzyme recovery and insect protein exploration.</p> <p><b>Regulatory challenges:</b> Notes the need for standards and transparency to foster trust and overcome barriers to innovation.</p>
<b>How can the NAPIC community address this innovation challenge?</b>	<p><b>Research and regulation:</b> Advance understanding of peptide fragments, allergenicity, and bioactivity while hosting workshops to streamline regulatory processes.</p> <p><b>Gaining Consumer Trust:</b> Build consumer trust by addressing taste, texture, and transparency concerns.</p> <p><b>Scaling and resources:</b> Provide access to pilot-scale production facilities and build resource databases for effective scaling.</p> <p><b>Encourage Supply chain alignment:</b> Encourage new crop cultivation, crop rotation, and market-driven supply chain strategies.</p> <p><b>Technological progress:</b> Innovate in areas like enzyme recovery, protein databases, and waste valorisation.</p> <p><b>Upskilling initiatives:</b> Offer training to bridge gaps in technical expertise and scale-up processes.</p> <p><b>Collaborative efforts:</b> Encourages partnerships to share insights and enhance nutritional understanding of protein sources.</p>
<b>Building a National Knowledge Base</b>	<p><b>Comprehensive databases:</b> Create expert, facilities, and protein source databases to centralise knowledge and foster collaboration.</p> <p><b>Stakeholder engagement:</b> Facilitate connections across academia, industry, and government for shared innovation.</p> <p><b>Sectoral trust:</b> Provide clear, accessible information on alternative proteins, including nutritional profiles and safety standards.</p>
<b>Upskilling the community</b>	<p><b>Skill development:</b> Focus on lab-to-industry transitions, data science expertise, and novel processing technologies.</p> <p><b>Training resources:</b> Consolidate training efforts across partners for efficiency and real-world relevance.</p> <p><b>Early career engagement:</b> Prepare future professionals through internships, leadership programmes, and partnerships with niche sectors like insect protein farming.</p>
<b>Broader comments</b>	<p><b>Sustainability focus:</b> Align protein discovery and production efforts with environmental goals and net-zero initiatives.</p> <p><b>Consumer-centric design:</b> Shift from mimicking meat products to promoting innovative food solutions.</p> <p><b>Terminology and branding:</b> Reframe communication to focus on specific protein sources and their benefits.</p>





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