

# An Evaluation of the Small Business Research Initiative: Appendix F: Case Studies

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# F Case Studies

## Introduction

- F.1 This Appendix includes the methodology, scope, and design of the case studies used in the main report. The purpose of the case studies is to illustrate user journeys and benefits of engaging with SBRI. Case study examples of individual competitions and beneficiary firms were produced to demonstrate and showcase the wide and varying benefits of SBRI. The case studies covered topics including rationale; inputs and activities; outputs, outcomes, and impacts; and final conclusions.

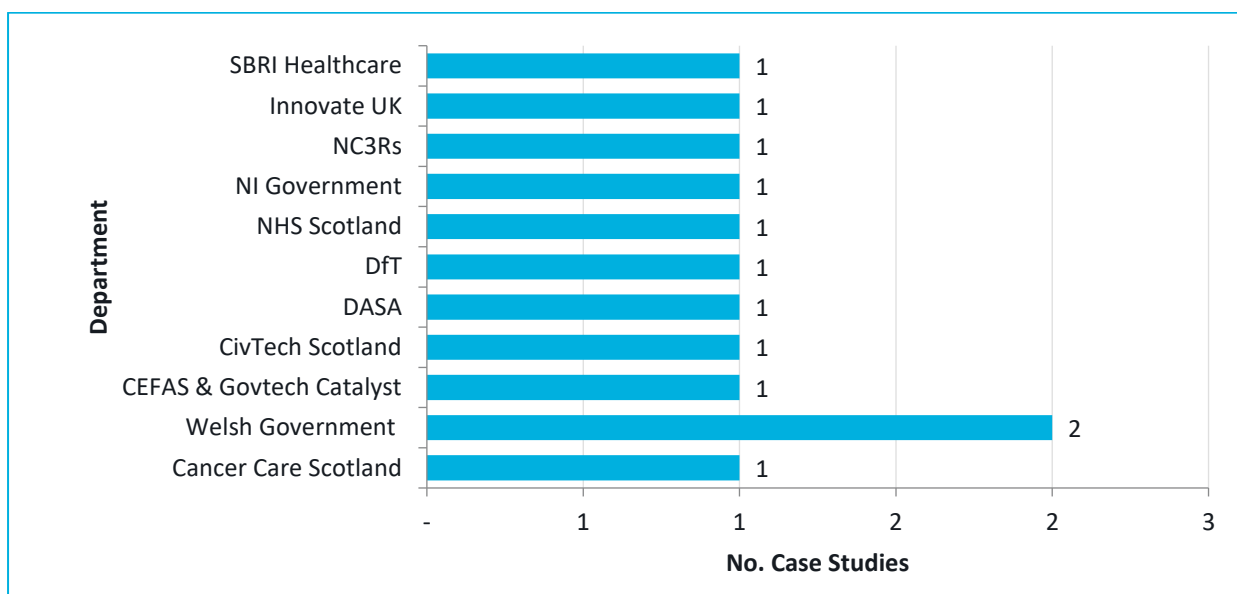
## Methodology

- F.2 A set of case study questions were designed which would reflect the agreed set of testable hypotheses and other information requirements. A framework was designed for selecting case studies i.e. departmental/agency spread; firm type; award size; timeframes; evidence of impact/success etc. This was based around the case study selection schematic:
- **Collation of leads:** Candidate list of potential case studies by availability of possible ‘stories to be told’;
  - **Pre-selection:** A long list of possible case studies was selected (n=28) based on available information at this point of the study (relying especially on internal UKRI/Innovate UK documentation);
  - **Assessment:** An assessment of key attributes and characterisations;
  - **Prioritisation:** A Shortlist of 12 case studies were selected to proceed, based on the framework designed during the case study question & template design phase. Relevant consultees were contacted and interviewed which included a senior representative from recipient firms alongside relevant UKRI & departmental leads; and
  - **Delivery:** Case study research and preparation. This stage included consultations and requests for further evidence to fill any substantive gaps. By using this analytical approach we were able to offer a novel case study format that combine illustrative impact evaluation and cross-cutting process evaluation findings in a cost-effective way.
  - **Sign off** – draft case study write ups were shared with consultees for review and clarifications before being finalised.

## Scope

- F.3 Of the 12 case studies selected, there were six from England, three from Scotland, two from Wales, and one from Northern Ireland. Five of the case studies were procured, two were still in development, two were developed but not procured, and three were commercialised via an alternative route.
- F.4 A breakdown of the different departments/organisations covered in the case studies can be found on the next page:

Table F-1: Number of case studies by department



Source: Steer E-D, 2021

## Design

Table F-2: Case Study Template

Introduction	
<b>Name of Case Study</b>	
<b>Competition</b>	
<b>Status</b>	[Delete as appropriate] Commercialised via alternative route Developed but not procured/commercialised Procured Still in development
<b>Department/Agency</b>	
<b>Geography</b>	[Delete as appropriate] Northern Ireland Scotland UK Wales
<b>Information Sources/ References</b>	
<b>Permissions to use information externally</b>	[Y/N/Following review]
Context, Rationale & Objectives	
<b>Context</b> Describe the business and department/agency & the wider context in which the competition was launched.	E.g. Business/organisation type, activities, location, size, etc. E.g. Account of department or agency, purpose, activities, etc.

<p><b>Rationale &amp; Objectives</b>  <i>Why is this a priority for department and what did it aim to achieve?</i>  <i>What did the business aim to achieve?</i></p>	<p><i>E.g. Stimulate innovation, support businesses, provide government department with new solutions, etc.</i></p>
<p><b>Why SBRI/PCP?</b>  <i>Department's motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i>  <i>Why did the business respond to competition?</i></p>	<p><i>Why was a solution not already being generated by the market?</i></p>
<p><b>Inputs &amp; Activities</b></p>	
<p><b>Competition design/delivery</b>  <i>Outline of process, roles/responsibilities and what worked well, not so well.</i>  <i>Details of award</i></p>	<p><i>E.g. Was the process a matter of routine? Had the approach been previously applied? Role of UKRI. How was a winner(s) chosen ?etc.</i>  <i>E.g. Had previously applied, had been recommended, comparison to other applications etc.</i>  <i>E.g. £2 million awarded, Phase 2, to advance ophthalmic and osteoarthritis 3Rs research and drug development...</i></p>
<p><b>Phase 1 process</b></p>	<p><i>Outline of process, roles/responsibilities and what worked well, not so well and extent to which expectations met.</i></p>
<p><b>Phase 2 process</b></p>	<p><i>Outline of process, roles/responsibilities and what worked well, not so well and extent to which expectations met.</i></p>
<p><b>Project close</b>  <i>Inc routes to commercialisation and/or procurement</i></p>	<p><i>Outline of process, roles/responsibilities and what worked well, not so well and extent to which expectations met.</i></p>
<p><b>Outputs, Outcomes &amp; Impacts</b></p>	
<p><b>Innovation/Product development</b>  <i>What new innovation has the product resulted in? What stage of readiness is this at? Is it on the market?</i></p>	<p><i>e.g. details of new widget to address y problem</i>  <i>e.g. fully operational/commercialised and in use.</i>  <i>e/g/ x number sold in x, y, z...</i></p>
<p><b>Business Impacts</b>  <i>Direct quantifiable growth impacts?</i>  <i>Additionality of SBRI?</i>  <i>Indirect/knock-on benefits?</i>  <i>Wider impacts?</i></p>	<p><i>E.g. no. jobs, value of inc. turnover, cost savings, profit. Value of procurement to department or wider commercialisation.</i>  <i>E.g. what would have happened in the absence of SBRI?</i>  <i>E.g. research partnerships established through SBRI evolved and important to firm growth; other innovations been developed that were catalysed/linked to SBRI?</i>  <i>E.g. SBRI supported more innovative culture or opened eyes to new markets etc.</i>  <i>e.g. Have there been any unintended or unforeseen outcomes from the case study?</i></p>
<p><b>Public sector impacts Qualitative Impact</b>  <i>Direct impacts?</i>  <i>Additionality of SBRI?</i>  <i>Indirect/knock-on benefits?</i>  <i>Wider benefits?</i></p>	<p><i>E.g. Public sector problem solved and/or societal benefits achieved</i>  <i>E.g. what would have happened in the absence of SBRI?</i>  <i>E.g. SBRI supported more innovative culture and/or SBRI has led to sustained and useful interactions between departments and businesses, etc</i>  <i>E.g. Have there been any unintended or unforeseen outcomes from the case study?</i></p>
<p><b>Conclusions</b></p>	
<p><b>Success Factors</b>  <i>Are there any key factors for why the case study was successful/unsuccessful?</i></p>	<p><i>E.g. Quality of competition, competence of applicants, route to procurement etc.</i></p>

<p><b>Key lessons</b> Are there any suggested improvements for future competitions?</p>	<p><i>E.g. Processes, structures, communication, etc were successful, or where things went less well solution not able to be adopted and why, etc.</i></p>
<p><b>Summary Impacts</b> Headline impacts across departments and firms</p>	<p><i>E.g. Most significant been to x.. E.g. Whilst public impacts more difficult to quantify, clear evidence of...</i></p>

Source: Steer E-D, 2021

These topic guides are to facilitate consultations with businesses or other organisations (e.g. research institutes) that carried out the case study projects and the departments/agencies that commissioned them. They are intended to elicit in-depth insights into project outcomes and the context and processes that gave rise to them.

Some of those being consulted may have been canvassed before in the course of the evaluation. This should be known in advance but the topic guides establish at the outset whether the particular individual being consulted had previously been canvassed about the case study project. The consultant should be prepared with the information gleaned from any previous consultation and should use discretion in asking for information and views that may have already been provided.

## Case Study Aide Memoire: Topic guide for businesses and other organisations

### A) Introduction

1. Offer thanks for taking time to talk.
2. Explain purpose is to obtain insights into project outcomes and the context and processes that gave rise to them – and to learn what works well and less well.
3. Confirm consultees were involved in the case study project and in what capacity.
4. Establish if and how they have been consulted before about this particular project. Explain consultation duration and method (e.g. tape) and that all responses will be kept confidential – only shared with research team members and any information used in the final report will be non-attributable.
5. Advise consultees they do not have to talk about anything they don't want to and they can end the consultation at any time.
6. Confirm willingness to participate.

### B) Context

1. Brief account of business/organisation type, main activities, location, size (sales, employment), % sales from UK establishments, % competition located in the UK, % activities accounted for by R&D and other forms of innovation. **Note: Some of this information should be available from the survey if they participated or from public sources. Interviewer should be familiar with the available information and confirm.**
2. In-depth account of context and motivation for responding to the relevant Competition and seeking assistance from Pre-Commercial Procurement. **Note: Interviewer should be aware of survey responses to this question if the business/organisation participated and should use the checklist of possible responses if they didn't. It will be important to position the motivation in the context of the organisation's performance, ambitions and challenges at that time.**
3. If not picked up in the above account, the interviewer to press on what alternative sources of funding had been considered or approached (if any) for the project and with what results.

### C) Process

1. Brief account of how the business/organisation became aware of Pre-Commercial Procurement assistance and the relevant Competition and the particular features of it they thought attractive. Establish if they had previously applied for assistance and whether or not they had been

successful. **Note: Interviewer to be aware of information on this if available for those who participated in the survey.**

2. Assessment of satisfaction with the Pre-Commercial Procurement practice with respect to the application process, the selection/award process, working with departments/agencies on the project, and project closure. **Note: Interviewer to be aware of information on this if available for those who participated in the survey.**
3. Views (and supporting evidence/examples) on ways in which the Pre-Commercial Procurement programme and process worked well (and should be retained or enhanced and worked less well (and should be improved). Draw out views and evidence on whether the project purpose and objectives were considered to be too tightly or loosely specified (and what the effects of either were). **Note: Interviewer should be aware of survey responses to this question if they participated (and press for elaboration) and should use the checklist of possible responses if they didn't.**

#### **D) Outcomes and impacts**

1. Assessment of whether involvement in this particular project (regardless of project performance) helped the businesses/organisations improve their understanding of public sector skill sets, culture and innovation requirements and its procurement processes for inducing innovation. Views on how these things would need to be changed/improved to encourage their further engagement with public procurement.
2. Assessment of whether and in what ways involvement in this project (regardless of whether its outputs were procured or used) helped:
  - de-risk, or at least reduce risk in, their innovative activity;
  - increase Technology Readiness Levels (TRLs) or Manufacturing Readiness Levels (MRLs) **Note: Interviewers will need to be familiar with TRLs and MRLs;**
  - reveal options for R&D in other areas in the light of success (or failure) in the assisted project (i.e. option value);
  - develop new business models and/or start-ups;
  - create useful interactions and collaboration with other businesses/organisations and/or the commissioning departments/agencies that will be sustained over the longer term.
3. Establish whether project spend matched budget and schedule; project met its technical and other targets; and the intended product or prototype was produced, procured and used by the commissioning department/agency (and, if so, its procurement value). Assessment of reasons for any shortfalls or failures on these matters. **Note: Interviewer should be aware of survey responses to this question if they participated (and press for elaboration) and should use the checklist of possible responses if they didn't.**
4. Assessment of whether product or prototype was sold to other organisations and, if so, who they were, and the value of sales involved. Views on why this did or did not happen. **Note: Interviewer should be aware of survey responses to this question if they participated (and press for elaboration) and should use the checklist of possible responses if they didn't.**
5. Establish levels of total employment, investment, revenue and profits at the time of the project and now. Assessment of the extent to which, as a result of involvement in the project, these metrics are higher or lower than otherwise would have been the case, to what extent and for how long these effects are expected to be sustained. **Note: Interviewer should be aware of survey responses to these questions if they participated (and press for elaboration if needed) and use the survey questions, checklists and prompts if they didn't.**
6. Assessment of the extent to which participation in the project affected:
  - the businesses/organisations in any other ways (elaborate on the effects – positive and negative) – especially with regard to spin-offs and multiplier effects;
  - suppliers, competitors and consumers – elaborate on nature and extent of effects and location;
  - other businesses/organisations (elaborate on who they were and the effects).



**Note: Interviewer should be aware of survey responses to these questions if they participated (and press for elaboration if needed) and use the survey checklists and prompts if they didn't.**

7. Assessment of the consequences if Pre-Commercial Procurement assistance had not been available or not awarded. Would not have gone ahead at all, slower, later, smaller, lower quality, lower risk and elaborate on the scale and nature of these consequences. **Note: Interviewer should be aware of survey responses to these questions if they participated (and press for elaboration if needed) and use the survey checklists and prompts if they didn't.**
8. Assessment of the alternative sources of funding that would have been sought, accessed if Pre-Commercial Procurement assistance had not been available and with what chances of success. **Note: Interviewer should be aware of survey responses to these questions if they participated (and press for elaboration if needed) and use the survey checklists and prompts if they didn't.**

#### **E) Any other observations and close**

1. Identify any 'critical instances' that are revealing of the project assistance working really well and not so well.
2. Invite assessment where not already covered of:
  - any aspects of project performance
  - Pre-Commercial Procurement assistance
  - strengths of the approach to be reinforced and weaknesses addressed.
3. Close and thank for the time, information and views. Note: Interviewer to say that consultee will be given opportunity to comment on and sign off on the draft case study report.

### **Case Study Aide Memoire: Topic Guide for commissioning departments/agencies**

#### **A) Introduction**

1. Offer thanks for taking time to talk.
2. Explain purpose is to obtain insights into project outcomes and the context and processes that gave rise to them – and to learn what works well and less well.
3. Confirm consultees were involved in the case study project and in what capacity.
4. Establish if, and how, they have been consulted before about this particular project.
5. Explain consultation duration and method (e.g. tape) and that all responses will be kept confidential – only shared with research team members and any information used in the final report will be non-attributable.
6. Advise consultees they do not have to talk about anything they do not want to and they can end the consultation at any time.
7. Confirm willingness to participate.

#### **B) Context**

1. Brief account of that part of the department/agency that launched the Competition and managed the process, its primary purpose and activities and its general approach to, and use of, Pre-Commercial Procurement assistance.
2. In-depth account of context and motivation for using Pre-Commercial Procurement assistance with respect to this project - the challenge and innovation required that gave rise to the Competition (and how both were identified and specified) and any alternative routes that were explored to meet the challenge and generate the required innovation (what they were and why rejected).

#### **C) Process**

1. Brief account of how the department/agency set up the relevant Competition. Establish if they used the process as a matter of routine, had previously applied the approach and drawn any lessons learned for specifying and managing this Competition and project (and what they were).

2. Assessment of satisfaction with respect to the application process, the selection/award process, managing the business/organisation on the project, and project closure. Identify any reasons for dissatisfaction.
3. Views (and supporting evidence/examples) on ways in which the process worked well (and should be retained or enhanced and worked less well (and should be improved). Draw out views and evidence on whether the project purpose and objectives were considered to be too tightly or loosely specified (and what the effects of either were).

#### **D) Outcomes and impacts**

1. Assessment of whether experience with this project improved:
  - the capacity of the department/agency to generate potentially useful procurement enabled innovations;
  - their understanding of how industry generated innovation can help address the policy challenges they face;
  - access to new private sector suppliers and to engage effectively with SMEs.
2. Assessment of whether the project led to sustained and useful interaction and collaboration between department/agency and businesses/organisations.
3. Assessment of whether and in what ways the project (regardless of whether its outputs were procured or used) helped:
  - define/specify the challenge(s) and possible innovative solutions more precisely;
  - reveal options for R&D in other areas in the light of success (or failure) in the assisted project (i.e. option value);
  - suggest ways of tackling the challenges that had previously not been thought of or considered or had been rejected.
4. Establish whether spend matched budget and schedule; project met its technical and other targets; and the intended product or prototype was produced, procured and used by the department/agency (and, if so, its procurement value). Assessment of reasons for any shortfalls or failures on these matters.
5. Assessment of whether and how the project:
  - helped de-risk the innovation process in the department/agency
  - improved the quality of public services
  - reduced delivery costs and schedules of public services
  - generated beneficial spill-over effects in the public sector
  - enabled the department/agency to develop options/contingency plans to act if and when required
  - enabled them to be better prepared to deal with risks and uncertainties

**Note: Interviewer to press for quantification of the claimed benefits and the extent to which they will be sustained.**

6. Assessment of the consequences if Pre-Commercial Procurement assistance had not been available. The project would not have gone ahead at all, in another form, slower, later, smaller, lower quality, lower risk. Elaborate on the scale and nature of these consequences – and impact on the challenge the project was designed to address.
7. Overall assessment of whether the project had been designed and delivered economically (resources acquired at minimum cost), efficiently (outputs generated at acceptable cost), effectively (objectives and output/outcome targets met or exceeded) and had delivered acceptable benefit-cost or cost-effectiveness ratios. Key factors causing success or failure in these terms. **Note: Interviewer to press for quantified measures of any claims made.**

#### **E) Any other observations and close**

1. Identify any 'critical instances' that are revealing of the project working really well and not so well.
2. Invite assessment where not already covered of:

- any aspects of project performance
  - Pre-Commercial Procurement assistance
  - strengths of the approach to be reinforced and weaknesses addressed.
3. Close and thank for the time, information and views. **Note: Interviewer to say that consultee will be given opportunity to comment on and sign off on the draft case study report.**

## Ambulance Sanitisation

Table F-1: Ambulance Sanitisation – Hygiene Pro Clean

Introduction	
<b>Name of Case Study</b>	Ambulance Sanitisation – Hygiene Pro Clean
<b>Competition</b>	COVID-19 Speed Cleaning Ambulances (2020)
<b>Status</b>	Procured
<b>Department/Agency</b>	Welsh SBRI Centre of Excellence (CoE)
<b>Geography</b>	Wales
<b>Information Sources/References</b>	Scoping Consultation with Lynda Jones, Welsh SBRI CoE, 18/06/2020 Case Study Consultation with Lynda Jones, Welsh SBRI CoE, 02/06/2021 Case Study Consultation with Jamie Borgeat, Hygiene ProClean, 02/06/2021 <a href="https://sbriwales.co.uk/case-study/rapid-innovation-in-the-health-sector-during-the-covid-19-pandemic/">https://sbriwales.co.uk/case-study/rapid-innovation-in-the-health-sector-during-the-covid-19-pandemic/</a>
<b>Permissions to use information externally</b>	Y
Context, Rationale & Objectives	
<p><b>Public sector context rationale &amp; objectives for the project and for using SBRI</b></p> <p><i>Wider context in which the competition was launched.</i></p> <p><i>Why is this a priority for department and what did it aim to achieve?</i></p> <p><i>What was the Department’s motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i></p>	<p>In March 2020, the NHS was facing the growing threat of the COVID-19 outbreak, placing immense pressure on an already pressurised service. Within Wales, 19 field hospitals were built and established to help deal with the potential numbers of infected patients that required hospitalisation. The Ambulance Service within Wales also came under sustained additional pressures during the pandemic with the number of COVID-19 related calls often exceeding 1,000 per day in the months of March and April.</p> <p>The Welsh SBRI CoE has been operational for the last two years, working to meet unmet needs of Welsh public services through innovative solutions, largely focussed on public health. In the health space, though there is a continual need for innovation, there is often a lack of funding and high associated risks. SBRI provides the model for delivery of focussed funding, advice, and networks to support solution development. The Welsh SBRI CoE consulted with the Welsh Ambulance Service (WAST) to identify the service’s unmet needs in the context of growing pressures due to the pandemic, to gauge where SBRI could potentially be of benefit in relieving some of these pressures to those on the front line, and ultimately to support improved patient care for those suffering with COVID-19.</p> <p>These discussions highlighted the issue of deep cleaning ambulances efficiently, ambulances must be thoroughly cleaned once a patient with suspected COVID-19 had been transported. Depots needed to deep clean ambulances which could take up to two hours, and in some circumstances, had to be undertaken at specialist cleaning centres which can be some distance away, some up to 70 miles, from the ambulances station or hospital site. This put an increased strain on an already busy and pressurised service as the vehicles could not be used until the cleaning was completed, leaving ambulances off the road and out of use for significant amounts of time.</p> <p>The Interim Director of Infection Control at WAST put trust in the SBRI process to help to solve this challenge. The Welsh SBRI CoE launched the challenge on behalf of the WAST to find a solution for disinfecting ambulances efficiently. The challenge looked to identify, develop, and demonstrate rapid sanitising technologies to help the WAST teams in their fight during the pandemic. The aim of the competition was to reduce the amount of time taken to decontaminate ambulances between patients significantly and as such, reduce ambulance down time and support the service to better respond to the public health crisis.</p>

	<p>This was designed to be a ‘rapid’ SBRI – to test solutions that were potentially already out there on the market as to whether they would work effectively to kill COVID-19 and were suitable for ambulances specifically.</p>
<p><b>Private sector context, rationale and objectives for responding to this specific competition and pursuing SBRI/PCP?</b>  <i>Business context at point of application?</i></p> <p><i>Why did the business respond to competition and what did the business aim to achieve?</i></p>	<p>Hygiene Pro Clean (HPC) are an innovative firm based in Stockport. HPC were an micro business at the time of the competition launch, with five employees and the aim to generate £750k turnover per annum. They were a new business, launched two years prior to innovate and develop solutions in anti-bacterial and anti-viral decontamination hygiene and deep cleaning.</p> <p>HPC had spent two years developing their Ultrasonic Atomising delivery system hygiene and deep cleaning techniques and had recently applied these to mass transit uses, to raise standards of cleaning on railways at no extra cost. The brief for the SBRI Rapid Ambulance Sanitisation competition was a perfect opportunity for HPC to develop their system in the ambulance context, working with key stakeholders across public services and widening their market access, while directly adding value during the global pandemic to support the NHS to save lives.</p>

### Inputs & Activities

**Competition delivery**  
*Details of award*  
*Any key points around process, responsibilities, challenges across any phases:*

- competition design/award;
- Phase 1;
- Phase 2;
- project close & routes to commercialisation and/or procurement

*Scope of the project/ technology/ innovation – how did the project seek to achieve its objectives*  
*Overall draw out any valuable perspectives on what worked well, not so well.*

The Welsh SBRI CoE was a recently developed centre, so did not yet have an appropriate online system in place for processing applications. The Welsh CoE worked with the Defence and Security Accelerator (DASA) to launch the challenge, with DASA hosting the challenge on their systems, having run many SBRI competitions. This led to a wider collaboration between WAST, Welsh CoE and Welsh Government, and the Ministry of Defence (MOD), DASA and the Defence and Security Technology Laboratories (DSTL), building upon skills from across other UK departments to deliver this challenge.

As opposed to a standard SBRI competition timeline, which takes approximately 12 to 18 months, the immediacy of the challenge necessitated a ‘rapid’ SBRI – with an accelerated timeline of just six weeks, to enable any technologies to be accessed quickly. This approach was the first of its kind within the UK.

With the ‘rapid’ timescales, the call to industry was released on the 25th March 2020, only open for one week for applicants to apply. There was an overwhelming interest with 216 applications in such a short window, with interest from both industry and academia. These 216 applications were evaluated within one week and 11 awards were made. It was felt by HPC the application process was clear, thorough, practical, sensible, and also challenging.

This was a single-phase competition, with each awardee awarded £20,000 funding to test and demonstrate their technologies. The 11 solutions were tested with DSTL in Porton Down, who were able to employ their techniques and expertise to test the effectiveness of each technology. DSTL needed to test primarily that the products successfully decontaminate, killing COVID-19. This process was undertaken within a week, with the DSTL concluding with a technical report on the findings from testing all 11 solutions. As a result of this test, 3 solutions then advanced to test the products in situ on Welsh ambulances. As well as effective decontamination of the ambulance, the testing criteria included the time taken to do so, the cost, and any potential damage to ambulance equipment. It was felt by HPC the test and demonstration process was driven by a clear end goal which made participation straightforward.

The unsuccessful solutions were suboptimal for a variety of reasons - inability to assure the cleanliness standards, no significant reduction in cleaning times compared to standard practice, or higher costs. The winning solution, put forward by HPC,

exceeded expectations and the end user teams valued it greatly. HPC's solution secured a six-week live trial with one of the WAST depots, resulting in procurement of the solution and roll-out across five depots in Wales.

## Outputs, Outcomes & Impacts

### Innovation/Product development

What new innovation has the product resulted in? What stage of readiness is this at? Is it on the market?

HPC developed an effective decontamination system that uses ultrasonic atomisation. This approach recognises and accounts for the interdependency between the delivery system and the cleaning solution, to optimise effectiveness. The system is self-contained, including chemical storage tank, air supply and a handheld gun that disperses the atomised spray at atmospheric pressure.

Part of HPC's offer is the wrap-around training to build and integrate competency within the client team to deliver effective decontamination. HPC's business model is to ensure their solution is embedded within the organisation, continually improving alongside the client. Once the asset, capability and license to operate is purchased by the client, it can be scaled. Currently, five WAST depots are using the solution for rapid sanitisation of ambulances, with plans to roll out across all depots. Further, HPC are working with WAST to expand the use of this technology to other parts of WAST facilities, buildings and fleet for the control of virus, bacteria, odours and improved employee working environment.

### Business Impacts

*Direct quantifiable growth impacts?*  
*Additionality of SBRI?*  
*Indirect/knock-on benefits?*  
*Wider impacts?*

The SBRI Rapid Ambulance Sanitisation competition catalysed multiple positive impacts for HPC, including:

- The competition enabled HPC to develop, test and demonstrate their existing atomising deep cleaning technology for the new application of ambulance sanitisation, resulting in WAST procuring their product.
- The competition has opened doors to new public service markets for HPC, with HPC working directly with key UK government stakeholders across departments throughout the competition.
- As a result of the competition, HPC are expecting significant business growth, with plans to more than double their annual turnover and employee count (to approximately 10-15 employees from 5 at competition outset) in the next year. To date, this has seen the employment of two new service engineers, office staff and expansion into new premises.
- The competition has created high growth potential for HPC's rapid Ultrasonic Atomising decontamination service outside of WAST too, with HPC currently setting out business cases for the ambulance services in London and the East Midlands. HPC are also working on expanding their decontamination offer to other emergency services such as the police and fire brigade.

### Public sector impacts

**Qualitative Impact**  
*Direct impacts?*  
*Additionality of SBRI?*  
*Indirect/knock-on benefits?*  
*Wider benefits?*

This competition also had many positive impacts for the public sector through the development and procurement of a solution to sanitise ambulances at pace, including:

- It has had major benefits for the ambulance service by reducing the time it takes to disinfect an ambulance by 86% to just 20 minutes. This reduces the amount of time ambulances are off the road and increases the amount of ambulances available to support patients in need.
- The solution also reduces the cost of cleaning an ambulance by 82%, saving the ambulance service money. Further, the Decon Pro Clean chemical used is an effective disinfectant, cleaner and deodoriser while eliminating use of toxic chemicals, resulting in less potential damage to the ambulances and increasing asset-life and longer-term savings as such.
- It has increased standards of cleaning to 'gold standard', with a solution that leaves less room for human error due to the delivery system not reliant on wiping surfaces by hand. This method of delivery also improved safety for operating teams at depots and reduced consumption of PPE. This has resulted in increased assurance of ambulance cleanliness and improved infection control practices, as well as benefits to staff safety and welfare due to reduced exposure time.

- Having this solution in place creates resilience against future risks that may cause significant spikes in ambulance demand. In March, April and May 2020, each ambulance required 331.5 hours of cleaning. However, with this new solution in place, just 45.7 hours would have been needed.
- The Welsh SBRI CoE and WAST were awarded the St David's Innovation, Science and Technology award for 2021 for the success of this competition.
- Welsh SBRI CoE and WAST collaboration with MOD, DASA and DSTL resulted in increased knowledge sharing between departments, giving WAST access to expert knowledge that can be utilised long-term. Namely, WAST were able to put in place improved practices to test thoroughness of cleaning following the DSTL trial techniques used for this competition at Porton Down.
- Further sharing of learning across NHS Wales and across departments throughout the UK is resulting from this project. Work is underway to scale up and apply these efficiency gains in decontamination across public services, such as in English and Scottish ambulance service trusts, schools, and police.

## Conclusions

### Key Lessons and Success Factors

*Are there any key factors for why the case study was successful/unsuccessful?*

*What went well or not so well?*

*Are there any suggested improvements for future competitions?*

There are several key success factors and learning lessons that arose from this SBRI competition, including:

- The Welsh SBRI CoE team learned that the SBRI model is adaptable and were quickly able to utilise it to assist the ambulance service during a crisis. They moulded the SBRI process to assist the service and show the benefits of innovation even in difficult and challenging times, demonstrating the possibility for and success of the rapid SBRI competition. This required the challenge to be run with commitment, urgency and enthusiasm for change which the SBRI CoE and WAST led collaboration did. Taking this learning forward, Welsh SBRI CoE have since run a further short SBRI challenge focussed on delivering clear face masks, lasting just 12 weeks.
- The collaborative approach to competition delivery was a key success factor, with sharing expertise between departments of significant benefit, such as utilising DASA's experience in delivering SBRI, and DSTL's robust testing of innovations to ensure trials were valid. The team effort was driven in particular by a shared goal to make a difference to those on the front line of the pandemic.
- This project enabled WAST to further analyse their processes and discover new ways to measure performance, infection prevention and control, implementing new and improved processes as a result.
- The SBRI model allowed WAST to work with industry to develop a solution that met their needs exactly, rather than buying an 'off the shelf' solution that is suboptimal. They were able to clearly specify the needs of faster disinfection of ambulances in the competition brief and develop and test solutions with the end user to meet these objectives.
- The project team is maximising impact through spreading the knowledge gained from this project wider than the ambulance setting. Projects are underway in other areas of Welsh Government on the back of this looking at how the learning can be used in other environments.
- A key issue for SBRI was recognised to be the link between SBRI funding to develop and test the solution and, if successful, a procurement contract to then supply it which is the real 'prize' for business. Departments are often required to go through a long procurement process to purchase the product once it is developed successfully. Welsh SBRI CoE reduced the length of this follow up process by actively involving procurement teams from the outset of the competition, and ensuring robust testing was conducted by enlisting the support from MOD, DASA and DSTL. This SBRI was able to demonstrate speedy procurement at the end of the competition of the HPC's winning solution. However, efforts to expand the service across other UK ambulance trusts, NHS and wider public services, despite high levels of interest, is proving more complex and taking time. To better allow the technology to spread, a more developed roadmap for procurement across various siloed public sector

departments and agencies with differing operating models is required. It was felt by HPC that SBRI could better support small businesses in navigating this procurement route into the public sector following competition success.

**Summary Impacts**  
*Headline impacts  
across departments  
and firms*

Despite just over one year having passed since this competition both launched and completed, there have been significant positive impacts for the public sector and winning firm to date, including:

- Reduction in the time it takes to disinfect an ambulance by 86% to just 20 minutes. This in turn reduced the amount of time ambulances need to spend off the road and increased the amount of ambulances available to support patients in need.
- The solution also reduced the cost of cleaning an ambulance by 82%, saving the ambulance service in Wales money.
- Improved cleaning standards and processes for infection control were embedded as a result of the collaboration.
- There is further potential for these gains in effectiveness and efficiency to be spread across all UK public services that require decontamination of facilities and equipment.
- The competition has opened doors to new public service markets for HPC and facilitated their collaboration with multiple key government stakeholders. The procurement of their solution by WAST and capacity to expand across other ambulance trusts across the UK has secured HPC a strong growth trajectory, with the firm having plans to more than double their annual turnover and employee count in the next year.

Source: Steer E-D, 2021



## AI Fracture Diagnosis

Table F-1: Artificial Intelligence (AI) Fracture Diagnosis by Seeai LTD and Bering Ltd

Introduction	
<b>Name of Case Study</b>	AI Fracture Diagnosis by SeeAI Ltd and Bering Ltd
<b>Competition</b>	Artificial Intelligence - supported early fracture diagnosis: SBRI competition
<b>Status</b>	Developed but not procured/commercialised
<b>Department/Agency</b>	Chief Scientist Office, NHS Grampian, and Opportunity North East
<b>Geography</b>	North East Scotland
<b>Information Sources/References</b>	Ignat Drozdov, Bering Ltd, <a href="mailto:idrozdov@beringresearch.com">idrozdov@beringresearch.com</a> Saile Villegas, SeeAI Ltd, <a href="mailto:saile@SeeAI.co.uk">saile@SeeAI.co.uk</a>
<b>Permissions to use information externally</b>	Y
Context, Rationale & Objectives	
<p><b>Public sector context rationale &amp; objectives for the project and for using SBRI</b></p> <p><i>Wider context in which the competition was launched.</i></p> <p><i>Why is this a priority for department and what did it aim to achieve?</i></p> <p><i>What was the Department's motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i></p>	<p>NHS Grampian is a large health board in the North East of Scotland, comprising of both teaching hospitals and health and social care partnerships. NHS Grampian convened the Innovation Hub in 2016 to focus on finding solutions to NHS challenges by progressing innovation projects at pace.</p> <p>This case study is focused on the AI – support of early fracture diagnosis SBRI competition.</p> <p>The aim of the project was to improve clinical workflow and safety by optimising clinical decision making and management pathways in relation to fracture detection in wrist and ankles.</p> <p>The competition was co-funded by Opportunity North East, a private sector leader and catalyst for economic diversification in North East Scotland, who led on the launch of the SBRI before passing over to NHS Grampian's Innovation Hub to oversee the project.</p> <p>Contracts for Phase 1 of the competition was awarded to five companies in September 2019 each receiving £20,000, and in April 2020 two companies from Phase 1 were successful in their bid to proceed into Phase 2, both receiving £70,000. The competition completed in August 2021.</p>
<p><b>Private sector context, rationale and objectives for responding to this specific competition and pursuing SBRI/PCP?</b></p> <p><i>Business context at point of application?</i></p> <p><i>Why did the business respond to competition and what did the business aim to achieve?</i></p>	<p>The two successful companies to receive Phase 2 funding were Bering Ltd and SeeAI Ltd.</p> <p>Bering Ltd was founded in 2010 by qualified medical professionals with backgrounds in Machine Learning and Healthcare after identifying a market gap in AI clinical support. Bering Ltd already had a successful track record in bidding for SBRI funding, having successfully secured Phase 1 and 2 funding (receiving £100,000 and £1,000,000 respectively) for an SBRI on data integration and the prediction of emergencies in 2015. This allowed them to create a tool, named 'Brave AI', in primary care that streamed more complex patients to GPs while using allied health professionals to do routine care. It also predicts where unplanned admissions/emergencies might happen, so that they get better care whilst supporting GPs to be able to focus on the sickest patients. This product has been commercialised with NHS England and is generating profits that are being used to progress other workstreams.</p> <p>In 2018, Bering Ltd continued to diversify their package of work, working on chest x-rays triage and reporting list prioritisation. They realised that similar algorithms could be used to support fracture diagnosis in hospitals and began to</p>

pursue the opportunity to progress this research securing the relevant Intellectual Property (IP) and setting up a clinical trial. Bering Ltd were then extremely well placed to respond to the AI fracture diagnosis SBRI competition in 2019. This completely aligned with their existing business needs and they were well placed to secure the funding with IP secured and an existing clinical opportunity.

SeeAI Ltd was founded in 2019 by two engineers with backgrounds in computer science. They shared the same interest in making a tool to support doctors in musculoskeletal healthcare. They were conducting some initial research with academia in detecting fractures using AI. They found the AI fracture diagnosis SBRI competition, which perfectly aligned with their interests and work. Being based at the University of Leeds, SeeAI Ltd has access to academic and NHS support. SeeAI Ltd established a team of industry, academia, and NHS clinicians, and successfully secured the funding to pursue their technology.

## Inputs & Activities

### Competition delivery

#### *Details of award*

*Any key points around process, responsibilities, challenges across any phases:*

- competition design/award;
- Phase 1;
- Phase 2;
- project close & routes to commercialisation and/or procurement

*Scope of the project/ technology/ innovation – how did the project seek to achieve its objectives*

*Overall draw out any valuable perspectives on what worked well, not so well.*

### Competition design/award

A partnership approach was adopted to support competition design and delivery, with NHS Grampian collaborating across sectors with support from universities, including the Grampian Data Safe Haven (DaSH) at the University of Aberdeen, and Canon Medical, to support success.

Being the first SBRI competition for NHS Grampian there were new processes and learning to understand how an SBRI competition should run. These processes are now well understood by NHS Grampian, and they have since joined a national SBRI project management group which supports all SBRI activity across Scotland.

The application process for Phase 1 was viewed as straightforward by both competitors. This may have been made easier by Bering Ltd's familiarity with the programme from its previous success in SBRI competitions.

#### Phase 1 (November 2019 to February 2020)

Phase 1 required a proof of concept of the technology which required access to patient records. Although being anonymised, the data could not be accessed remotely which meant the five companies were required to work out of Aberdeen to access the data. This was a pre-requisite at application. After a month of travelling back and forth from Leeds SeeAI Ltd relocated to Aberdeen, however Bering Ltd continued to commute from London throughout the duration of Phase 1.

#### Phase 2 (August 2020 to August 2021)

At the end of Phase 1 the competitors completed an end report outlining their findings. Four of the five competitors went on to submit applications for Phase 2.

Phase 2 of the SBRI was about developing and evaluating a prototype of the solution created in Phase 1.

In February 2020 COVID-19 impacted on mode of project delivery from face to face to working remotely. The original start date of May 2020 was postponed until August due to a delay in access to the Safe Haven Artificial Intelligence Platform (SHAIP) infrastructure which had been indirectly impacted by COVID-19. New ways of working were introduced so that data could be securely accessed remotely and this meant work could continue despite COVID-19 restrictions. Access to SHAIP was facilitated through the Industrial Centre for Artificial Intelligence Research in Digital Diagnostics (iCAIRD) consortium partnership – a pan-Scotland collaboration of industry-NHS-academia, with industry leadership provided by Canon Medical Research Europe and Royal Philips.

### **Commercialisation (Ongoing)**

There are two major barriers to the commercialisation of AI solutions in clinical practice: i) end-user buy-in/clinician interest and ii) regulation.

The UK's exiting of the EU has meant that the legislation on the regulation of medical devices has changed. The efficacy data for any medical device now has to be audited by an external body before the product can be sold (i.e. getting a CE marking). There are only three bodies who are able to do this audit, none of which are currently taking on new clients. Simply put, whilst the NHS can host competitions and help support the development of successful innovations, it is not able then to procure them without the CE marking for which there is currently no clear timeline.

Whilst the competition closed at the end of August 2021 with two working prototypes, these cannot be transformed into working products until they have had clinical validation and a CE mark. This is a considerable journey and there is no route to procurement in the UK until this regulatory journey has been taken.

For Bering Ltd, there has been appetite from some customers involved in co-development and they are currently trying to find an alternative route to get this medical device stamp of approval. In sales overseas, Bering Ltd has identified potential buyers in the Nordic Countries and Spain, countries with similar health markets to that in the UK. However, since Brexit, additional certificates are needed to sell into the EU which have additional financial implications.

Since SeeAI Ltd's success with this competition they have secured other complementary funding and support. SeeAI Ltd have been in close contact with regulatory bodies, and they are looking to start their regulation journey for their product in early 2021. They are part of an accelerator programme aimed at helping digital health innovators navigate the NHS in the Yorkshire and Humber region (Propel@YH) which has provided them with a lot of additional support including information and training around building business cases, CE marking, networking etc.

Both consultees have found that the Phase 2 funding wasn't sufficient to work towards commercialisation alone (although is very good early stage investment). Bering Ltd's profits from Brave AI (the previous SBRI competitions product) are funding this new innovation, as it was judged to be a key part of the company's growth strategy.

To fund the future development of the technology, SeeAI Ltd are exploring grants through National Institute for Health Research (NIHR) and Yorkshire and Humber Academic Health Science Network and they have ongoing discussions with investors. They have also had some interest from other universities, companies, healthcare providers as well as private investment which they can draw upon if needed.

Neither of the consultees were concerned about the products eventually reaching commercialisation but were concerned around timeframes.

Challenges are expected at scale due to problems around the product's generalisability, i.e. will each hospital require different targeted AI (due to different machineries, radiographers, patients/populations) or will the same systems work across different hospitals. Machines are the greatest concern, with issues around calibration of machines meaning a product consistently underperforms in a hospital.

Performance levels for this type of technology are difficult to measure as many licensing bodies are just starting to put their approach together to respond to this new technology. For instance, if the AI still improves performance but not as much as in the original hospital where the model was developed, this may still be considered acceptable.

Currently Bering Ltd is in the process of seeing how the technologies work across a range of different hospitals in Scotland and using their radiographers as the 'gold standard' comparator.

## Outputs, Outcomes & Impacts

### Innovation/Product development

What new innovation has the product resulted in?  
What stage of readiness is this at? Is it on the market?

SeeAI Ltd has a working prototype that can detect many different fractures in wrist and ankle bones.

Bering Ltd has a working prototype which integrates with Radiology Reporting Systems and is able to detect fractures in the wrist and ankle bones.

Routes to market through commercialisation and/or procurement are discussed in the previous section.

### Business Impacts

*Direct quantifiable growth impacts?*  
*Additionality of SBRI?*  
*Indirect/knock-on benefits?*  
*Wider impacts?*

SeeAI Ltd was established in 2019, the SBRI funding was a very good early investment to develop their product. The additional resource allowed SeeAI Ltd to recruit a clinical lead and a machine learning researcher.

Bering Ltd has also hired one person post award to work in the core fractures team, as well as working with six clinical collaborators.

Both organisations noted that perhaps the greatest benefit of this process is the access to data that working with NHS provides. Critically, this data access makes SMEs competitive even against very large competitors who have much larger innovation budgets; it 'evens the playing field'. There is also an additional stamp of approval for the firms for having worked with the NHS and the acknowledgement they are fulfilling a genuine NHS need. These benefits mean that the SBRI competition was still extremely attractive despite the Phase 2 funding not being sufficient to reach commercialisation.

The businesses have also benefitted from collaborative relationships that are expected to continue beyond SBRI. In particular, relationships with clinicians have been critical as these are needed if you want to develop clinical tools. The clinicians provide critical inputs into the development and commercialisation of the tools.

The publicity has also been of benefit to the two companies. The project publicity helped Bering Ltd to attract interested talent to work on these projects.

### Public sector impacts Qualitative Impact

*Direct impacts?*  
*Additionality of SBRI?*  
*Indirect/knock-on benefits?*  
*Wider benefits?*

The successful hosting of this SBRI competition has paved the way for NHS Grampian to use this same approach to bring forward similar innovations that solve NHS challenges, and a further SBRI competition is currently being hosted by NHS Grampian.

If successfully procured by the NHS, this technology will:

- **Improve health outcomes** through a faster diagnosis and more efficient service. Typically, it could take 2 weeks from x-ray to diagnosis using the current pathway, whereas the diagnosis of x-rays using these methods is instant; and
- **Relieve pressure on radiologists** by taking away one of their more mechanistic but time-consuming tasks for simpler injuries e.g. a sprain. This means that radiologists can concentrate on more life threatening and

complex diagnoses such as MRIs for strokes, and on patient wellbeing/quality of care.

## Conclusions

### Key Lessons and Success Factors

*Are there any key factors for why the case study was successful/ unsuccessful?  
What went well or not so well?*

*Are there any suggested improvements for future competitions?*

- For NHS Grampian there were lessons learnt in the **initial design of the programme**. However, it should be noted that issues around the process (with the exception of data access in Phase 1) weren't raised by the businesses, and were seen as very well structured compared to other SBRI competitions experienced/seen;
- Having a **shared and clear vision** that was shared by all stakeholders meant that everyone had a common goal. There were a lot of logistical things that needed to be done, information governance that the businesses needed help with, technical issues etc. NHS Grampian were 'pulling strings', 'mobilising the troops' and using their influence to make things happen to facilitate progress;
- **Close engagement/communications** with the different stakeholders was extremely beneficial. Both organisations cited the close networks with InnovateUK, Opportunity North East, Canon Medical, Aberdeen Data Safe Haven, NHS Grampian, and patients as critical success factors. On reflection, SeeAI Ltd wish they had relocated to Aberdeen from the outset to benefit from this to a greater extent;
- For Bering Ltd, having the right **clinical leadership** was key. They had a consultant radiographer who was available as a go-between to advise their computer science developers;
- SeeAI Ltd cited personal **passion** (one from having been misdiagnosed) and drive as a key reason for success through a trialling and exhausting process. This level of dedication and enthusiasm also helped support relationship development.
- More **support and awareness of clinicians' challenges** is a lesson, and **improvement of safeguarding methods for clinicians** would dramatically improve the process for organisations. As clinicians are very busy it is difficult to engage them in additional research and this is aggravated by the hoops they have to go through to provide private companies with data access.

### Summary Impacts

Headline impacts across departments and firms

Whilst neither company have yet had their products procured or commercialised, they have added four jobs. Both companies are confident their products will be commercialised once regulatory obstacles have been overcome which should result in substantial business benefit. Both are exploring a plethora of further public and private investment opportunities.

The potential public sector impacts are significant as the technologies have the potential to improve health outcomes whilst relieving pressure on overworked radiologists.

Source: Steer-ED, 2021

## Child Health: Restoring Function

Table F-1: Child Health: Restoring Function – Open Bionics’ Hero Arm

Introduction	
<b>Name of Case Study</b>	Child Health: Restoring Function – Open Bionics’ Hero Arm
<b>Competition</b>	Self-care and independence for children with long-term conditions – Category 2: Assisting or restoring function (limb rehabilitation), 2017
<b>Status</b>	Commercialised, but not procured by the NHS
<b>Department/Agency</b>	SBRI Healthcare
<b>Geography</b>	UK
<b>Information Sources/References</b>	<ul style="list-style-type: none"> <li>• Case Study Consultation with Joel Gibbard, Open Bionics, 30/03/2021</li> <li>• Scoping Departmental Consultation with Raffaella Roncone &amp; Caterina Lombardo, LGC Group, 24/06/2020</li> <li>• <a href="https://sbrihealthcare.co.uk/competition/self-care-and-independence-for-children-with-long-term-conditions/">https://sbrihealthcare.co.uk/competition/self-care-and-independence-for-children-with-long-term-conditions/</a></li> <li>• <a href="https://openbionics.com/">https://openbionics.com/</a></li> <li>• SBRI Annual Review 2018</li> <li>• <a href="https://sbrihealthcare.co.uk/case-studies/">https://sbrihealthcare.co.uk/case-studies/</a></li> <li>• PA Consulting (2017) A review of the benefits of the SBRI in healthcare</li> <li>• RAND (2017) SBRI Healthcare – an evaluation of programme activities, outcomes and impacts</li> </ul>
<b>Permissions to use information externally</b>	Y
Context, Rationale & Objectives	
<p><b>Public sector context rationale &amp; objectives for the project and for using SBRI</b></p> <p><i>Wider context in which the competition was launched. Why is this a priority for department and what did it aim to achieve?</i></p> <p><i>What was the Department’s motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i></p>	<p>SBRI Healthcare is an NHS England &amp; NHS Improvement initiative, launched in 2008 and became funded by NHS England since 2013 and is supported by the regional Academic Health Science Networks (AHSNs). SBRI Healthcare has been managed by LGC Group since 2019 after winning an open tender competition for the contract, with each competition assigned a dedicated Project Manager as part of this delivery. Prior to 2019, SBRI Healthcare was administered by Health Enterprise East and the Eastern AHSN.</p> <p>SBRI Healthcare aims to promote economic growth whilst addressing unmet health needs and enhancing the take up of known best practice, through providing funding to companies to solve healthcare problems. Working with AHSNs and NHS England, challenge specifications are developed for industry to solve these most pressing health needs. The ultimate goal is to create solutions that will improve patient care, improve efficiency for the NHS and support business growth. To date, SBRI Healthcare has funded 220 companies, with a total £92.3million funding.</p> <p>The Child Health: Restoring Function competition was launched in 2017. It was part of an overarching competition to support self-care and independence for children with long-term conditions, with two categories, Restoring Function, and Self-Care and Remote Monitoring. The Restoring Function category focussed on supporting independence for children with long-term conditions through assisting or restoring limb function.</p> <p>Restoring function to support independence amongst children and young people with long-term conditions was identified as a priority unmet health need that required innovative solutions. It was identified through work with the Yorkshire &amp; Humber AHSN and the The Technology Innovation Transforming Child Health (TITCH) Network and consultation involving a broad range of healthcare professionals and families.</p>

Within this context, there were key challenges identified around developing suitable technology for children and young people, due to the complexity of adequate prosthesis provision for diverse physical needs and growth, and social and psychological development. Solutions could either be age specific, or instead be adaptable to growth and development. The critical concerns of the child, the parent and the healthcare professional are that solutions promote independence, are tailored to the individual, and complement their needs. Currently, this process is restricted due to cost and increased demand on limited NHS resources.

Alongside the primary goal of the competition to support self-care and independence for children through restoring function, other competition objectives include to support patient care and efficiency within the NHS. Applicants were asked specifically to consider how their technology innovation could:

- reduce numbers of hospital admissions; and
- facilitate independence for children and young people with long-term conditions, that may ultimately support better participation in home and school activities and lead to improved social independence in adulthood.

**Private sector context, rationale and objectives for responding to this specific competition and pursuing SBRI/PCP?**

*Business context at point of application?*

*Why did the business respond to competition and what did the business aim to achieve?*

Open Bionics are a Bristol-based Research & Development firm, founded in 2014, specialising in the development of bionic hands. At the time of the competition, they were selling bionic hands successfully to a small academic market, whilst developing a new bionic hand prototype in the background. These efforts to develop the bionic hand had gone through multiple prototype versions, with which they had some success.

When Open Bionics applied to the SBRI Healthcare competition, they had revenues of £100,000-£150,000 and 10 employees. Approximately 50% of current sales were within the UK, with the remaining half of revenue coming from sales overseas. At this time, Open Bionics were the only UK producer selling bionic hands, with the majority of bionic hand production elsewhere in the EU and a small amount of the active market in the USA.

The firm's primary motivation for responding to the SBRI competition was to get assistance with funding to support the development of their new bionic hand product. Open Bionics were actively seeking out potential competitions and funding opportunities to bring finance into the company. As a UK producer in the health technology market, they also had a specific business objective to get the product into the NHS. Though there were already bionic limb products on the market, the vision for this product was to better meet these needs with an improved product, specifically, to deliver affordable, myoelectric prostheses in the NHS.

**Inputs & Activities**

**Competition delivery**

*Details of award*

*Any key points around process, responsibilities, challenges across any phases:*

- competition design/award;
- Phase 1;
- Phase 2;
- project close & routes to commercialisation and/or procurement

Child Health: Restoring Function was a two phase SBRI competition. Phase 1 lasted 6 months, with applicants receiving £100,000 to trial the feasibility of their products. Phase 2 then followed, a 12-month product development phase. Initially, Phase 2 awards were intended to be £1million for each firm, but due to the success of many firms in Phase 1, this was reduced to £700,000 to enable the competition to fund more companies to advance to Phase 2. Each applicant partnered with the local AHSN to develop their technologies.

Open Bionics worked with the West of England AHSN, and were funded £800,000 in total, £100,000 for Phase 1 and £700,000 for Phase 2, to develop affordable, 3D-printed, bionic prostheses for children and young people.

*Scope of the project/ technology/ innovation – how did the project seek to achieve its objectives*  
*Overall draw out any valuable perspectives on what worked well, not so well.*

In Phase 1, this funding enabling Open Bionics to run a clinical feasibility trial for the provision of affordable, multi-grip, 3D printed, bionic prostheses for children and young people with upper limb deficiencies in the NHS, to promote functional independence. During this first phase, Open Bionics felt significant pressure to deliver and as a result felt they achieved remarkable progress in the first six months. Time pressure they felt was useful. Crucially, they trialled the product with the Centre for Enablement in Bristol, working with Bath University and Gyrobot on the world's first clinical trial to make affordable bionic arms available for children in the UK, working with 7 Bristol-based children. Although the trial was deemed a success, the product didn't perform well enough to gather scientific results due to its unreliability. Nonetheless, Open Bionics felt undertaking the trial itself proved an extremely valuable learning experience.

In Phase 2, the funding supported Open Bionics to deliver a fully tested and clinically approved, multi-grip myoelectric bionic hand, the Hero Arm. It came in 3 sizes: small, medium, and large ready to fit children aged 8 – 17 at the point of commercial launch, with associated add-on products, including customisable prosthetic covers. The Hero Arm developed is a prosthetic limb for young people that is low cost. This cost reduction was achieved through utilising 3D scanning and printing technology, which costs a fraction of the standard price and time to build. The 'Hero' aspect of the prosthetic limb is also key for the product, designed to build confidence amongst children, based on popular characters from films such as Iron Man, Frozen and Star Wars. This second Phase focussed more on the NHS' requirements, with extra care placed on ensuring good results, trialling the product again but more extensively with NHS clinics across the UK. Open Bionics appreciated the staged process, with the jump in funding and timing deemed appropriate for what was required of them in the concept delivery phase and the delivery phase.

Following the successful development of the Hero Arm through the competition, the product has since been launched extensively in the private sector, available in private clinics in the UK from April 2018 and internationally from April 2019.

Open Bionics continued to work with NHS England to meet the clinical requirements for the NHS to commission them and for the Hero Arm to be available through the NHS for children across the UK. Now three years on, Open Bionics are yet to secure this procurement for the Hero Arm due to delays caused from waiting for tenders (there is an extended tender cycle of four years), a complex and opaque process around clinical commissioning guidelines, NHS staff changes and the pandemic. The associated clinical research has now also moved on from Bath University to the University of the West of England.

Open Bionics consequently prioritised their private sector sales market from April 2020, due to the need to secure commercial return on the product, (which is currently loss-making and the firm is reliant on investors).

## Outputs, Outcomes & Impacts

### **Innovation/Product development**

*What new innovation has the product resulted in? What stage of readiness is this at? Is it on the market?*

The Hero Arm, an affordable, 3D-printed, bionic prosthesis for children and young people was the end product developed by Open Bionics as a result of their SBRI Healthcare competition journey.

The Hero Arm is the world's first clinically approved 3D-printed bionic arm, with multi-grip functionality and empowering aesthetics. Engineered in Bristol, UK, the Hero Arm is a lightweight and affordable myoelectric prosthesis, available now in the USA, UK, Europe, Australia and New Zealand. The bionic hands can be created for children as young as eight. It supports increased independence and self-care that the competition set out to achieve, enabling a full range of



hand and forearm motion - grab, pinch, high-five, fist bump, thumbs-up. It also supports children and young people's confidence, with the Hero design and branding "welcome to the future, where disabilities are superpowers", changing perceptions of prosthetic limbs for young people.

**Business Impacts**

*Direct quantifiable growth impacts?*  
*Additionality of SBRI?*  
*Indirect/knock-on benefits?*  
*Wider impacts?*

As a result of the SBRI competition, Open Bionics filed four new patents, achieved CE mark allowing sale throughout the European Economic Area, and USA Food and Drug Administration (FDA) Approval and launched the Hero Arm device in 2018. In the UK market, Open Bionics have secured 5 major private sector Enablement Centre clinics as buyers, where they have made sales and generated revenue. The firm is also now operating extensively in the international health technologies market, with sales in France, Ireland, Netherlands, Russia, USA and Australia. 65 patients globally now have the Hero Arm. When Open Bionics applied to the competition they had revenues of £100,000-£150,000, and 10 employees, now they have annual revenues of £800,000 and 35 employees.

As well as revenues generated from sales, Open Bionics were able to leverage further public and private investment. They raised further public investment including Innovate UK Innovation 4 Growth (I4G) grants and support from Business West. At the end of Phase 1, the firm had raised £450,000 in private investment, and by the end of Phase 2, raised £4.65million Series A (Foresight Williams Technology EIS Fund, Ananda Impact Ventures and Downing Ventures) private investment focused on developing their international market presence. Phase 1 added significant value in accelerating their time to market, Open Bionics felt the product launch would not have been this successful without those trials in Phase 1 which ensured the product was ready. Phase 2 added the most value in helping the business' and product's credibility, it is due to this increased credibility to which Open Bionics attribute a reasonable degree of private investment.

Open Bionics' Hero Arm is also award winning. In 2017, during the SBRI competition, they secured the \$1million UAE AI & Robotics International Award for Good, which drove them forwards in completing the development of the Hero Arm at the time. The Open Bionics co-founders, Joel Gibbard and Samantha Payne, were named as the 2018 Hottest Startup Founders in Europe, at The Europa Awards. Since then, the Hero Arm has won further awards including the James Dyson Award for Engineering, a Wired Social Innovation Award and even a Guinness World Record. The firm are continuing to develop their offer with further products under development and plans to access broader markets with higher returns on investment expected.

**Public sector impacts**

**Qualitative Impact**

*Direct impacts?*  
*Additionality of SBRI?*  
*Indirect/knock-on benefits?*  
*Wider benefits?*

There are an estimated five million upper limb amputees globally, and Open Bionics is building and developing the next generation of bionic limbs to serve this population, and working to change perceptions around prosthesis, turning disabilities into superpowers.

Many of the objectives set out for the competition have been met by the product developed, a more affordable solution, that is well catered to children and young people, and that improves independence. The product has made significant strides in the private sector and accessed markets internationally, supporting 65 patients to date worldwide. Each time Open Bionics fits someone with a Hero Arm, they join the Bionic Squad, the first people in the world to be fitted with 3D-printed, multi-grip bionic arms. Their individual stories can be found here: <https://openbionics.com/bionic-heroes/>.

However, despite clinical trial successes through Open Bionics' collaboration with NHS clinics, the Bristol Centre for Enablement, Bath University and Gyrobot, the Hero Arm has not yet met the NHS requirements to be procured into the NHS to achieve its goal of making affordable bionic arms available for

children across the UK on the NHS. Open Bionics have not yet received clarification that would enable them to understand the specific requirements yet to be met by the product. As such, the competition's objectives of reducing hospital admissions and efficiency savings for the NHS are yet to be seen, and little further public sector impacts to report, with the exception of one sale to the NHS through an exceptional funding request. However, Open Bionics estimate that the Hero Arm could create £400,000 cost savings a year per patient treated with the Hero Arm for the NHS.

## Conclusions

### Key Lessons and Success Factors

*Are there any key factors for why the case study was successful/ unsuccessful? What went well or not so well? Are there any suggested improvements for future competitions?*

A number of important lessons and success factors can be derived from this initiative. These include:

- *Credibility of the programme* – it was felt that the credibility of the SBRI programme was a key success factor in attracting further investment into Open Bionics.
- *Flexibility of the programme* – the flexibility of the competition was appreciated, enabling applicants to research and develop through trial and error, without being locked into a single route to impact.
- *Barriers to adoption within the NHS* – the barriers to adoption within the NHS was flagged as a key challenge for this competition and SBRI Healthcare competitions in general, by applicants, project managers and independent evaluators. The LGC Group identified new technologies being developed through the competitions but not then getting adopted by the NHS as the biggest challenge in SBRI Healthcare, but that this barrier is not specific to SBRI, instead, it's a department-wide issue that NHS England are seeking to address. Key barriers to adoption within the NHS that were raised by this case study consultation, the PA Consulting (2017) review of SBRI in healthcare and RAND (2017) evaluation of SBRI Healthcare include:
  - There is potentially a *conflict between the competition objectives of business growth and adoption of the product into the NHS*. Open Bionics found that they needed to pursue private sales in order to generate revenue as a start-up company, which meant they had very limited time and resources to spend on the lengthy process to gain access to the NHS – which would have long-term returns but not in the short- or medium-term whilst working to gain the clinical validation required.
  - This was made more difficult by a *lack of clear guidance how to achieve the clinical validation* required for adoption into the NHS. RAND's surveys of SBRI Healthcare applicants found that complex and bureaucratic procurement systems and shortage of resources to complete development and obtain regulatory approvals left many companies having finished the competition but still requiring further support to reach adoption. PA Consulting's research found that significant additional work is required after the competition that companies need to undertake before the NHS adopts their products and services including regulatory approvals. But, that digital technologies were adopted more quickly than 'breakthrough' medical device innovations due to the lengthy clinical trials required for the latter.
  - *Resistance to innovation and change within the NHS*, as found by RAND's surveys of SBRI Healthcare applicants - 57% of respondents stated that adoption of their product was hindered by a lack of motivation and accountability for innovation uptake within the NHS and resistance to change.

### Summary Impacts

*Headline impacts across departments and firms*

The initiative has delivered a range of important impacts for the participating firm and some wider emerging and expected public sector impacts, including:

- *Product development* – a world first, award winning, affordable, multi-grip, bionic prosthesis for people with upper limb deficiencies.

- *Investment leveraged* – over £5million of public and private sector investment leveraged to support the development of Hero Arm.
- *Firm growth* – eight times increase in revenue and over three times growth in number of employees.
- *Commercialisation & internationalisation* – the Hero Arm is now available in the UK, EU, Russia, USA and Australia.
- *Improved patient care* - 65 patients have now been supported worldwide, the Bionic Squad, each with their own success stories of how the Hero Arm has transformed their day-to-day lives.
- *Building confidence and independence* for people with upper limb deficiencies through the technology itself and through the wider ethos of the Hero Arm of disabilities as superpowers.
- Prospect of NHS cost savings and efficiency gains if adopted in the future.

Source: Steer E-D, 2021

## Cumbria Tree Growers

Table F-1: Cumbria Tree Growers - Tree Tape

Introduction	
<b>Name of Case Study</b>	Cumbria Tree Growers - Tree Tape
<b>Competition</b>	Tree seed challenge
<b>Status</b>	Commercialised via alternative route
<b>Department/ Agency</b>	CivTech Scotland & Forestry and Land Scotland (FLS)
<b>Geography</b>	Scotland
<b>Information Sources/ References</b>	Josh Roberts, Forestry and Land Scotland <a href="mailto:Josh.Roberts@forestryandland.gov.scot">Josh.Roberts@forestryandland.gov.scot</a> Barbara Mills, CivTech <a href="mailto:Barbara.Mills@gov.scot">Barbara.Mills@gov.scot</a>
<b>Permissions to use information externally</b>	Y
Context, Rationale & Objectives	
<p><b>Public sector context rationale &amp; objectives for the project and for using SBRI</b></p> <p><i>Wider context in which the competition was launched.</i></p> <p><i>Why is this a priority for department and what did it aim to achieve?</i></p> <p><i>What was the Department's motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i></p>	<p>Planting trees supports the absorption of carbon dioxide from the atmosphere and turning it into sustainable, renewable materials for construction and manufacturing. This is well understood in Scotland; the first country in the world to declare a climate emergency. The Scottish Government's ambitions for tree planting are set out in the recently published Forestry Strategy for Scotland and the Climate Change action plan. Forestry not only contributes to achieving net zero carbon targets but also £1 billion in annual GVA to the Scottish economy.</p> <p>The demand for trees in Scotland is ever increasing. In 2009, this was somewhere in the region of 40 million, increasing to 60 million in 2019, and in order to meet the Scottish government's climate change action plan commitments, the demand for trees in 2029 will be c. 90 million.</p> <p>However, there are significant challenges in planting additional trees using existing processes/conventional methods. These include:</p> <ul style="list-style-type: none"> <li>• <b>Maintaining the supply of seed:</b> Many of the main tree species planted in the UK, including the more common Oak and Sitka, are 'masting' species, for which good seed crops are only produced in certain years, interspersed with periods of low- or non-production which makes it difficult to maintain a consistent supply of seed;</li> <li>• <b>Seed wastage:</b> It is not uncommon to lose two thirds of seeds before leaving forest nurseries, e.g. a kilo of Sitka spruce seed (the most widely planted commercial tree species in the UK) can produce up to 330,000 seedlings per year in laboratory conditions. However, failure to germinate, drought, badly formed trees, weed competition and predation can result in a kilo of seed sown only generating around 100,000 saleable seedlings in each year.</li> <li>• <b>Constrained resources:</b> Having scaled up production across the sector by half in the last decade, the industry's existing processes are reaching full capacity and supplies of seed are already extremely tight;</li> <li>• <b>Rural labour shortages:</b> Production at tree nurseries relies on manual labour and rural labour is both in short supply and of high cost. The need to increase production by over 50% again in the next ten years is unlikely to be achieved through existing processes because of limited labour supply;</li> <li>• <b>Recent weather conditions:</b> Extremely hot, dry weather during the spring and early summer of 2017 and 2018 caused poor seed germination in nurseries resulting in a shortage of young trees for planting in Scotland (at a time when national tree planting targets were, and still are increasing); and</li> <li>• <b>Time constraints:</b> It takes a minimum of 20 years of careful management to create a new seed orchard, and longer for some species. It is not viable to wait this long for new seed considering the high levels of demand for seed and the urgent need to tackle climate change.</li> </ul>

Because of the above, there is a need to make available seed go much further than it does currently.

CivTech is a tech accelerator, launched in 2016 by the Scottish Government, designed in consultation with the Small Business Research Initiative (SBRI) team at Innovate UK. It is an example of pre-commercial procurement. CivTech works with government departments across Scotland to define, run and fund challenges (such as through CivTech's pre-commercial fund or the CAN DO Innovation Challenge Fund run by Scottish Enterprise) that help innovative companies launch new products with global potential and that support economic growth and Scotland's public services.

It is worth noting that, in general, this approach is more 'hands-on' than comparative pre-commercial procurement models as it requires more intensive coaching and business expertise from CivTech's project team. It also works at the earliest possible point in conception, supporting concepts through business case development before launching into pre-commercial procurement.

The team at FLS were familiar with pre-commercial procurement, having previously run a challenge based project based on a two phase SBRI, characterised by an intensive early selection process, before working with up to five companies for six months then two companies for up to two years.

FLS applied to Scottish Enterprises' CAN DO Innovation Challenge Fund to set up a challenge that works to find a technological solution to address the constraints set out above on the supply of nursery seeds. Through this application process FLS were introduced to the Civtech team. FLS considered running the challenge in house following the SBRI model it had used previously and it considered collaboration with Civtech according to their model at the time, which involved a longer selection process over the course of around six weeks, before selecting a single company to work with for six months. FLS sought to develop a hybrid of the two models with Civtech. Multiple applicants would still go through the longer version of the selection stages with Civtech, however the key difference was that instead of only taking one company into the accelerator, as was typical for Civtech at that point, up to five companies would be taken on for the six month accelerator, more closely matching the SBRI model. This best-of-both worlds approach allowed the team to test and support a much broader range of concepts, as many of the techniques require germinating a seedling from seed, something which inevitably requires a more prolonged period of time to demonstrate.

The timing of the application was fortuitous, as CivTech were currently adjusting their model to increase their cap on an individual challenge budget from £250k to £650k. This increase meant that they would be able to support more than one organisation through the first two stages.

After a successful application, the competition challenged companies to find new ways to make better use of Scotland's limited tree seed bank, stretching them to utilise a variety of emerging technologies to find a solution that better utilises available seed with a higher proportion of seed going on to leave the nursery as trees. Critically, new processes should not use more (and ideally use less) manual labour, and not require major infrastructure changes that require shut-downs in production, loss of existing growing stock or multi-million-pound capital investment programmes.

**Private sector context, rationale and objectives for responding to this specific competition and pursuing SBRI/PCP?**

Cumbria Tree Growers are wholesale producers of high quality bare rooted trees and hedge plants for farmers, landowners and forestry companies.

The CEO of Cumbria Tree Growers (Michael Ashby) had observed new developments in vegetable production around automated transplanting technology over the past decade which were now tripling the typical yield of seedlings produced from a kilo of

*Business context at point of application?*

*Why did the business respond to competition and what did the business aim to achieve?*

seed. This technology, driven by PlantTape Inc. (a business owned by [Tanimura & Antle \(taproduce.com\)](#)), has now been fully proven in commercial agriculture, and is rapidly expanding in the world of field vegetable production. The method greatly reduces production time and provides further efficiencies throughout the whole production system, from seed sowing to the final saleable product.

Michael had long considered that this method could be adjusted to work for tree planting but did not have the resources or support to realise this. The Tree seed challenge, delivered as part of CivTech, provided the support to take this concept through to a commercial success through a package of both funding support, alongside mentorship and guidance. After some initial development of the technology and discussions about the intellectual property behind Plantape during the accelerator, Michael founded a company called Treetape to develop the concept and make it suitable for growing trees.

Michael Ashby was one of five successful applicants (TreeTape, Forestart, Forest Research, Silvibio, and Elsom's Seeds) who participated in this challenge.

## Inputs & Activities

**Competition delivery**  
*Details of award*

*Any key points around process, responsibilities, challenges across any phases:*

- competition design/award;
- Phase 1;
- Phase 2;
- project close & routes to commercialisation and/or procurement

*Scope of the project/ technology/ innovation – how did the project seek to achieve its objectives*

*Overall draw out any valuable perspectives on what worked well, not so well.*

Typically, the CivTech Challenge involved three main stages (Exploration, Acceleration and Pre-Commercialisation). Due to the increase in the competition budget, CivTech were able to take all five of the teams through the exploration and acceleration stages, with four companies including TreeTape also being successful in progressing to Pre-Commercialisation.

A summary overview of the stages of work were:

- **CivTech Exploration (Sept 2019-Oct 2019):** Introduction to the CivTech process and to the workshop schedule, which took place over two weeks at Codebase (Civtech's technology incubator). This stage cost c. £3,000 per supplier with a total cost of c. £15,000;
- **CivTech Acceleration (Nov 2019-March 2020):** A five-month programme of intense project development, business workshops and Checkgate meetings, all taking place at Codebase in Edinburgh. This stage cost c. £20,000 per supplier, with a total cost of £100,000; and
- **CivTech Pre-commercialisation (April 2020+):** Ongoing until completion supporting production trials, with financial support set at a bespoke level for each company according to their need, but with an overall contract spending cap over the entire project of £610,000

The technology behind TreeTape immediately stood out to the project team as an exciting prospect at the proposal stage and the staged CivTech approach worked particularly well for the development of this technology. The funding and support provided by the accelerator provided Cumbria Tree Growers with the space to truly learn from other industries and the amount of upfront support in tailoring the business case allowed for a solution that thoroughly addressed the challenge problem.

The work as part of the accelerator culminated in a public presentation of TreeTape at the CivTech Demo Day hosted at the Edinburgh International Conference Centre to an invited audience of more than 500 delegates comprised of government officials, business leaders and potential investors.

At the close of the accelerator, TreeTape had all of the theoretical components in place to progress but the theory needed to be tested. For trees, testing needs to happen in Spring to allow for the required germination. It progressed with a modest trial in March 2020.

Meanwhile, the impact of COVID-19 and associated physical distancing were keenly felt by the forestry industry. There were significant industry concerns that 2020

would go by with limited if any trees being germinated at forest nurseries in Scotland in Spring (and therefore all of that year). This would have a serious impact on Scotland's woodland, the ability to reach Climate Emergency targets and on downstream work and economic activity in the forestry sector. A solution that reduced the level of manual inputs and meant that tree-planting could progress with minimal interruption throughout the pandemic was, therefore, of even greater appeal.

Therefore, despite the uncertainty around COVID-19 and not yet having the results from the first production trial, the second production trial went ahead in April 2020. Not only this, but FLS requested TreeTape to scale-up production plans by 1000%. In seed terms, this meant an increase from planting 400,000 seeds by September 2020 to planting four and a half million seeds in the same timeframe. Costs also increased proportionally by ten times.

This was a considerable risk as it was not only gambling with precious seed, but the technology was still untested, with results from the first trial still awaited.

An increase of this scale provided considerable logistical challenges and drew on the strong partnerships that were built across the process so far with FLS, CivTech and Cumbria Tree Growers working 'around the clock' to get the initiative off the ground and into the field with legal agreements signed and seeds secured.

The results from the first trial were disappointing with lower levels of germination than anticipated, including scorching on the leaves and over-watering. However, the learning from these results were immediately applied to the second trial which was underway with very positive germination results. The trees from the second production trial were subsequently planted in Northern Scotland in September 2020. Planting the trees in the ground was also very impressive, achieving over a million plants in a single 8 hour day, compared with current industry practices that would have struggled to achieve 60,000 in the same time.

On reflection, consultees views from FLS and CivTech are mixed on whether activity would still have been scaled, or even have gone to the second production trials after the disappointing returns from the first trials, if it wasn't for the urgent need to respond to the challenge posed by COVID-19 and associated restrictions. Each iteration of the trials there are still considerable lessons being learned which is providing the team with confidence they can get to where agriculture is with this technology very soon.

## Outputs, Outcomes & Impacts

### **Innovation/Product development**

What new innovation has the product resulted in? What stage of readiness is this at? Is it on the market?

Conventional tree-planting methods mean that currently, the majority of trees that foresters' plants are first grown in dedicated forest nurseries where seeds are germinated and grown to a suitable size before being taken to be planted at a future forest site. The uprooting of these tiny seedlings after their first year and then replanting them at the right spacing for another years' growth is slow, labour-intensive and costly.

The 'Tree Tape' technology, developed by Cumbria Tree Growers, has allowed the very latest technology from the vegetable growing industry to be adapted to produce tree seedlings for forestry nurseries. At the heart of this revolutionary transplanting system is the tape. It is comprised of pockets of coir and peat sandwiched between layers of biodegradable paper tape to form a continuous ribbon of cells. Differing paper formulations allow for varying tape life, e.g. for conifer production a tape with a lifespan of up to 16 weeks is needed due to their slow, early growth.

Seeds are then sown into the side of the uncut tape blanks and held in place. This process fully automated and extremely quick with over 300,000 tape cells sown each hour. These are then held in optimum growing conditions for 10-12 weeks before they are moved outside to acclimatise them to outdoor conditions for several weeks.

Specially designed transport boxes are then filled at a high density with the trays of growing seedlings and transported to production glasshouses in the nursery fields where they will be planted for an additional 12-18 months until they have grown large enough to be ready for forest planting.

The planting in the nursery fields utilises the PlantTape transplanting machine and is where the greatest improvements in worker productivity can be seen. The ability to plant around 1 million seedling trees with only 2 operators in a standard working day makes the work rate of this machine unrivalled anywhere in the world. As the ribbon of tape is fed through the planting mechanism it is cut into individual segments that can be placed with exact precision at almost any desired spacing. The versatility of this approach enables the differing growth needs of individual species and the length of the crop cycle to be fully accommodated.

Together, this process ultimately provides a more accelerated growing system (due to both the optimum growing conditions), with less resource, that gives the greatest number of seeds from each kilo of seed the ability to germinate and grow. This method has never been used in this way and has the potential to transform tree planting around the globe.

**TreeTape UK Ltd officially started trading** 19<sup>th</sup> May 2020 and has taken over the development and commercialisation of the growing system.

**Business Impacts**

*Direct quantifiable growth impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider impacts?*

Whilst the process is yet to go through a full project life cycle, the innovation's process improvements are explored below.

The existing system used for replanting seedlings that is currently being used by FLS allows nursery staff to plant up to 60,000 seedlings in one day (with optimum conditions). The trialling of TreeTapes has resulted in an **unofficial world record** planting >1 million trees (as reported by FLS) in one day using fewer operators; an **increase in per person productivity of almost 2000 percent**. With optimum conditions, FLS estimate that this can increase further, with 1.3million trees planted in the same timeframe.

Additionally, moving the germination inside to a glasshouse **means more trees can be grown from the same quantity of seed**. The conventional method of scattering seeds in the field results in about 50% germination, the trials have shown that increase to up to 79% in the greenhouse. As part of the third trial this has increased again to past 90%.

Looking elsewhere to the market, there are other cell-based alternatives for reducing people resource whilst increasing germination success, but they are very expensive. TreeTape technology still allows seedlings to eventually be grown in a field which is far more affordable to growing under glass, keeping cost of production low.

It is very unlikely that this idea would have progressed without CivTech in the short-to medium-term. Cumbria Tree Grower's CEO/technology lead had had this idea for over four years but had not had the resources or motivation to take it forward. It is also unlikely that it would have been taken forward if the competition required much more than an idea; pre-commercial procurement was necessary because it required no proof of concept. Essentially, this approach allowed for the complete de-risking of the innovation process for Cumbria Tree Growers.



## Public sector impacts

### Qualitative Impact

*Direct impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider benefits?*

Again, whilst the process is yet to go through a full life cycle, the anticipated impacts to the wider public are substantial.

It has the potential to not only make a large contribution to Scotland's future climate emergency effort, but it's also a technology that could deliver benefits to forestry around the world. This could completely revolutionise the sector, improving industry profitability whilst significantly reducing carbon emissions globally.

It is also anticipated that the flexibility of this new approach will mean that at the end of the growing period the final plants will have greater uniformity than is achieved using current standard practices. It is also possible to vary the seed sowing date to in order to influence the height of the final crop.

Finally, one of the greatest successes of this process was the development in people. Alongside, traditional business impacts, the programme's coaching and business development support had a profound impact on Cumbria Tree Growers CEO. Traditionally nervous in public speaking, the accelerator programme allowed the individual to build up his commercial understanding alongside various softer competencies including his confidence and public speaking, and at the aforementioned Demo Day hosted at the Edinburgh International Conference Centre, he presented to over 600 people and gave the most positively received talk of the day.

## Conclusions

### Key Lessons and Success Factors

*Are there any key factors for why the case study was successful/unsuccessful?*

*What went well or not so well?*

*Are there any suggested improvements for future competitions?*

A number of important lesson and success factors can be derived from this initiative. These include:

- *Responding and being flexible to the current context* – This competition undoubtedly benefitted from circumstance. Industry issues were amplified and support for this new technology was dramatically increased due to COVID-19's unprecedented lockdown clashing with Spring. This meant that activity in the second production trial progressed before the disappointing results from the first trial were returned, which may have stopped or slowed down proceedings;
- *Recognising that innovation is incremental and takes time* – Despite what would have been seen as a substantial setback, the ultimate success of this technology, provided learning opportunities for the sponsor team and they may be more supportive of technologies with strong processes but limited initial impact in the future;
- *Providing a flexible package of support* - As the technical innovation and demand were well understood, the hardest part of the process was seen at the outset of the programme, in developing a business model that worked for the technology and the challenge. Specifically, the support was catered to understanding the IP and associated access rights. This technology required investment in foreground IP to pivot this existing technology and make it work for trees. The CivTech programme was exceptionally catered to the business, adapting content and support to this need. Having this flexibility was critical for success; and
- *Establishing collaboration and long-term relationships* – Being able to pivot to changing requirements, including a dramatic increase in the scale of production, heavily relied on the strong connections between CivTech, the project sponsor (FLS), and the applicant (TreeTapes), forged in the preceding stages of work.

Overall, the programme of support provided by CivTech was extremely well received and FLS would be keen to re-engage CivTech for future challenges. So much so, that FLS stated they would re-engage the programme even if CivTech were unable to partially fund the programme and all funding would need to be sourced through FLS. They have since done this as part of another challenge in CivTech 5.0 which was entirely self-funded by FLS.

## Summary Impacts

*Headline impacts across departments and firms*

In summary, whilst this technology is in early stages of trialling and testing, the anticipated impact are substantial, most notably:

- **Better success rates:** An increase in rates of germination from 50% to 79% with forecasted further improvements;
- **Worker productivity:** An increase in per person productivity of almost 2000 percent as reported by FLS;
- **Quality of product:** It is anticipated that this new approach will result in greater tree uniformity and greater control over the height of the final crop;
- **Low production costs:** Low production costs compared to cell-based alternatives that offer similar outcomes;
- **Sector development:** A combination of improved worker productivity, quality of product and low production costs has the potential to dramatically improve sector profitability and growth; and
- **Public benefit:** This technology development contributes to national and international carbon reduction targets and the net zero agenda.

As much of this is anticipated it will need to be monitored/reviewed over time.

It is, however, very unlikely that this idea would have progressed without CivTech in the short- to medium-term although over the longer term it is to be expected that other actors would consider the same approach. That the support of the programme was required would seem to be demonstrated by the fact that the applicant had had the idea for several years and the underlying technology was already available but nothing had happened. The de-risking of this innovation process provided through this programme would appear to have been critical.

Source: Steer E-D, 2021

## GovTech Catalyst and Seafood Innovation

Table F-1: GovTech Catalyst and Seafood Innovation

Introduction	
<b>Name of Case Study</b>	GovTech Catalyst and Seafood Innovation
<b>Competition</b>	GovTech Catalyst & Seafood Innovation Fund
<b>Status</b>	GovTech Catalyst: 15 challenges over three years, drawing to a close in Spring 2021.  Seafood Innovation Fund: Three successive ‘calls’ for applications are planned. Call 2 closed to applicants in June 2020 and projects are still ongoing. Funding for Call 3 has not yet been confirmed.
<b>Department/ Agency</b>	GovTech Catalyst is funded via the National Productivity Investment Fund, a funding pot which belongs to the Department for Business, Energy and Industrial Strategy (BEIS). The Catalyst is administered and supported by a small team of staff from the Government Digital Service (GDS). Each of the fifteen challenges has one or more public sector ‘challenge owners’, which could be a central government department, a local authority, Arms-Length Body or similar.  The Seafood Innovation Fund (SIF) is administered by the Centre for Environment, Fisheries and Aquaculture Science (Cefas), an agency of the Department for Environment, Food & Rural Affairs (DEFRA).
<b>Geography</b>	UK-wide
<b>Information Sources/ References</b>	Ian Tester, GDS <a href="mailto:ian.testers@digital.cabinet-office.gov.uk">ian.testers@digital.cabinet-office.gov.uk</a> Gary Pritchard, GDS, <a href="mailto:gary.pritchard@digital.cabinet-office.gov.uk">gary.pritchard@digital.cabinet-office.gov.uk</a> Steve McLinden, Mid & West Wales Fire & Rescue, <a href="mailto:s.mclinden@mawwfire.gov.uk">s.mclinden@mawwfire.gov.uk</a> Andrew Ayling, Brandwidth <a href="mailto:andrew.ayling@brandwidth.com">andrew.ayling@brandwidth.com</a> Suzanna Neville, Cefas, <a href="mailto:suzanna.neville@cefas.co.uk">suzanna.neville@cefas.co.uk</a>
<b>Permissions to use information externally</b>	Y
Context, Rationale & Objectives	
<p><b>Public sector context rationale &amp; objectives for the project and for using SBRI</b></p> <p><i>Wider context in which the competition was launched.</i></p> <p><i>Why is this a priority for department and what did it aim to achieve?</i></p> <p><i>What was the Department’s motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i></p>	<p><b>GovTech Catalyst</b></p> <p>GovTech Catalyst was set up following discussions between the Cabinet Office, BEIS, and HM Treasury. There was a desire to increase public sector productivity and capability; and to encourage the concept of challenge-based procurement. These discussions culminated in development of a business case, led by BEIS, to use £20m from the National Productivity Investment Fund towards a challenge-based procurement fund focused on digital solutions to public sector issues. GDS were selected as the delivery agent due to their expertise in digital delivery. The fund was announced by the Chancellor in 2017, and the business case finalised in March 2018. The 3 year programme was then launched the following month (April 2018).</p> <p>93 public-sector bodies expressed an interest in being a ‘challenge owner’, and just 15 of these were selected to proceed, with final challenge owners including local government, government agencies and central government departments. Successful challenge owners include for example the Home Office, Northern Ireland Audit Office and Nature Scotland. Proposed challenges must involve a digital element to the solution (either software or hardware), use innovative technology and be suitable for the challenge-led procurement process.</p>

Amongst challenge owners, the main motivation for applying was to develop solutions to existing problems/challenges, access the digital skills and expertise offered by GDS and apply this to a problem; and also to access the £20m funding pot available (although GDS reports that this was less of a motivating factor for central government departments).

For this case study, Mid- & West Wales Fire & Rescue Service, one of the selected challenge owners, was interviewed. The Fire Service had previous experience of implementing new technologies successfully (a project to implement drones). So, when approached by contacts within the Welsh Government about running a GovTech Catalyst SBRI programme, they were positive and could see the potential value quickly. The specific challenge was to design a technology which would allow the position and movements of fire fighters to be tracked while inside a burning building. The equipment needed to be able to function in an environment with high levels of heat, humidity, smoke (and therefore poor visibility), with no reliable internet connection or GPS (which stops working inside buildings as it needs a clear line of site to multiple satellites), be affordable for a Fire Service to procure for an entire crew (meaning it needed to cost hundreds, not thousands, of pounds per device), and be operational within 90 seconds of arriving at an incident. This budget constraint is due to affordability within finite equipment budgets. Such technology is not currently available on the market, and so the GovTech Catalyst programme was viewed as a good route to procuring a solution.

#### **Seafood Innovation Fund**

SIF is the first ever SBRI competition run by Cefas. It is a £10m funding pot spread over three years. The purpose of the Fund is not to procure anything for Cefas, but instead to catalyse change in the seafood sector. The Fund is designed to encourage industry participants to take risks on commercial innovations, with the hope that this will have benefits for applicants and also for the sector as a whole (such as for example environmental benefits and improved competitiveness of the seafood sector). Due to its role in the sector, Cefas are not only administrators of the competition, but have also entered the competition as applicants themselves, proposing development of innovations which could potentially have sector-wide benefits. Conflict of interest was avoided by setting up a team within the Cefas operations directorate to administer the fund that is separate from the science directorate. All documentation submitted to the fund is confidential and securely stored, and the governance structure for the fund is UK-wide removing Cefas from the decision-making process for awarding funds. The SBRI format was chosen due to the ease of having an already set-up model with processes, templates, and advice available from UKRI and others who had been through the process before. Govtech Catalyst, as a recently developed programme-level SBRI approach, provided some advice to Cefas during the early stages of planning SIF.

**Private sector context, rationale and objectives for responding to this specific competition and pursuing SBRI/PCP?**

*Business context at point of application?*

**GovTech Catalyst**

For this case study, *Brandwidth* was interviewed. Brandwidth was an applicant to the GovTech Catalyst Mid-West Wales Fire & Rescue competition. Out of the five competitors participating in Phase 1, they were one of two competitors selected to progress to Phase 2 of the competition, and the project is currently underway but due to close soon. Brandwidth is a digital innovation agency with approximately 60 employees. Past products include for example a connected car app for

*Why did the business respond to competition and what did the business aim to achieve?*

Porsche (which allows the driver to connect to the car remotely and control some functions such as the air conditioning, or to check the charge level), and development of Virtual Reality (VR) software to support a Nokia VR camera.

For Brandwidth, the motivation for applying was to be involved in an interesting project, which made use of existing experience/skills, and supported R&D investment for the business. The firm's previous Nokia VR project meant that they had a good foundation of relevant existing skills – visualisation and 3D modelling techniques used for the Nokia VR project could be used for the development of software for the tracking and visualising of a firefighter's position.

The firm tries to keep up to date with cutting edge new technologies and being involved in R&D projects such as this helps them to do that. In this case, there was a clear end user (the firefighter), and clear customer (the fire service), and a clear need for novel technology – therefore it 'ticked all the boxes' for the firm in terms of selecting a suitable R&D project.

#### **Seafood Innovation Fund**

No SIF applicants were interviewed for this case study. A separate evaluation of the Fund is being prepared (commissioned by Cefas) and case studies will be available as part of that.

### **Inputs & Activities**

#### **Competition delivery**

*Details of award*

*Any key points around process, responsibilities, challenges across any phases:*

- competition design/award;
- Phase 1;
- Phase 2;
- project close & routes to commercialisation and/or procurement

*Scope of the project/ technology/ innovation – how did the project seek to achieve its objectives*

*Overall draw out any valuable perspectives on what worked well, not so well.*

#### **GovTech Catalyst**

*Timeline/Processes:*

The three-year GovTech Catalyst programme was launched in April 2018. At the time of interview (February 2021), the programme was seven weeks from closure, and awaiting confirmation of potential extension funding. The intention was to launch 15 separate challenges (each with a different challenge owner) and complete any suitable for progressing to phase 2 over the three-year period. Whether challenges have progressed to Phase 2 was at least partially driven by a robust end of Phase 1 evaluation for each challenge (currently absent in standard SBRI). Details of the 15 challenges selected are available on the gov.uk website<sup>1</sup>.

Each of the challenges have progressed differently:

- Two of the 15 challenges reached Phase 2 and were completed and closed;
- Nine of the 15 challenges are currently at Phase 2, but have been extended beyond the original programme closure date; and
- The remaining four were ceased after closing Phase 1 for varying reasons (two went down a different procurement route, one was not suitable and two were judged to have low chances of a successful outcome so were dismissed on VfM grounds).

*Challenges and lessons learned:*

For GDS, major challenges and lessons learned have been around:

- The aggressive timelines for delivery of challenges. The first competition was due to be launched only one month after completion of the business case, and a new competition was launched every month thereafter. This meant that the resourcing

<sup>1</sup> <https://www.gov.uk/guidance/current-govtech-catalyst-projects>

requirements grew every month, and also that competitions were all in different stages of completion. For future rounds, the GDS interviewee suggested they would choose to group competition owners together in cohorts, so that the coaching and administration could be 'batched' together;

- The level of advice and support needed from 17 challenge owners and 75 supplier teams was significant, and required more resource than had been planned for by GDS;
- Disruption caused by COVID-19, which affected not only GDS's ability to support the programme, but also challenge owners' ability to run the competitions, and even firms' ability to work on technology development or conduct user research/prototype testing. One competition (around warehousing and customs' facilities) had to be abandoned due to the disruption caused by EU Exit and COVID-19;
- One project ended early due to issues around Intellectual Property (IP). The challenge owner was not happy for the IP being developed to stay with suppliers, due to concerns around national security, and so chose to move away from the SBRI format and instead to run Phase 2 using their own contractual terms;
- Only a small budget (approximately £35k) was set aside for evaluation of the programme, which will not be sufficient to develop meaningful evaluation findings. The budget was for a simple post-programme evaluation, with no budget assigned in-programme;
- GovTech Catalyst's central hypothesis was that the likelihood of developing procurement-ready digital products could be improved by overlaying the SBRI process with GDS Digital standards and assurance processes, as well as improving the digital capability of both challenge owners and suppliers. It is too early to evaluate the impact of this robustly, but the overhead of introducing, coaching and upskilling participants is significant;
- Processes have been progressively streamlined and made more efficient so that all challenge owners can receive adequate support within the available resources. GDS have made the decision to focus more one-to-one support and coaching in the Phase 1 stage of each competition, and set up Phase 2 stages so that they can be relatively 'self-running' – making use of the advice given at Phase 1; and
- One lesson learned has been around the criticality of early involvement of procurement professionals. Those who had not been involved in the SBRI competition from the beginning later went on to cause some issues at the Phase 2 stage of the project. GDS reported that one lesson learned was the importance of involving individuals responsible for procurement from the outset of each project and ensuring they are comfortable with both the SBRI process and the GovTech Catalyst assurance process overlaying it.

### **Mid-West Wales Fire & Rescue**

#### *Timeline/Processes:*

The Mid-West Wales Fire & Rescue SBRI competition 'Improving firefighter safety and operational response' was the sixth GovTech Catalyst competition to be launched. It opened in October 2018, with a total funding pot available of £1.25m. Initially, 400 Expressions of Interest were received from potential suppliers. Of these, 51 were shortlisted, ten taken forward to interview, and five selected for Phase

1, in which firms were allocated £50k each for research and development of a first prototype. Following completion of Phase 1, the five companies were invited to a workshop in which the GovTech Catalyst presented the specification for the project, and the five firms gave presentations on the prototypes they had developed for Phase 1, and their ideas for the next Phase.

Only two firms could be selected to move to Phase 2 (as per the GovTech Catalyst model of funding five competitions at Phase 1 and up to two at Phase 2). Following the workshop, two of the firms decided to form a joint venture to work collaboratively on a Phase 2 bid – they were selected, alongside one other firm (Brandwidth, who was interviewed for this case study). Each of these two were then awarded £500k over a 23-month period to develop a viable product.

*Challenges and lessons learned:*

- The nature of the project, which required many hours of live-testing by firefighters undertaking training drills (to ‘train’ the algorithms used to detect firefighter movement patterns) meant that COVID-19 lockdowns significantly hampered the product development process. As a result, the project had to be extended from a planned December 2020 finish to an April 2021 completion date;
- The joint working between two of the Phase 1 applicants has been a success and has enabled teams with different ideas and skillsets to combine and produce a better overall product. The firm interviewed for this case study suggested that if Phase 2 involved just one development team, potentially combining two or three of the Phase 1 applicants, this could have led to an even better outcome.

**Seafood Innovation Fund**

*Timeline/Processes:*

SIF is a £10m funding pot distributed across three years and three separate funding calls. The first call (July to September 2019) received 73 applications. Of these:

- 14 feasibility studies were selected for funding, and completed by March 2020 (with some overruns, due to COVID-19 impacts). Ten of these then put in applications for R&D projects in Call 2, of which five were awarded funding and are currently underway.
- 13 R&D projects were selected for funding. These are longer-term projects than the feasibility studies, and are currently still underway.

Call 2 was open from February to June 2020, again for applications for both feasibility studies and R&D projects. In Call 2, funding was provided for:

- 14 feasibility studies; and
- 16 R&D projects.

*Challenges and lessons learned:*

For the SIF, major challenges and lessons learned have been around:

- Some of the contractual terms around intellectual property, which some applicants were not willing to accept. One Call 1 applicant was awarded £250k but chose not to accept funding because they were unwilling to sign the IP agreement within the standard contract. Similarly, an applicant to Call 2 also declined funding due

to the IP clause and took the decision to self-fund the project. One of DEFRA's agencies applied to the Fund in Call 2, but declined funding due to the Clause 23. Indemnity and Insurance part of the contract. Cefas have now amended the unlimited liability clause in line with wider Government contracts and capped liability to the sum awarded instead. The IP clause has not been amended and remains identical to the SBRI template provided.

- Running a fund is a time-consuming endeavour and, like GDS, Cefas commented on the need to try and streamline processes and reduce the administrative burden. They are considering a more staged approach to applications, with a lighter touch first stage such as for example a two-minute video expression of interest. Not only would this lessen the burden of application sifting, it would also make it a lighter-touch process for firms, and less wasted effort for firms who do not put in a winning bid.
- The different amount of time taken for feasibility studies versus R&D projects has caused complexity for administration of the fund – for example it has been challenging to maximise the potential for feasibility studies to generate R&D projects when some feasibility studies have overrun (for unforeseeable reasons, such as COVID-19 disruption) and the timing for Calls was pre-designed. As a result, the Cefas interviewee suggested that in future they may streamline the process by only accepting feasibility studies for Call 3.
- Demonstration of support: SIF made clear that match-funding wasn't a requirement to be awarded funding. However, through the assessment process, it became clear that those who had secured match funding were better able to demonstrate industry buy-in and potential for future sales of the product. For future rounds, the fund administrators intend to make it clearer to applicants that applications which demonstrate industry support (through match funding or other means, such as e.g. loans of equipment/facilities to carry out testing) will be given preference.

## Outputs, Outcomes & Impacts

### Innovation/Product development

What new innovation has the product resulted in? What stage of readiness is this at? Is it on the market?

### GovTech Catalyst

A wide range of different innovations have been produced as part of the 15 challenges. These include for example: identification of terrorist imagery (Home Office), digitalisation of a waste management system (DEFRA), and an app aimed at reducing loneliness in rural locations (Monmouthshire Council).

The Mid-West Wales Fire & Rescue competition resulted in development of two prototype products to solve the challenge. Both involve use of an accelerometer worn on the firefighter's wrist. By calibrating the accelerometer during training exercises (so that it can recognise the typical movements made such as crawling, ducking, rolling etc.) the accelerometer is able to detect changes in direction and steps taken, such that it can draw a map of the firefighter's route through the building.

The product is currently approximately TRL four to five. Due to COVID-19, the development team were not able to attend the firefighter training exercises they had planned, and therefore the software has not been 'trained' to the extent desired. The budget provided by SBRI has enabled the product to get this far, but it has not yet been field tested with the hardware in a representative location. A fair amount more testing and iteration will likely be required before the product can be commercialised.



	<p>Since there is no further funding available from SBRI, Brandwidth are considering alternative options such as adding in extra functionality to attract alternative customers, or pivoting towards the defence market (for whom this product is an attractive offer, given the similar challenging working conditions faced), potentially by obtaining further SBRI funding through DASA. There are also licensing challenges which need to be addressed before the product can be commercialised. Once the product is ready for sale, Brandwidth hope to be able to approach Fire and Rescue services in the UK and overseas.</p> <p><b>Seafood Innovation Fund</b></p> <p>SIF has similarly produced a diverse range of different products, such as:</p> <ul style="list-style-type: none"> <li>• A hybrid generator for use by aquaculture farms which allows for switching between diesel and electric power (this is a lower carbon option than the traditional diesel generator used on the farms).</li> <li>• A product for the weighing, measuring and sorting of fish at ports, allowing for more automated and accurate data collection on stock levels.</li> <li>• A ‘waterjet bleeder’ – which uses jets of water rather than physical blades to slaughter fish, with resultant hygiene, productivity and animal welfare benefits.</li> <li>• Imaging/behavioural analysis products to optimise the quantity of aquaculture feed being dispensed at a time, reducing waste feed and lowering the risk of disease.</li> <li>• A project using sea cucumbers to reduce the disease and effluent from aquaculture pens.</li> </ul>
<p><b>Business Impacts</b></p> <p><i>Direct quantifiable growth impacts?</i></p> <p><i>Additionality of SBRI?</i></p> <p><i>Indirect/knock-on benefits?</i></p> <p><i>Wider impacts?</i></p>	<p>As described above, Brandwidth have not yet reached commercialisation of the product. However, they reported the following business impacts:</p> <ul style="list-style-type: none"> <li>• While headcount has not increased, the project has enabled the company to maintain roles and project work despite the market disruption caused by COVID-19 (which could have otherwise resulted in job losses).</li> <li>• The project has provided excellent publicity for the firm. They have used it as a case study, on their website and in press releases, and this may have led (indirectly) to additional work being won.</li> <li>• New relationships have been developed with various academic institutions, in particular the large engineering universities such as Imperial, Bristol and Kingston. These relationships have been very useful both for the firm and for the universities – for the firm, they bring access to students, who are smart, good at solving problems, and relatively low-cost. Brandwidth are also considering an option to start funding PhD or Masters projects, and are even starting to get involved with advising on syllabus design, to ensure that new graduates have the skills required to for the future workforce.</li> <li>• Finally, Brandwidth is now considering creating a new spin-out R&amp;D company which would focus specifically on development of new products. Being a small spin-off would give them an advantage for accessing some funding routes.</li> </ul>
<p><b>Public sector impacts Qualitative Impact</b></p> <p><i>Direct impacts?</i></p> <p><i>Additionality of SBRI?</i></p> <p><i>Indirect/knock-on benefits?</i></p> <p><i>Wider benefits?</i></p>	<p><b>GovTech Catalyst</b></p> <p>Although it is still early days for many of the SBRI competitions operated through GovTech Catalyst, some promising technologies have been developed. Monmouthshire County Council’s competition aimed at reducing rural isolation has resulted in development of apps that help address loneliness, and a product is expected to be procurable in the</p>

short to medium term. DEFRA's competition for digitalisation of waste management is also expected to be procured in the medium-term.

For Mid-West Wales Fire & Rescue, the SBRI project has brought the technology forward by approximately four years (interviewee estimate). While there is not yet a product ready to procure (which had been the hope, and may have been possible without COVID-19 disruption), it is expected that a product may be ready, using alternative funding sources, within the next 12 months or so. If such a product does become available, it will be an attractive proposition for Fire & Rescue services across the UK – contributing to tactical decision-making and reducing risk to life for both firefighters and civilians. More widely, there may be other similar benefits outside the Fire & Rescue service – for example if the product is also purchased by Counter-Terrorism or military units.

#### **Seafood Innovation Fund**

For SIF, the focus is on developing products that are useful and have wider benefits (such as environmental benefits) for the seafood industry – that is, products which aquaculture farms and other actors in the industry would be interested in purchasing to improve productivity, reduce carbon emissions, improve animal welfare etc. There are also some technologies under development which are of interest for DEFRA/Cefas to purchase – for example the product being developing for stock management at ports.

More widely, it is hoped that there have been new partnerships or collaborations developed as a result of the fund, in particular with technology developers who don't traditionally operate in the seafood sector. It is hoped (but too early to say whether this has happened or not) that having developed a prototype through SIF, firms might become more active at developing products for the sector going forwards.

## **Conclusions**

### **Key Lessons and Success Factors**

*Are there any key factors for why the case study was successful/ unsuccessful?*

*What went well or not so well?*

*Are there any suggested improvements for future competitions?*

Bringing together these two programme-level competitions, key lessons are:

- The level of administrative burden required to run a programme-level SBRI competition should not be underestimated. Sufficient planning time, refinement of processes, learning from others who have run similar programmes, and careful planning of timelines/cohorts, with allowance for potential delay, can all help to improve the experience.
- The intellectual property requirements of the standard SBRI contract are off-putting for some firms. Both of the programme-level competitions featured in this case study experienced issues around intellectual property, leading to drop-outs at the firm or departmental level.
- This case study documents programme spending worth £30m, but to date no products have been procured as a result of the competitions. This is mostly due to timing (competitions were still underway and prototypes in development during the time of the case study interviews) but also disruption from COVID-19 causing delays to project timelines; and in the case of SIF, a more complex route to procurement, since the challenge owner does not intend to procure the product.

## Summary Impacts

*Headline impacts across departments and firms*

### **Firm-level impacts:**

For the firm interviewed, main impacts were:

- Relationship development and partnering – new relationships being formed between academic institutions and private companies, leading to mutual benefits;
- Safeguarding of jobs by offering a steady source of funding during the economic disruption caused by COVID-19; and
- Excellent publicity, leading to new work-winning opportunities.

### **Department-level impacts:**

Some products have been developed which are likely to be procured in the short to medium term. These address issues such as rural isolation, waste management and terrorist imagery. For the Seafood Innovation Fund, new products have been developed which will have benefits for the seafood sector and wider society – such as decarbonisation benefits, animal welfare, and industry competitiveness. These benefits will only be realised, however, if the products being developed are procured by industry.

Source: Steer E-D, 2021

## Viking Unmanned Ground Vehicle

Table F-1: Horiba Mira - Viking Unmanned Ground Vehicle (UGV)

Introduction	
<b>Name of Case Study</b>	Horiba Mira - Viking Unmanned Ground Vehicle (UGV)
<b>Competition</b>	Last Mile Re-supply
<b>Status</b>	Procured (initial small order of 3 vehicles to test/pilot)
<b>Department/ Agency</b>	Defence and Security Accelerator (DASA)
<b>Geography</b>	UK
<b>Information Sources/ References</b>	<a href="mailto:pestockel@dstl.gov.uk">pestockel@dstl.gov.uk</a> ; <a href="mailto:JGPOWELL@dstl.gov.uk">JGPOWELL@dstl.gov.uk</a> ; <a href="mailto:nbarsby@mail.dstl.gov.uk">nbarsby@mail.dstl.gov.uk</a> ; <a href="mailto:robert.mohacsi@horiba-mira.com">robert.mohacsi@horiba-mira.com</a>
<b>Permissions to use information externally</b>	Agreed and signed off by both consultees
Context, Rationale & Objectives	
<p><b>Public sector context rationale &amp; objectives for the project and for using SBRI</b>  <i>Wider context in which the competition was launched.</i></p> <p><i>Why is this a priority for department and what did it aim to achieve?</i></p> <p><i>What was the Department's motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i></p>	<p>The Strategic Defence and Security Review (2015) highlighted a poor track record in embracing innovation within the Ministry of Defence alongside an inflexible and narrow supply chain focussed around a small number of prime suppliers. Following on from the Review, the Defence and Security Accelerator (DASA) was established in 2016 to deliver a step change in innovation capacity and capability.</p> <p>DASA recognised that it needed to look beyond its prime suppliers in order to diversify its supplier base and to access and take advantage of the latest emerging technologies. The SBRI framework, with its established mechanisms which could be readily tailored and adapted, provided a convenient mechanism for DASA to engage a wider market and to test and prototype new technologies.</p> <p>DASA identified 'Autonomous Last Mile Re-Supply' as a priority area for innovation and SBRI. It wanted to explore how it could improve and automate its existing logistics operations in supplying the battlefield. These operations are currently inefficient requiring convoys of armoured vehicles and stockpiles of supplies. Current logistical operations are both vulnerable to attack and resource intensive. DASA wanted to reduce casualty numbers and within the wider context of an army reducing in numbers, it wanted to restructure and streamline logistics operations so that the army can maintain the number of combat troops.</p> <p>Critically, DASA also wanted to improve its logistics operations and deliver a faster, more flexible, user led system that can get the right supplies into the field at the right time. This is vital to maintaining the effectiveness of the army, reducing casualties, and providing an edge in combat scenarios. DASA had been looking at innovation in logistics beyond the defence sector, for example Ocado's 'autonomous' warehouse, and wanted to engage with new commercial and innovation networks to enable it to translate emerging technologies into its own operations.</p>
<p><b>Private sector context, rationale and objectives for responding to this specific competition and pursuing SBRI/PCP?</b>  <i>Business context at point of application?</i></p>	<p>Horiba-Mira is a well-established civil and defence vehicle engineering company employing c. 600 people across multiple sites in UK and globally. Alongside the MoD, major clients include Jaguar Land Rover and Honda. The firm's business model is framed around three technological pillars – Autonomy, Electrification, and Cyber.</p> <p>Horiba-Mira has been working on unmanned vehicles for around twenty years and there has been increased interest in the area over the last five years or so.</p>

*Why did the business respond to competition and what did the business aim to achieve?*

MoD/DASA has been a longstanding customer of Horiba Mira who had been developing their 'Viking' vehicle over many years, along with their Modular Autonomous Control Equipment (MACE), including via support from previous MoD programmes. The 'Autonomous Last Mile Re-Supply' programme provided the opportunity for Horiba Mira to develop new autonomous software technology for their existing Viking product. The innovative software component had not been developed as part of the original design of the vehicle.

## Inputs & Activities

### Competition delivery

*Details of award*

*Any key points around process, responsibilities, challenges across any phases:*

- competition design/award;
- Phase 1;
- Phase 2;
- project close & routes to commercialisation and/or procurement

*Scope of the project/ technology/ innovation – how did the project seek to achieve its objectives*

*Overall draw out any valuable perspectives on what worked well, not so well.*

DASA issued the 'Autonomous Last Mile Re-Supply' SBRI competition in mid-2017. Phase 1 was utilised 'test and survey' the market to identify emerging technologies and the state of the art in logistics innovation. In order to widen their net and encourage applications and ideas from as broad a cohort of firms as possible, DASA took a non-prescriptive approach setting out a package of 'desirements' as opposed to 'requirements'. Twenty-five firms were shortlisted, from 132 bids, and awarded a c. £50k for six months feasibility work costing a total of £1.8m.

Horiba-Mira demonstrated proof of concept through computer simulation and were awarded £0.6m Phase 2 funding. Of the five firms which were given a Phase 2 award, only 1 was from within the defence industry. This shortlisting process included extensive engagement between DASA and the firms with a view to clarifying the extent to which the respective firms understood defence needs and potential for practical deployment of technologies in the field. The principal mechanism for this was appointment of a Dstl technical partner for each supplier. Horiba-Mira welcomed DASA's approach to ensuring engagement with both innovation leads and users (i.e. field officers), providing clarity and balance around the twin objectives of innovation and novel technology, alongside user-led, short-term practical deployment. At Phase 2, UKRI and DIFID provided additional funding to DASA which enabled a more extensive programme with a larger number of firms. DIFID's interest reflects the overlap with the development agenda and humanitarian missions in hard to reach places.

At this stage DASA also actively encouraged collaboration and partnering across bidders in order to develop a 'fuller' and more readily deployable solution. The onus was placed on bidders to identify and develop appropriate partnership arrangements. Horiba Mira initially developed a partnership with software designer Fraser Nash. However, the partners agreed to decouple following Phase 2, primarily due to challenges around agreeing IP rights.

Partway through Phase 2, the Army Warfighter Experiment (AWE 2018) a UK army event to showcase Robotic and Autonomous systems to the wider Army provided the opportunity for a high profile showcase event for the SBRI 'Autonomous Last Mile Re-Supply' projects, including Viking UGV. AWE provided conditions to demonstrate how emerging technologies perform in the field. Viking UGV was subsequently showcased at the Coalition Autonomous Assured Resupply activity in Michigan, United States. DASA extended the SBRI timetable to allow projects time to focus on preparing for the international showcase event.

Following a successful trial at AWE and completion of the Phase 2 prototyping process, Dstl placed a £2.3m order for three Viking UGV's which were delivered in early 2021. The MoD is currently testing and trialling the technical viability of these vehicles and how they might integrate into the wider army system before making any decisions around any potential future investment.

## Outputs, Outcomes & Impacts

**Innovation/Product development**

What new innovation has the product resulted in? What stage of readiness is this at? Is it on the market?

Defence related requirements around autonomous vehicles are very different to road based civilian cars. This reflects the highly constrained, off road environments that the army is operating in and the requirements for more secure and less vulnerable vehicles. For example, military vehicles are more susceptible to cyber-attacks and cannot rely on GPS systems which can be readily denied in the field.

Stealth is also vital, which requires a move away from detectable sensors to greater reliance on cameras and AI. Horiba Mira had been developing the Viking UGV over several years and the SBRI process enabled the firm to develop the vehicles autonomous applications – in particular around stealth and AI technology. This allows for the off-road routing of UGVs, enabling navigation of the terrain (i.e. ravines, bridges etc) with reduced risk of detection.

**Business Impacts**

*Direct quantifiable growth impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider impacts?*

Horiba-Mira is clear that the firm would not have invested in developing this technology without DASA support through SBRI. The software was not part of the original Viking design and the firm had not invested (or received contracts) for this element previously. It would not have been possible to justify the level of investment without the prospect of a lead customer at the end of the process. Indeed, it is likely that the firm would have exited from its autonomy business pillar in the defence sector in 2017, without the SBRI contract. This would have had a significant detrimental impact on the business as market interest and demand around the firm’s autonomy pillar has increased substantially over the last 5 years.

Over this period, the firm has expanded beyond UK defence to international contracts. The engineering team has expanded from c. 10 to c.17 people. This growth cannot be wholly attributable to SBRI. However, SBRI has been instrumental in the firm’s growth in this area and the firm has benefited from the recent £2.3m acquisition of three Viking vehicles. It has also strengthened the resilience of the firm which saw a drop off in demand from the civilian car side of the business as a result of COVID-19, whilst the defence side of the business remained more stable.

The expansion of the team has primarily comprised software engineers and Horiba-Mira regard the technology and software, which can be applied to multiple vehicles/platforms, as the key growth opportunities, moving forwards. Horiba-Mira are now looking to secure external investment to significantly scale up operations (c. 20 more software engineers) so that they are able to compete on the international stage and capitalise on their technological expertise and defence network.

**Public sector impacts**

**Qualitative Impact**

*Direct impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider benefits?*

The Autonomous Last Mile Re-Supply competition has been influential in the development of a collaborative and innovative approach to finding innovation. Whilst Horiba-Mira was an established supplier, the wider competition (and SBRI model more generally) has helped enable the agency to look beyond its prime contractors, diversify its supplier base and provide access to new and emerging technologies.

Dstl has recently acquired three Viking UGVs and is undertaking rigorous testing of the vehicles prior to any potential future investment and deployment in the field. It is too early to quantify impacts, but Dstl anticipate the following potential benefits:

- Saving lives - reducing risks both for logistics personal and through provision of ‘better’ logistics to support battlefield personnel.

- Allowing redeployment of tasks – in the context of a shrinking army, facilitating the restructuring and redeployment of some of the c. 1/3 army personnel tied up in logistics to increase combat personnel.
- Open up army to technology and innovation – which can be developed into other aspects of military operations, beyond logistics.

## Conclusions

### Key Lessons and Success Factors

*Are there any key factors for why the case study was successful/ unsuccessful? What went well or not so well? Are there any suggested improvements for future competitions?*

A range of lessons and success factors can be drawn from the experiences of the 'Last Mile Re-Supply' SBRI:

- *Open call and not overly prescriptive 'desirements'* – enabled DASA to cast a wide net and engage with a large number of new firms and new ideas;
- *Deep engagement with firms prior to Phase 2* – enabled firms to engage with both innovation and user teams providing clarity around the balance of objectives for novel technology alongside practical deployment.
- *Pace of process* – aligned well to agile and innovative development team.
- *Lead customer role* – provided an incentive for the firm to engage and helped to de-risk the innovation process which enabled the firm to invest in technology development
- *Non-linear, collaborative process* – the technology development through SBRI built on several years of collaboration in bringing the Viking UGV and the autonomy into the field and was dependent on sharing of risks, ideas and resources.

### Summary Impacts

*Headline impacts across departments and firms*

The headline impacts delivered by this SBRI competition comprise:

- Horiba-Mira – retention and expansion of its autonomy expertise within the defence side of the business which has become an increasingly attractive and profitable market proposition. This has contributed to the firm's growth, resilience and internationalisation and helped pivot its growth model from traditional automotive engineering to software engineering and technologies.
- DASA – trialling a new UGV with novel AI-based autonomy, with the potential to save lives and support restructuring within the army system. It has also contributed to creating a more diversified supplier base and opened up access to a new and emerging technologies.

Source: Steer E-D, 2021

## Metal Extraction from Water Flows

Table F-1: Metal Extraction from Water Flows – Elentec

Introduction	
<b>Name of Case Study</b>	Metal Extraction from Water Flows – Elentec
<b>Competition</b>	Metal Mine Pollution (2015)
<b>Status</b>	Commercialised via alternative route
<b>Department/Agency</b>	Natural Resources Wales, Welsh Government
<b>Geography</b>	Wales
<b>Information Sources/References</b>	<p>Consultation with Peter Stanley, Natural Resources Wales, 26/02/2021</p> <p>Consultation with John Bostock, Owner at Elentec, 03/03/2021</p> <p><a href="https://businesswales.gov.wales/innovation/natural-resources-wales-nrw">https://businesswales.gov.wales/innovation/natural-resources-wales-nrw</a></p> <p><a href="https://www.institution-engineering-designers.org.uk/Article/Features/dead-rivers-brought-back-to-life">https://www.institution-engineering-designers.org.uk/Article/Features/dead-rivers-brought-back-to-life</a></p> <p><a href="https://naturalresources.wales/about-us/what-we-do/water/metal-mine-water-pollution/?lang=en">https://naturalresources.wales/about-us/what-we-do/water/metal-mine-water-pollution/?lang=en</a></p> <p><a href="https://naturalresources.wales/media/677988/07a-addressing-the-impacts-from-abandoned-metal-mines-nrw-b-3016.pdf">https://naturalresources.wales/media/677988/07a-addressing-the-impacts-from-abandoned-metal-mines-nrw-b-3016.pdf</a></p> <p><a href="https://gov.wales/nearly-ps10m-help-improve-water-quality-wales">https://gov.wales/nearly-ps10m-help-improve-water-quality-wales</a></p> <p><a href="https://mon.uvic.cat/life-demine/project-results/obtained-results/">https://mon.uvic.cat/life-demine/project-results/obtained-results/</a></p> <p><a href="https://naturalresources.wales/media/680181/metal-mines-strategy-for-wales-2.pdf">https://naturalresources.wales/media/680181/metal-mines-strategy-for-wales-2.pdf</a></p>
<b>Permissions to use information externally</b>	Y
Context, Rationale & Objectives	
<p><b>Public sector context rationale &amp; objectives for the project and for using SBRI</b></p> <p><i>Wider context in which the competition was launched.</i></p> <p><i>Why is this a priority for department and what did it aim to achieve?</i></p> <p><i>What was the Department’s motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i></p>	<p>Wales has a long history of mining metal ores dating back to the Bronze Age largely in the West and North of the country due to its geology. The industry reached its peak in the latter half of the 19th century and by the 1920s most mining had ceased. Discharges from underground workings and leaching of metals from spoil heaps however, still present significant sources of water pollution today. There are approximately 1,300 abandoned metal mines in Wales that are estimated to impact over 700km of rivers.</p> <p>Once the source of prosperity, metal mines are now the principle cause of pollution of Welsh waterbodies failing to achieve the environmental and ecological standards set by the European Water Framework Directive (WFD). This legacy compromises valuable ecosystem services – elevated levels of metals, primarily zinc, lead and cadmium, occasionally copper, have a detrimental impact on the ecology of river systems, reducing fish populations and the diversity of invertebrate fauna. The Metal Mine Strategy for Wales (Environment Agency Wales 2002) identified the 50 abandoned metal mines causing the greatest impact on rivers in Wales and therefore were prioritised for remediation.</p> <p>Current technologies for remediating the rivers were however, largely not applicable – there were just two solutions out there for treating polluted mine discharges. In Wales, the additional challenge is that most of the metal mines are in upland terrain with flashy rivers and a complete lack of infrastructure. Coal mine treatment systems historically have been successful, but this solution isn’t effective for metal mines, where the recalcitrant metals of zinc and cadmium require alkaline conditions i.e. a higher pH. Pilot trials in 2009/10 led to the construction of a passive treatment system in 2014, whereby metal pollutants were removed through a large-scale biologically enhanced filtering media. This passive system requires large areas to be effective and the alternative of a heavy industrial high density sludge process were not deemed good fits for the steep</p>



river valleys of West and North Wales. Implementation of these systems could be damaging to the natural landscapes, habitat and heritage.

As such, in this 2015 SBRI competition funded by Innovate UK and Welsh Government, Natural Resources Wales (NRW) were seeking to assess varying small to medium size cost effective technologies to help remediate or mitigate pollution from metal mine sites in steep upland terrain with a lack of infrastructure, such as transport and power. The Pre-Commercial Procurement (PCP) competition model allowed NRW to open up this question to anyone of all specialties, widening the pool of expertise new ideas could emerge from. The SBRI model of opening the challenge out to the market had worked for NRW previously to solve an issue they didn't know how to address.

**Private sector context, rationale and objectives for responding to this specific competition and pursuing SBRI/PCP?**

*Business context at point of application?*

*Why did the business respond to competition and what did the business aim to achieve?*

Elentec are a chemistry and engineering specialist firm located in Menai Bridge, Anglesey, North Wales with, at the time of the competition (2015), just 3 employees as well as supporting a PhD. Their main activities included aquaculture (fish farming), recycling, water conservation and carbon credits, and 100% of Elentec's sales were in the UK, through their aquaculture workstream.

Elentec saw the SBRI Metal Mine Pollution competition as a good opportunity to develop their technology in a slightly different area, suited to their wider business objective around green, sustainable technology development. They felt that the environmental issues that presented a problem in Wales are relevant around the world. If, as a business, they could address the issue in Wales, they would open themselves up to a global market where these mine legacy and operational issues also exist.

NRW needed a mobile system for remote locations and with their experience of developing similar technologies for the aquaculture context in North Wales, they felt they could adapt their technology for the application of remediating metal mine waters - an adaptation they had not previously considered.

**Inputs & Activities**

**Competition delivery**

*Details of award*

*Any key points around process, responsibilities, challenges across any phases:*

- competition design/award;
- Phase 1;
- Phase 2;
- project close & routes to commercialisation and/or procurement

*Scope of the project/ technology/ innovation – how did the project seek to achieve its objectives*

*Overall draw out any valuable perspectives on what worked well, not so well.*

The competition received 25 applications in total by the application deadline 5<sup>th</sup> January 2015, which was more than NRW had anticipated. NRW had two groups of assessors Bob Vaughan, Dave Johnstone, Gareth Browning and Peter Stanley whom evaluated the applications using technology readiness, the innovation, sustainability, cost and likely chance of success based on the submissions. The consensus was reached that four systems should be funded for Phase 1 to test their feasibility. Three of these four systems were from university applicants and one from the business community – Swansea University, Cardiff University, Durham University and Elentec. Each organisation's solution took a unique approach to the challenge in hand. Elentec's focussed on electrochemical coagulation whereas Swansea and Durham University's solutions utilised algae to adsorb metals, and Cardiff University's solution was a development of the industrial passive system previously trialled, that additionally enabled the re-use of waste by-products.

Phase 1 involved each of the four applicants receiving £25k funding to develop and trial their systems in the laboratory and report their results. The intention was for two of the systems to then receive a further £75k to continue to develop the solutions in Phase 2. All four solutions were successful in extracting metal from the water in the Phase 1 trials, however two solutions were deemed less favourable and were not taken forward to Phase 2. The Durham University solution appeared more challenging to scale-up, and the Cardiff University solution was considered less novel as a further development of a solution previously trialled. Both solutions are however being progressed outside of the competition with NRW engaged in these efforts to further develop as useful alternative tools in the environment. The Elentec and Swansea University

solutions received further funding to continue development in Phase 2 of the competition at the end of September 2015.

Ultimately, the Swansea University system of cultivating algae on crushed recycled PET held in long linear sausage shapes was less successful in field trials despite showing promise in the laboratory. The field system was only 20% as effective as predicted and would require scaling up by five times to meet requirements. This work wasn't taken forward to conclude the competition, with the solution abandoned due to lack of further funding required and staff turnover at the University.

Elentec's solution, on the other hand, was very successful in field trials on rivers in Wales with a system located at Lake Geirionydd with water entering the River Crafnant before reaching the Conwy and the Irish Sea. It met the needs of a small scale, versatile system, that could fit on upland terrain and performed well in extracting metal from waterbodies even when later tested on the most concentrated discharges in Wales at Frongoch. This active solution, uses powered electrodes to coagulate metals in flowing water, allowing the metals to be extracted as sludge.

Final trials were finished in July 2016 with the concluding paper published in February 2017, that NRW found Elentec's solution a complete success. Recent costs of treatment systems and remediation at just 129 sites has indicated high level costs of £283M over 40 years to clean their polluting impacts. NRW has a joint Metal (Non-Coal) Mine Programme with the The Coal Authority and they are tasked with assessing the feasibility of clean up at each site and optioneering the treatment systems to ensure the system is effective, delivers on cost and sustainability. They are just commissioning the first treatment system at Abbey Consols using a passive dosed sodium carbonate system. The opportunity to road test a scaled demonstration electrochemistry system has not yet become available.

Elentec has taken the technology forward, developing with further testing, including making it even more compact. Elentec partnered with Swansea University and The University of Vic in Catalonia, receiving £2m EU LIFE programme funding to develop the system into one that could not only be used to clean waterbodies removing metal mine pollution, but be used in operational mines to clean up their process waters. This international collaboration was particularly significant as Spain has active mines with sensitive ecosystems that could benefit, hence The University of Vic's involvement. Swansea University attached their nanoparticulate membrane filter technology to the Elentec system to enhance treatment and process sustainability, enabling the solution to reach 99.5% metal extraction potential. This combined project is named Life Demine.

## Outputs, Outcomes & Impacts

### **Innovation/Product development**

What new innovation has the product resulted in? What stage of readiness is this at? Is it on the market?

Elentec's solution is a novel containerised electrochemistry unit that is energy-efficient with a low power consumption, and portable. It is therefore suitable for the steep terrain and lack of infrastructure surrounding abandoned Welsh metal mines. Polluted waters are collected and fed through the electrode chambers. The polluting metals are then separated from the water through precipitation in a purpose-built clarifying tank and filtration, allowing the treated water to be polished through membrane filtration prior to discharge, and the potential for metals to be recovered.

Elentec is now also involved in further work designed to recover raw materials from mine water – a multi partner, 11million euro, EU funded project – Rawmina,

which includes more European companies as well as opening opportunities in Chile and South America.

By the end of the SBRI competition trials in July 2016, reported in February 2017, the solution was at Technology Readiness Level 7. The system has since progressed further with the international collaboration on the technology. Trials of the system were progressing in Wales, at Frongoch, with plans to deploy the system in salt mines in Germany too, though both trials have been restricted by COVID-19.

The system is now market-ready, beginning sales to both mine operators and local governments in the UK and abroad, with adaptability for 'fly in, fly out' contracts in otherwise inaccessible locations, though no sales of the water treatment system have been made yet.

**Business Impacts**

*Direct quantifiable growth impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider impacts?*

Elentec benefitted from a range of impacts as a result of taking part in the Metal Mine Pollution SBRI competition, these have included:

- *Increased access to further public funding* – following the SBRI competition, Elentec secured EU funding to develop the solution further with partners across Europe. Without the SBRI competition, Elentec felt they wouldn't have been collaborating internationally on this technology development.
- *Increased their innovation activity and R&D* – the SBRI competition gave Elentec the funds to undertake innovation activity as a firm, reducing the risk of developing a novel technology application. The competition also enabled Elentec to form research partnerships with universities across Europe to develop the technology further.
- *Opened access to new markets* – the SBRI competition provided Elentec with an opportunity to venture into a new market area, an opportunity to solve water pollution from metal mines globally. This industry wasn't in Elentec's original business plan and they wouldn't have focussed on this area without the SBRI competition alerting them to the gap in the market.
- *Firm growth* – though Elentec have not sold any of these water treatment systems yet, the system is now market ready with commercial activity anticipated in the next year. As a result of the competition and follow-on EU funding to develop the solution further, Elentec are looking to take on 2 more employees and report increases in the value of the firm that they are yet to quantify. Without the SBRI competition, Elentec felt they would have seen this growth, but more slowly, and would have taken a different direction to get there.
- *Exploring new business models as a result* – due to their expansion into a new market area as a result of the competition, Elentec are considering splintering into two functional entities to support their growing market offers.
- *Increased interaction with other businesses and academia* – Elentec collaborate with more organisations now than before the SBRI competition and follow-on EU funded programme.
- *Product development* – the SBRI competition gave Elentec the opportunity to investigate, trial and test their technologies in greater depth. The lessons learned from this process have fed into their overall technology development, both for the mine metal pollution application and applications elsewhere.

**Public sector impacts**

**Qualitative Impact**

*Direct impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider benefits?*

The use of SBRI brought new ideas to NRW that they hadn't been aware of before, providing a package of new specialist technologies that can be used in different environments to extract metal from polluted waterbodies across Wales. Including, crucially, finding a solution that would fit within the steep upland terrain where many of these abandoned mines are situated.

These technologies themselves create a wider public sector impact of reducing pollution, positively impacting the local ecology and landscapes. With the Well-Being of Future Generations Act launched in Wales in 2015, considering the health of the environment to create a sustainable and resilient Wales is increasingly important. And it's not just the environment which will benefit from this technology; the Welsh economy could also receive a boost, as the companies involved in this work share the technology with overseas markets. There is also potential currently being explored in reimagining these metal waste repositories as potential future resource hubs. The metals that are extracted from the polluted streams are valuable, and there is potential for their extraction to offset some of the costs of the river clean up.

At competition closure and following successful trials, NRW and Welsh Government did not procure Elentec's solution to clean up the polluted rivers in Wales. This work has advanced Wales towards achieving the WFD Good Ecological Status required, through the development of a successful solution, yet lack of procurement makes achieving this standard utilising the Elentec solution unlikely. A long-term financial commitment was required to assess and deliver remediation works, where previously metal mine remediation relied on year by year bidding exercise. As part of the Welsh Government 2020-21 Budget, £4.5m capital funding was committed by Welsh Government to fund the implementation of the Metal Mines Strategy for Wales to improve water quality across Wales and to tackle water pollution issues from abandoned metal mines, with NRW receiving this funding for a metal mine remediation programme, focusing on the most polluting abandoned mines to tackle water pollution issues. The current capital programme is also considering remedial anti-pollution interventions at Cwm Rheidol, Cwmystwyth, Frongoch-Wemyss and Cwmystwyth all significant metal polluters with potential to include treatment over the next five to six years should stakeholders agree with designs. Electrochemistry is an option, but it has to be evaluated against other treatment options to deliver value for the public purse. The carbon cost of power and physical cost of sludge disposal has to be carefully assessed and understood.

The SBRI applicant efforts in this area spanned business and academia, which created a concentration of new specialisms and technologies in Wales in this field. This, alongside Wales having 9 of the UK's 10 most polluted rivers, has created the ideal conditions for a technology cluster to form around metal extraction. A Centre of Excellence has now formed, featuring a mineXchange conference that has run annually for four years now, bringing together researchers and businesses in this field, featuring site visits to the mine pollution technology trials in situ. This has provided a networking opportunity to share knowledge across organisations working on novel solutions to these polluted river challenges. Further, NRW through the mineXchange sponsors academic research in the field, including PhDs, MScs and MRes'.

The SBRI competition also amplified Wales' position on the global stage in mine water remediation. Electrochemistry was featured in international conferences in both Finland and Russia, new research papers were published, and the next International Mine Water Conference is now due to be held virtually in Wales. It will return as a live event in July 2023 where it is intended to showcase the mine water treatment system to encourage its global commercialisation.

## Conclusions

### Key Lessons and Success Factors

*Are there any key factors for why the case study was successful/ unsuccessful?*

A number of important lessons and success factors can be derived from this initiative. These include:

- *Knowledge sharing between silos* - Inspired by the competition being open to all specialties, NRW has adopted this approach for the Centre of Excellence development through actively ensuring organisations and

*What went well or not so well?*

*Are there any suggested improvements for future competitions?*

academia are drawn together, to share knowledge and technology between silos of expertise.

- *De-risking and encouraging innovation through funded challenges* - A key success factor for Elentec developing this solution to the gap in the market of a suitable metal extraction technique, was having the funds available to take the risk, test and develop a new application. Further, it was felt the problem-focussed nature of the SBRI funding mechanism lent itself to fostering innovation.
- *Evaluating across a broad range of specialisms* - In the delivery of the competition, it was highlighted that there is a potential learning lesson for future SBRI competitions, where the competition being open to all specialties across industries meant that the assessors were evaluating applications outside of their own areas of expertise, potentially leaving room for solutions to fall through the gaps.
- *Dedicated programme management resource* – It was raised<sup>2</sup> that extra dedicated programme management resource for the competition would be a key improvement.
- *Recognition that innovation is incremental and takes time* – it was reflected that anticipating novel solutions quickly is optimistic, and that it should be recognised that developing state-of-the-art new technologies from concept phase takes time, and often requires further academic research. For this solution, the competition began in 2015, but sales to this market sector are yet to be made of Elentec’s successful water treatment product.
- *Barriers to procurement* – despite Elentec developing a solution to solve the metal mine pollution of rivers in Wales, NRW and Welsh Government are yet to purchase this solution. As an active treatment system it requires chemicals in the electrodes and power to function, the disposal of sludge is important too, with hazardous waste having to be exported to England. NRW has a duty to ensure the system is sustainable and delivers on Sustainable Management of Natural Resources when compared to other options like High Density Sludge or passive systems like Vertical Flow Ponds using different media and Reactor Beds. Carbon and Whole Life costs over a forty year period are important in this selection process.

### **Summary Impacts**

*Headline impacts across departments and firms*

The initiative has delivered a range of important impacts for the public sector sponsors and the participating firm which comprise:

- The development of multiple new technologies to the problem, with Elentec’s solution capable of achieving 99.5% metal extraction from polluted waters in inaccessible locations.
- Enabled Elentec to grow, access new markets, progress their technological capabilities, partner with academia and access to international markets.
- Advanced Wales as a Centre for Excellence in Metal Mine Pollution technologies, with increased knowledge sharing and capability building locally, across the UK and internationally.

Source: Steer E-D, 2021

## My Clinical Outcomes

Table F-1: My Clinical Outcomes

Introduction	
<b>Name of Case Study</b>	My Clinical Outcomes
<b>Competition</b>	Cancer Innovation Challenge: New approaches to record and integrate cancer PROMs (Patient Reported Outcome Measures)/PREMs (Patient Reported Experience Measures)
<b>Status</b>	Developed and procured in part
<b>Department/Agency</b>	DataLab, Digital Health and Care Institute and Stratified Medicine Scotland
<b>Geography</b>	Scotland
<b>Information Sources/ References</b>	Steph Wright, The Data Lab Tim Williams, My Clinical Outcomes
<b>Permissions to use information externally</b>	Y
Context, Rationale & Objectives	
<p><b>Public sector context rationale &amp; objectives for the project and for using SBRI</b></p> <p><i>Wider context in which the competition was launched.</i></p> <ul style="list-style-type: none"> <li>• <i>Why is this a priority for department and what did it aim to achieve?</i></li> <li>• <i>What was the Department's motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i></li> </ul>	<p>The Cancer Innovation Challenge is a £1M project to use innovation and data to improve outcomes for cancer patients in Scotland and help Scotland become a world leading carer for people with cancer. It is funded by the Scottish Funding Council (SFC) and led by the Data Lab (Scotland's Innovation Centre for data and AI) in collaboration with fellow Innovation Centres, the Digital Health and Care Institute (DHI now Digital Health &amp; Care Innovation Centre) and Stratified Medicine Scotland (SMS now Precision Medicine Scotland).</p> <p>The Challenge was seeking an appropriate funding mechanism and decided on using SBRI after consulting with UKRI. Funding was split across two separate competitions:</p> <ul style="list-style-type: none"> <li>• New Approaches to Record and Integrate Cancer PROMs (Patient Reported Outcome Measures)/and PREMs (Patient Reported Experience Measures); and</li> <li>• Innovative data science solutions to improve cancer care and outcomes in Scotland.</li> </ul> <p>The first competition (the focus of this case study) was responding to emerging research that provided evidence of PROMs and PREMs (which were routinely being used in other types of healthcare) generating improved outcomes when applied to cancer patients. This included research in 2017 in the US<sup>3</sup> that showed for the first time how, when applied to cancer, they helped patients deal with chemotherapy better, live longer and have a better quality of life. On average, individuals were living 5-months longer with no change in care; 31% of patients experienced better quality of life and better physical functioning; there was a 7% reduction in emergency room visits; and patients were able to remain on potentially life prolonging chemotherapy for an average of 2 months longer. This approach had not yet been trialled anywhere within the UK.</p> <p>PROMs and PREMs represent a different type of outcome measurement for the NHS for cancer patients. The NHS is historically good at capturing some metrics (e.g. waiting times and mortality rates), but consultations</p>

<sup>3</sup> <https://jamanetwork.com/journals/jama/fullarticle/2630810>

	<p>highlighted the challenges in measuring the quality and type of care and its impact on patient experience and outcomes.</p> <p>The competition presented an opportunity to apply the approach to cancer patients in Scotland. A key objective was ensuring that any solutions that came out of the competition were interoperable with NHS Scotland IT infrastructure and patient portals in the future.</p>
<p><b>Private sector context, rationale and objectives for responding to this specific competition and pursuing SBRI/PCP?</b></p> <p><i>Business context at point of application?</i></p> <p><i>Why did the business respond to competition and what did the business aim to achieve?</i></p>	<p>My Clinical Outcomes (MCO) is a business that uses a web-based platform for collecting and using Patient Reported Outcome Measures (PROMs) in clinical care.</p> <p>MCO was established in 2011 and was working with various clinical specialties including orthopaedics in the NHS and private sector across England and Wales before 2017. However, its services had never been used in oncology or in Scotland.</p> <p>MCO captures outcomes data from patients (through tailored questionnaires) throughout treatment and follow-up. Results are available in real-time to clinicians and hospitals. Clinicians can use the data to prioritise care including face-to-face reviews for those most in need and hospitals can use the aggregate data to understand variation in outcomes across all patients and identify/respond to any areas of concern e.g. through process improvements.</p> <p>MCO was aware of emerging research in this area and interested in trialling MCO's success elsewhere in the UK and in other clinical environments to cancer patients in Scotland.</p>

## Inputs & Activities

### Competition delivery

#### *Details of award*

*Any key points around process, responsibilities, challenges across any phases:*

- competition design/award;
- Phase 1;
- Phase 2;
- project close & routes to commercialisation and/or procurement

*Scope of the project/ technology/ innovation – how did the project seek to achieve its objectives*

*Overall draw out any valuable perspectives on what worked well, not so well.*

Data Lab wanted to progress as quickly as possible and carried out the review and submission of the competition themselves, using a commercially available submissions platform to manage the submissions and review process. They had the option to run the competition through SBRI but this was considered likely to have involved longer timeframes. The administrative burden associated with setting up the SBRI process was very high.

The competition was run with two phases:

- **Phase 1 (Sept-17-Dec-17):** Five projects were awarded funding of up to £25k each to undertake a 3-month feasibility study from 1 September 2017; and
- **Phase 2 (Feb-18-Aug-18):** Two projects were awarded £100k each to embark on a six-month phase for development and evaluation of a proof of concept/prototype.

MCO considered that the funding calls were well written and easy to respond to.

The key challenge in Phase 1, launched in September 2017, was to identify a willing and enthusiastic clinical team in Scotland. As the funding call was open to all organisations across Scotland, the UK and Europe, Data Lab supported the successful organisations to establish networks locally which mostly didn't exist prior to the award and would have been much more difficult to establish otherwise.

MCO quickly found the clinical team that wanted to work with them on this project at NHS Ayrshire and Arran, championed by the Clinical Director for Cancer Services and Haematologist. MCO worked closely with the team at

NHS Ayrshire and Arran which was open and enthusiastic in its collaboration with MCO. This reduced administrative burdens and supported product development.

MCO developed a platform that generated different question sets depending on their specific conditions and local needs and challenges to be automatically shared with patients at relevant time intervals. The platform underwent usability testing with groups of panels and MCO worked closely with patients and clinicians to develop the end product in an iterative process. The platform went live in January 2018 to positive feedback. As of June 2021, some 116 haematology patients had submitted 1,384 assessments, with 7.3% of assessment responses flagging 'red' responses indicating potential toxicity and warranting further enquiry. The most assessments completed by a single patient to date has been 107. The system has been shown to improve safety by making telephone consultation more effective and efficient, with the Director of Cancer Services, Dr Peter Maclean, commenting: "With a PROMs assessment available a phone call can take 2 mins; if not, you either do it properly and it takes you 10 minutes or you don't and you risk missing something."

As a high-profile challenge and area of interest, collaboration from partners locally was high and key stakeholders were involved in the process from the start. The Cancer Innovation Challenge involved partners such as the IHDP (Innovative Healthcare Delivery Programme, The Usher Institute, University of Edinburgh, University of Stirling and NSS (NHS National Services Scotland)

2 out of the 5 Phase 1 projects were selected to proceed to a Phase 2 which launched in February 2018. This comprised a six-month process to further develop the prototype and demonstrate the benefits of successful implementation. Following the successful launch of the trial as part of Phase 2, MCO was successful in securing four further allocations of funding as well as continuing to work with the team at NHS Ayrshire and Arran in developing the product. The further funding included developing a solution for: breast cancer patients at The Beatson West of Scotland Cancer Centre; ovarian cancer patients, being treated surgically at Greater Glasgow and Clyde; and for newly diagnosed patients with any of six tumour types undergoing treatment in the South and East Scotland Cancer Network of four health boards. A final allocation was made to explore the technical strategy for integrating the solution into the National Digital Platform.

Activity directly funded by the Cancer Innovation Challenge project came to an end in February 2020 as the health sector focussed its attention on dealing with COVID-19. MCO then paused all additional design and implementation work. At this point, it was working with 5 of the 14 health boards across Scotland.

By this point, NHS Ayrshire and Arran had become a paying client (£10,000 per year) to MCO and the platform is still running at the hospitals 3.5 years after its initial launch.

However, funding wasn't available to progress work with the other projects (particularly Beatson that was the most progressed) and, whilst the local team tried to find funding locally to take it forward, this was difficult to obtain due to wider COVID-19 pressures.

## Outputs, Outcomes & Impacts



**Innovation/Product development**

What new innovation has the product resulted in? What stage of readiness is this at? Is it on the market?

Whilst MCO's platform has been shown to work for cancer patients, the tool needs to be tailored for each hospital and associated care pathways. Consequently, it will always involve upfront design and implementation costs which are difficult to meet within the health sector with competing demands on funding which is being further stretched by COVID-19.

**Public sector impacts Qualitative Impact**

*Direct impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider benefits?*

Another impact of COVID-19 was that it became more difficult to continue treatment and care for other illnesses, including cancer. Health services in Scotland were keen to find solutions to support vulnerable cancer patients whilst minimising/avoiding face-to-face contact. COVID-19, therefore, encouraged the use of MCO.

As was demonstrated in NHS Ayrshire and Arran, the platform reduced the need for face-to-face contact and MCO worked to design and launch a free platform available across Scotland. This was a more generalised platform rather than being tailored to each hospital and was available free-of-charge, for cancer teams at any of the 14 health boards and 3 cancer networks to support their patients through COVID-19. This free service was available from March 2020 to March 2021. MCO bore the design, development, implementation and running cost for this service internally, building on the design work funded and developed through this competition. That led to some 23 clinical teams across 8 health boards engaging with the platform across 12 cancer types.

The COVID-19 recovery strategy came out before Christmas 2020 for Scotland, specifically featured PROMS, with funding set aside for care for cancer patients, partly as a result of the SBRI project. A number of health boards who have worked with MCO through COVID-19 have bid into this fund to try and continue working with MCO. In June 2021, the Scottish Cancer Policy Team announced funding of £500,000 would be made available to build on the work that had come before to establish and support PROMs for cancer patients although there is not as yet a clear strategy for how the funds will be deployed.

This work has substantially helped to ensure the continuity of care for cancer patients throughout the COVID-19 crisis and would not have happened without the work across the previous three years.

**Business Impacts**

*Direct quantifiable growth impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider impacts?*

Apart from the annual income from NHS Ayrshire and Arran and Dumfries and Galloway, MCO's work in Scotland is now unfunded pending the publication of a strategy following the announcement of the Cancer Policy Team.

The project helped MCO to secure projects elsewhere in the UK, including palliative care in Brighton for a very complicated pathway that involves considerable pre-screening (contact value £18,000 per year). MCO is also engaging with the private sector working with Novartis across five sites across different clinical needs (one being cancer) for approximately £50,000 per year. This project could also scale locally.

MCO is of the view that neither of these deals would have been possible without the work carried out for the SBRI competition which gave the team the evidence base for doing this work robustly at scale. The ambition going forward would be to do this at the national level for the NHS.

MCO has also developed relationships with clinicians across Scotland which the firm anticipates will generate long-term benefits.

**Conclusions**

**Key Lessons and Success Factors**

*Are there any key factors for why the case study was successful/ unsuccessful?*

*What went well or not so well?*

*Are there any suggested improvements for future competitions?*

- MCO reflected that a lot of the work they do in design and development can be extremely lean (as the cost has to be borne by the company). SBRI gave MCO the bandwidth and ‘thinking time’ to create the best possible product.
- SBRI was of particular benefit to Data Lab and the wider team due to the phasing of the competition and therefore the de-risking of the innovation process.
- Consideration from the outset of the importance of integration into the current systems and care pathways has been of vital importance and ensured the usability of the end-product.
- It is too early to say whether the ambition of Cancer Innovation Challenge to improve outcomes for cancer patients across Scotland will be achieved because of this project but it has delivered an important step in that direction.

**Summary Impacts**

*Headline impacts across departments and firms*

- MCO currently has an additional £84,000 annual income for sales of its product developed on the back of the design work funded by SBRI and the subsequent work undergone across Scotland.
- The product supported the continuity of cancer treatment and care throughout the COVID-19 pandemic (to March 2021) by reducing the need for face-to-face consultations (although it should be noted that this was an unintended impacts and not the targeted outcome for this SBRI).
- Recognition of the positive impact of integrating remote PROMS and PREMS into the care pathways of cancer patients in Scotland.

Source: Steer E-D, 2021

## Rates Max

Table F-1: Rates Max - Belfast Business Rates Maximisation

Introduction	
<b>Name of Case Study</b>	Rates Max - Belfast Business Rates Maximisation
<b>Competition</b>	Northern Ireland Business Rates
<b>Status</b>	Procured (but on hold)
<b>Department/ Agency</b>	Northern Ireland Government (Department of Economy on behalf of Belfast City Council)
<b>Geography</b>	Northern Ireland
<b>Information Sources/ References</b>	<a href="mailto:FergusonD@BelfastCity.gov.uk">FergusonD@BelfastCity.gov.uk</a> ; <a href="mailto:HarperI@BelfastCity.gov.uk">HarperI@BelfastCity.gov.uk</a> <a href="mailto:nick@nquirminds.com">nick@nquirminds.com</a>
<b>Permissions to use information externally</b>	Agreed and signed off by both consultees
Context, Rationale & Objectives	
<p><b>Public sector context rationale &amp; objectives for the project and for using SBRI</b></p> <p><i>Wider context in which the competition was launched.</i></p> <p><i>Why is this a priority for department and what did it aim to achieve?</i></p> <p><i>What was the Department's motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i></p>	<p>Across Northern Ireland, the majority of vacant commercial premises are eligible for 50% business rates relief, while some are eligible for 100% relief. The existing process for establishing whether a building is occupied or vacant relies on a process of periodic, manual inspection based on highest value properties supplemented with some level of local knowledge. Business rates are collected centrally, through the Land and Property Services (LPS) division of the Department of Finance.</p> <p>Business rates are a critical revenue stream for Belfast City Council (BCC), accounting for around two thirds of the local authority's budget. Both BCC and LPs have long held concerns that a substantive number of occupied commercial premises are incorrectly being identified as vacant - meaning that reduced business rates are being charged. Inaccuracies and time lags in data result in reduced business rates revenue and a reduced budget envelope for BCC and the Northern Ireland Executive.</p> <p>In 2016, BCC established a new City Innovation Team (CIT), championed by the Deputy Chief Executive, to help identify innovative solutions to operational and policy challenges. In partnership with the LPS, and BCC's own Building Control Team, the CIT developed a pilot SBRI project designed to find a solution to better ensure accurate categorisation of properties and collection of business rates.</p> <p>The Business Rates SBRI competition was a trailblazing initiative for the CIT. As part of its wider ambitions, the CIT wanted to explore and demonstrate the potential opportunities and benefits of innovative, 'Big Data' approaches to addressing practical challenges faced by the local authority and other public sector partners.</p> <p>The specific objective was to use intelligent data analytics to bolster the rates collection system and to ensure that errors, omissions, and mistakes in property listing were spotted quickly and remedied efficiently. This was to be achieved by developing and adopting a more sophisticated data analytics approach based around collating more accurate and up to data and intelligence on the occupation status of business premises and the eligibility for rates payments across the local business base.</p> <p>The SBRI model provided an excellent 'fit' for the newly established CIT to trial an innovative route to procuring an innovative solution. SBRI</p>

provided a well-established mechanism for collaboration and partnership with LPS, including a package of processes and tools and wraparound support (from UKRI and others), making it an attractive and accessible trailblazing initiative for BCC.

BCC and LPS had tried many approaches over the years to establish a robust rates identification and collection process but hadn't found the optimum solution to meet their needs. Both organisations were keen to explore how the application of emerging new technologies and data science could enhance the existing process. The SBRI competition was regarded as an excellent opportunity to stimulate private sector creativity, agility, and expertise in developing an innovative solution to this long-standing public-sector problem.

**Private sector context, rationale, and objectives for responding to this specific competition and pursuing SBRI/PCP?**

*Business context at point of application?*

*Why did the business respond to competition and what did the business aim to achieve?*

NquiringMinds Ltd (NQM), were one of six successful applicant firms awarded Phase 1 SBRI funding. NQM are experts in data sharing and advanced analytics that help 'places' to capture, secure and use data intelligently. Based in Southampton, they had previously worked for local authorities and were well placed to respond to the challenge posed by the SBRI Business Rates competition.

NQM has engaged in multiple SBRI competitions and regards SBRI as a unique route to market and vital to delivering its business model - orientated around embedding innovative technology within UK public sector partners. Prior to the Business Rates competition, the firm had recently been involved in DCMS's Smart Cities SBRI and based on this experience had recognised the importance of developing innovative solutions which respond directly to the financial imperatives of their public sector customer base.

The Business Rates competition's objectives aligned directly with NQM's expertise and areas of interest and enabled them to build on some emergent, pre-existing modelling/analytical tools. For NQM, the primary motivation for responding to the competition was around market development. The award was helpful in terms of de-risking R&D activities, but the real attraction was that this was not simply a research piece or abstract innovation but was a '*real problem with a real customer*' behind it.

**Inputs & Activities**

**Competition delivery**

*Details of award*

*Any key points around process, responsibilities, challenges across any phases:*

- competition design/award;
- Phase 1;
- Phase 2;
- project close & routes to commercialisation and/or procurement

*Scope of the project/ technology/ innovation – how did the project seek to achieve its objectives*

In 2016, local authorities were unable to directly run SBRI competitions and so BCC ran a joint bid with LPS through the Department for the Economy – Northern Ireland's SBRI sponsor department. BCC contributed £50k of its own resources, alongside an SBRI pot of £100k. This provided a total funding envelope of £150k for Phases 1 and 2 of the competition.

Competition design involved an intensive process of scoping and collaboration across the partners involving workshops, data assessments and the development of formal data sharing and collaboration agreements. Much of this work was supported by Future Cities Catapult (now known as Connected Places Catapult). The standard UKRI competition templates were adopted and tailored to meet partners' needs. To help raise its profile, the competition was officially launched in July 2016 at Belfast City Hall and CIT subsequently ran a programme of 'meet the buyer' type activities.

Six companies applied. Four were given Phase 1 awards of £5k. Phase 1 comprised an intensive six-week feasibility process. The competition, award and Phase 1 processes worked well from NQM's perspective. The

Overall draw out any valuable perspectives on what worked well, not so well.

short, intense feasibility phase aligned well with the firm’s dynamic and agile company culture. However, the Phase 1 process could have been more streamlined for participating firms if the project partners had undertaken a prior, comprehensive data audit. Providing a single, comprehensive stakeholder map at the outset could also have reduced duplication of effort for the participating companies.

Two data analytics companies, NquiringMinds Ltd and Analytics Engines, went through to Phase 2 and were awarded £55k each to further develop their prototypes. The biggest challenge was around data sharing and delays in the release of data. From NQM’s perspective, the delays around accessing data are typical of a project of this nature, as hurdles around GDPR and data privacy need to be carefully navigated. Ultimately, NQM were able to access the data needed and were granted an extension (into an unofficial Phase 2b), to help offset delays.

NQM’s overall experience of this competition has been very positive and it was clear to the company that the project benefited from senior buy-in within BCC and LPS. This resulted in dedicated resource from both public partners and a passionate, supportive, and transparent customer-side team.

At the outset, the public partners were not clear on which public body would be best placed to procure any eventual solution. BCC ultimately took the lead and channelled procurement of NQM’s data analytics solution through GCloud (one of the government’s digital marketplace procurement frameworks). At this stage, the CIT stepped back from the process, and the initiative was led by the BCC’s procurement and Building Control teams.

The partners decided to trial NQM’s proposed approach. To better understand its potential benefit, they agreed to run it in parallel with the existing LPS ‘Business as Usual’ inspection regime for a 12-month period. In early 2019 BCC procured two years of analytical services from NQM to pilot and develop this new approach, but the trial has been on hold due to COVID 19 lockdown, with social distancing measures prohibiting site inspections, and government intervention in the rating system.

**Outputs, Outcomes & Impacts**

<p><b>Innovation/Product development</b>          What new innovation has the product resulted in? What stage of readiness is this at? Is it on the market?</p>	<p>NQM’s data analytics solution provides more sophisticated data and intelligence to inform assessment of whether commercial premises currently categorised as vacant, by LPS, are in fact occupied – and if so, by whom and for how long.</p> <p>This involves collating and analysing multiple data sources (e.g. LPS and BCC’s respective databases; NI Water; utility companies etc) to establish the probability of whether a premise is vacant or occupied. This ‘intelligence’ can then be used to better target building inspections and generate a more accurate list of commercial premises liable for business rates.</p>
<p><b>Business Impacts</b>          Direct quantifiable growth impacts?          Additionality of SBRI?          Indirect/knock-on benefits?          Wider impacts?</p>	<p>NQM has doubled in staff and revenue in the period following the Business Rates SBRI. Although this growth is not wholly attributable to participation in this competition, the SBRI process has been helpful in supporting the firm’s growth.</p> <p>NQM has benefitted from a range of impacts, including:</p>

- direct revenue generated through the competition and BCC's subsequent service licence/subscription. Whilst relatively modest in scale, this revenue has helped to offset R&D costs and given NQM confidence to invest in and develop innovative, data analytics solutions;
- strong relationships developed with BCC and LPS. NQM regard this initiative as a long term, strategic collaboration around developing data analytics solutions for public partners, extending beyond the business rates solution;
- increased firm profile stemming from media coverage of the competition. This has not only raised the profile of NQM as a firm, but the value and benefit of services it offers and the advantages (particularly to the public sector) of sharing data across multiple organisations. NQM was one of two SME case studies featured in the Industrial Strategy Challenge Fund prospectus and features as a case study for the Future Cities Catapult;
- new collaboration opportunities and routes to market stemming directly from the relationships, profile and technology developed through the business rates competition have opened up with both public and private sector organisations. This includes NQM being invited to collaborate on tender opportunities that it would otherwise not have considered; and
- development of derivative products/services, which redeploy data analytics for alternative purposes. NQM has been agile in responding to COVID 19 and is now analysing the occupancy status of commercial premises through the lens of economic vibrancy as opposed to business rates. Working with Bournemouth City Council, NQM are currently in proto-typing phase in developing data and intelligence which helps identify the scale, pace and location of high street and retail decline across the city as part of a wider local economy health check.

Although Analytics Engines did not get through to procurement phase, the company also reported a positive experience. They added a head of Smart Cities into their Structure and developed skills in a range of AI techniques such as fuzzy matching and other new technologies. This enabled Analytics Engines to win other competitions and work with other authorities.

**Public sector impacts Qualitative Impact**

*Direct impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider benefits?*

Although the planned trial of the proposed solution has been paused, BCC has identified a range of actual and prospective benefits that will be derived from the Business Rates SBRI process. These include the following direct impacts resulting from the specific competition's objectives:

- findings from the pilot work which indicate that approximately 25% of properties that were said to be vacant or underoccupied, were in fact occupied and liable for business rate payments. It is estimated that correcting for these inaccuracies could increase BCC's rates revenue by c. £0.5m per annum (full evaluation of the further project is yet to be carried out); and
- more sophisticated and accurate approach to determining the occupancy status of commercial premises across the city. The data generated by NQM enables a more targeted and efficient approach to property inspections, and this change in behaviours has reduced the costs/resources associated with collecting rates, whilst at the same time increasing the revenue being generated.

BCC has also identified the following wider benefits of delivering this trailblazing SBRI initiative:

- cultural corporate benefits derived from working with agile companies who ‘see the world differently’ and bring perspectives and expertise that have positively influenced BCC’s approach to problem solving and collaboration;
- stronger relationships between BCC and LPS and a deeper understanding of challenges and opportunities for partnership working with central agencies;
- ‘opened eyes’ to the benefits of pre-commercial procurement. Without SBRI, the CIT would have struggled to articulate the procurement challenge. It would have taken much longer to get off the ground and may never have happened without established SBRI mechanisms and process which effectively de-risked the process. Critically, this SBRI helped BCC recognise that the local authority does not always need to know what the solution is prior to commissioning. SBRI opens the opportunity to co-create and collaborate with innovative companies to identify a solution;
- BCC, and the CIT in particular, have been able to use the Business Rates SBRI as a springboard for encouraging more extensive and creative Big Data approaches and solutions across the city. This cultural and behavioural change includes supporting use/re-use of data sets to stimulate innovation in SMEs and is also reflected in BCC’s ongoing Data Maturity Assessment;
- Looking forward, and building on the confidence, insights and capabilities generated by the Business Rates SBRI, BCC has developed ambitious proposals (as part of the Digital Pillar of the Belfast Region City Deal) to develop a cutting edge urban data platform and a proposed Citizens Office of Data Ethics.

## Conclusions

### Key Lessons and Success Factors

*Are there any key factors for why the case study was successful/unsuccessful?*

*What went well or not so well?*

*Are there any suggested improvements for future competitions?*

A number of important lessons and success factors can be derived from this initiative. These include:

- *Senior buy-in within the project sponsor* – vital to ensuring a sufficient level of dedicated resource from public partners and to ensure that a budget is ringfenced to procure a successful solution. This provided the sponsor agency with the capacity and resource to deliver the SBRI and engage effectively with companies. The role of the CIT was important here as this provided the ‘space’ to think differently, innovate and champion the SBRI process.
- *Clear route to market* - the demonstrable long-term commitment from BCC, evidenced by resource, gave confidence to the participating firm that this was a purposeful and well supported process, and critically, one that was underpinned through a genuine route to market, not ‘just another piece of research.’
- *Collaboration and long-term relationships* – the buy-in, commitment to innovation and route to market have fostered a collaborative and open relationship between BCC and NQM which benefits both parties.
- *Recognise that innovation is incremental and takes time* – the Phase 2 process was extended in acknowledgement of the delays in sharing data and the additional benefits that an extension to the timeline would bring. The impacts of COVID-19 have put the project on hold, but partners are engaged in continuing dialogue and commitment to the project. Both BCC and NQM have taken a long-term view on the wider impacts of the project around: culture change; strategic relationships; redeployment of the data analytics solution; and developing an improved service offer their respective customers.

	<ul style="list-style-type: none"> <li>• While there are benefits that can be realised through the partnership working, the use of data analytics to assist with this type of innovative solution can only be effective with good quality, consistent and well formatted data. This will be a crucial factor moving forward.</li> </ul>
<p><b>Summary Impacts</b>  <i>Headline impacts across departments and firms</i></p>	<p>The initiative has delivered a range of important impacts for the public sector sponsors and the participating firm which comprise:</p> <ul style="list-style-type: none"> <li>• <i>De-risking the innovation process</i> - for the firm, this was achieved through offsetting the costs of investment in R&amp;D, and critically, through innovating with a clear route to market. For BCC, SBRI provided the mechanism to enable collaboration across the public partners and provided a clear and recognised route to market for identifying an innovative solution to a long-standing problem.</li> <li>• <i>Fostering cultural and behavioural change</i> – within BCC both at the ‘project level’, in terms of a more effective and efficient approach to business rates collection, but also more widely in term of embracing big data and innovative approaches to problem solving at the corporate level;</li> <li>• <i>Prospect of increased revenue generation</i> – the pilot indicated additional business rate revenues for BCC of c. £0.5m per annum. Full evaluation of the further project is to be carried out.</li> <li>• <i>Stimulating further innovation and wider routes to market</i> – beyond the direct funding and the services commissioned through this SBRI, NQM have benefited from increased profile and developed a broader network of commercial relationships that have increased its routes to market. Critically, NQM has pivoted, as result of COVID, to develop a derivative product called the Economics Analyser, which looks at the interplay of rates and the need to regenerate cities and high streets. This has potential to further drive firm growth and deliver positive public sector impacts. Analytics Engines has also had a positive experience and used the SBRI as a springboard to profile their work.</li> </ul>

Source: Steer E-D, 2021



## Reducing Childhood Obesity

Table F-1: Reducing Childhood Obesity: Bug Farm Foods & Pennotec

Introduction	
<b>Name of Case Study</b>	Reducing Childhood Obesity: Bug Farm Foods & Pennotec
<b>Competition</b>	Reducing Childhood Obesity (2017-2019)
<b>Status</b>	Developed but not procured/commercialised
<b>Department/Agency</b>	Welsh Government
<b>Geography</b>	Wales
<b>Information Sources/ References</b>	<p>Consultation with Luke Player, Innovation Strategy, 12/02/2021, <a href="mailto:luke.player@innovationstrategy.co.uk">luke.player@innovationstrategy.co.uk</a></p> <p>Consultation with Dr Jonathan Hughes, Penotec, 04/03/2021, <a href="mailto:jonathan.hughes@pennotec.com">jonathan.hughes@pennotec.com</a></p> <p>Consultation with Dr Sarah Beynon, Bug Farm Foods, 09/04/2021, <a href="mailto:sarah@thebugfarm.co.uk">sarah@thebugfarm.co.uk</a></p>
<b>Permissions to use information externally</b>	Y
Context, Rationale & Objectives	
<p><b>Public sector context rationale &amp; objectives for the project and for using SBRI</b></p> <p><i>Wider context in which the competition was launched.</i></p> <p><i>Why is this a priority for department and what did it aim to achieve?</i></p> <p><i>What was the Department's motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i></p>	<p>Across Wales, there is a childhood obesity crisis with more than 40% of Welsh children becoming overweight or obese by age 11, one of the highest proportions of obese children in Europe. Childhood obesity increases lifetime risk of many serious health conditions, representing a major health issue for the country.</p> <p>Research and stakeholder consultation across government departments in Wales revealed that lack of nutritious food and drink options was a key determinant and provided an opportunity for food and drink businesses to step in to innovate. As such, the Welsh Government aimed to tackle childhood obesity in Wales in part by encouraging projects that develop innovative, healthy and affordable Welsh food and drink solutions.</p> <p>There were concurrent campaigns underway also aiming to tackle childhood obesity, such as trialling extra fitness classes in schools and public health campaigns encouraging healthier eating habits. However, improving the health content of food and drinks available to purchase was identified as a gap. A key barrier to food and drink businesses innovating new ingredients in this way is the high cost of Research and Development (R&amp;D). Through running an SBRI competition, the Welsh Government felt they could purchase R&amp;D from an organisation to provide innovative solutions to this problem. The SBRI competition, therefore, presented a new opportunity to tackle this problem through innovation, by bringing down this cost for small businesses.</p> <p>The competition aimed to align to two important policies in Wales – the Wellbeing for Future Generations Act (2015) that aims to improve the social, economic, environmental and cultural well-being of Wales, and the Healthy Eating in Schools Regulations (2013). Companies were invited to provide solutions which focused on reducing the levels of salt, sugar and saturated fats, as well as increasing the levels of vitamins, minerals and fibre in food and drink for children, whilst also driving down costs.</p> <p>The objectives that the Welsh Government set out for the competition were threefold:</p>

- To improve the nutritional composition of food and drink available to children.
- To drive down the cost of nutritional food and drink products for families, schools and local authorities.
- To demonstrate healthy living solutions can reduce the prevalence of childhood obesity in Wales.

**Private sector context, rationale and objectives for responding to this specific competition and pursuing SBRI/PCP?**

*Business context at point of application?*

*Why did the business respond to competition and what did the business aim to achieve?*

**Rationale & Objectives**

Why is this a priority for department and what did it aim to achieve?

What did the business aim to achieve?

Pennotec and Bug Farm Foods were the competition's two successful applicant firms.

Pennotec were established in 2012 as a consultancy business but in 2013 became more of an R&D focussed enterprise, looking to do contract research for external organisations in manufacturing of products. They were also undertaking grant-funded projects to grow the business through creating their own products from food manufacturing waste. Pennotec's ethos is to innovate and demonstrate how you can sustainably derive value from waste products, with the aim to develop and commercialise new products out of this waste.

Based in Gwynedd, North West Wales, Pennotec currently have 7 employees. Their revenue comes from two key areas – successful product innovation commercialisation (a water cleaning product derived from shell waste from across the UK to clean hot tubs and swimming pools) and contract research sales. Pre-COVID-19, their turnover was approximately £320k, falling to £250k over the last year. Product sales account for 10%, contract R&D accounts for 60% and grant-funded research the remainder. Less than 50% of their sales are international.

Pennotec saw this SBRI competition as an opportunity to demonstrate their offer and concept to the market, that manufacturing by-products can be a valuable rather than disposable resource. As a business they wanted to serve markets in a way that would have a positive environmental or societal impact. They saw this competition as an opportunity to move into the food manufacture market. In particular, they felt waste from food manufacture could create further food and food supplements, a higher value market than the industrial applications they were majoring in at the time. To ensure they were equipped for the food and drink field, they brought together a consortium of public and private organisations to apply together, combining Pennotec's knowledge with an Irish company CyberColloids Ltd and Bangor University.

Dr Beynon's Bug Farm LTD (The Bug Garm) and Grub Kitchen LTD were early stage start-ups at the time and the directors of the business came together and founded Bug Farm Foods LTD in 2017. They are a food R&D, manufacturing and retail business with a focus on edible insects. The Bug Farm have their own visitor attraction at which Grub Kitchen is located, and Bug Farm Foods were already producing their Cricket Cookies remotely out of Food Centre Wales.

Due to their aim to break into the mainstream food market with an interesting niche food offer, they had attracted significant media attention from the outset. At the time of the SBRI competition, they had just filmed a TV programme about the business and their Cricket Cookies. Their aim was to expand, extend the product innovation they had begun with the Cricket Cookies and work to make their products healthier. Their Business Adviser flagged the SBRI competition for innovative food and drink solutions to reduce childhood obesity in Wales and they felt it was

an unmissable opportunity despite feeling it was too early for them at that time.

Bug Farm Foods wanted to respond to the competition to expand their current offer, further influence prevailing perspectives and create positive environmental and health impacts. They wanted to create a staple food from novel ingredients, insects, and change the current western view of this. The key aim was to create an environmentally sustainable, nutritious and tasty food and felt their goals perfectly aligned with the competition objectives.

## Inputs & Activities

### Competition delivery

#### *Details of award*

*Any key points around process, responsibilities, challenges across any phases:*

- competition design/award;
- Phase 1;
- Phase 2;
- project close & routes to commercialisation and/or procurement

*Scope of the project/ technology/ innovation – how did the project seek to achieve its objectives*

*Overall draw out any valuable perspectives on what worked well, not so well.*

In 2017, the Welsh Government commissioned Innovation Strategy LTD to launch and manage the Reducing Childhood Obesity SBRI Competition.

The competition design involved assessing what kinds of businesses would be able to solve the challenge and what a potential solution would look like and, from this, forming a budget based on what the businesses would likely need to develop such solutions. Stakeholders were involved from across Welsh government departments including key representatives from schools, public health and the food and drink industry.

The outcome was that the competition would require both a feasibility phase to develop concepts and a demonstrator phase to take the solutions to adoption and the timeline was structured around this. Monthly stakeholder workshops were also a key feature of the competition design, bringing together technical advisers to give advice and guidance and to track progress throughout both Phase 1 and Phase 2.

The competition received twenty applications, of which five businesses went through to Phase 1. This Phase was a short phase, just 3 months, focussed on companies developing their concepts, testing ideas and trialling new techniques and processes to formulate the new products. Marking the end of Phase 1 were presentations from each business to show their proposed concept, which were evaluated to assess whether they should continue on to Phase 2, the demonstrator phase.

Two Welsh companies, Bug Farm Foods and Pennotec (Pwllheli), were awarded funding to develop their solutions; St Davids-based Bug Farm Foods developed VEXo, a meat alternative product made from insect and plant protein, and Pennotec worked with Bangor University's Biocomposites Development Centre to develop MilaCel, a fat-replacing ingredient made from the cider industry's apple waste.

Bug Farm Foods used the first Phase to test insects to assess their nutritional composition and explored whether they could make an edible and appealing recipe for children that fulfilled the objective of reducing salt, sugar and saturated fat contents. Pennotec developed their fat-replacing fibre in this Phase in a non-food environment, focussing on the technical feasibility of whether the small amount of fibre, rehydrated with water could fill the space in food previously occupied by the fat it was replacing.

The demonstrator phase, Phase 2, was launched with project start up meetings involving the technical advisory groups to set their objectives for the phase. The aim of Phase 2 was to develop their technologies further to create an established prototype ready for commercialisation. Fortnightly checkpoints were in place with the competition managers to review progress. A key aspect of the competition design was the businesses' working with schools in Phase 2 to further develop and test their products. It was initially 12 months but extended to 14 months.

In Phase 2 Pennotec needed to develop their product in a food grade environment from the initial fibres they had tested in Phase 1. To do so, they interacted with food technologists, food manufacturers and food psychologists which was out of their core area of expertise but in doing so expanded their skill sets and capabilities. As well as collaborating with Bangor University's Biocomposites Development Centre, Pennotec worked with Coleg Menai's Food Technology Centre and CyberColloids Ltd of Cork to develop their food technology.

For Bug Farm Foods, Phase 2 also involved linking with academia, namely, the University of the West of England, to conduct a scientific research study to solidify the understanding surrounding their novel product. Both businesses worked with schools throughout this phase to test and refine their product ideas to ensure that they were appetising to the target market, children. At the end of the competition, Bug Farm Foods secured a trial with a school to have their product on schools' food menus across Pembrokeshire. Pennotec undertook tasting trials with Primary school age children at festivals and with children from two local schools (Nefyn and Pentreuchaf) and have built commercial opportunities with other businesses with their product as an ingredient. The product in its current form was more suited to kitchens with industrial facilities.

It was felt that the bi-monthly series of workshops with the technical advisory groups worked well, as did having a dedicated manager for the competition (which Welsh Government outsourced). Working with academics to publish research was of key benefit to Bug Farm Foods. Both organisations felt they were well supported by Welsh Government departments and academia in their product development.

It was highlighted that a longer Phase 1 could have been beneficial, giving the organisations more time to test the feasibility of their concepts in collaboration with the advisory panels. It was also flagged that it could have been beneficial to have additional funding for Phase 3 focused on scaling up the manufacture of the products for adoption. Pennotec's solution was at an earlier stage of Technology Readiness at the end of Phase 2 and therefore would have especially benefitted from a Phase 3 to be adoption-ready.

Competition closure involved a showcase event at Taste Wales, Newport. This dissemination event allowed the two organisations to showcase their innovations and build commercial opportunities. This event raised interest from stakeholders both locally and internationally in the products. The competition itself won two awards at the GO Awards Wales 2020, the Go Excellence Award and the Procurement Innovation of the Year Award<sup>4</sup>.

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<sup>4</sup> <https://www.goawards.co.uk/wales/go-awards-wales-online-2020-winners/>

## Outputs, Outcomes & Impacts

### **Innovation/Product development**

What new innovation has the product resulted in? What stage of readiness is this at? Is it on the market?

Bug Farm Foods' product VEXo is an insect and plant protein mince manufactured in Pembrokeshire, developed especially for young people to encourage healthy eating and help reduce childhood obesity in Wales. VEXo Bolognese reduces saturated fat by 70-80% when compared to beef Bolognese, is high in protein and contains other important nutrients e.g. vitamin B12, iodine and iron, while looking and tasting just like regular Bolognese. At the end of the competition, VEXo had been developed to a Technology Readiness Level (TRL) of 8, fully operational and ready to commercialise. From trialling VEXo in schools, they found that 100% of the children that tasted VEXo Bolognese liked it. Bug Farm Foods were due to put Vexo into all school meals in Pembrokeshire the week that schools first shut due to COVID-19 restrictions in March 2020. As schools get back to normality post-COVID-19, they expect for this to go ahead as planned.

Pennotec's product, MilaCel, uses apple waste from cider production to create fat mimicking fibres that can be used to replace and reduce fat content in foods. The company is collecting and preserving apple pomace, a by-product of apple juice and cider production operations which is available in commercially viable quantities in Wales and has until now been overlooked as a food ingredient. Though they did not secure a trial with schools to include MilaCel in school meals specifically, taste testing was a success and they have gone on to work with a sausage production company to reduce the fat content of their sausages, a baked goods company to reduce fat and sugar in baked goods and a yogurt company to reduce thickening carbohydrates in low fat drinking yogurts. During the competition, Pennotec found that their product was not suitable for non-industrial kitchens like those in schools and homes in its current, dry, form, as they rarely have the facilities to rehydrate it. In Phase 2, Pennotec tested the product in schools using a pre-prepared wet form. Pennotec have since continued this research through securing Horizon 2020 EU funding for a spin-off project to develop the product into one usable in non-industrial kitchens.

### **Business Impacts**

*Direct quantifiable growth impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider impacts?*

Bug Farm Foods benefitted from a range of impacts as a result of taking part in the Reducing Childhood Obesity SBRI competition, these have included:

- Establishing beneficial links with the Welsh Government and accessing funding that enabled them to develop a healthy new food product, that they would not have been able to otherwise, and roll this out in Welsh schools, entering a new market.
- Gaining interest about and developing it as a retail-ready food product for sale in supermarkets.
- Spreading awareness and building support of using insects in food products amongst key stakeholders, both in the food industry and in Health and Education Government departments.
- Achieving business growth as a result of the competition, although less than expected due to COVID-19 halting their VEXo sales into schools and plans to enter supermarkets.
- Enabling them to upgrade their facilities to include a research and development kitchen space in West Wales, the UK's first insect protein R&D lab.
- Positioning themselves as a key partner in developing new regulations for this aspect of the food and drink industry in the UK post EU exit.
- Increasing interest in their products both amongst the public and in the media, including significant TV and newspaper coverage.

- Improving cross-sector collaboration as part of the competition which enabled them to work with academics to publish research in peer-reviewed journals. This has had knock on effects in the research field, inspiring further studies surrounding edible insects and young peoples' eating habits.

Pennotec also benefitted from a range of impacts, which included:

- Accessing funding which reduced the risk associated with undertaking the innovation activity to develop new products in new markets, the food and food supplements markets.
- Enabling them to move operations into a larger facility which allowed them to prepare food grade ingredients to support their entry into this new market.
- Increasing employment by 1.5 FTEs - one new food technologist and engineering apprentice focused on this new market area. Although Pennotec are yet to generate revenue from the new product, further scale up funding is being sought to de-risk the scale up from pilot to manufacture with the intention of commercialising in the next 18 months.
- Extending their capabilities and knowledge of creating new value out of waste products into a new market area, improving industry links and gaining a better understanding of the needs of food manufacturers, which in turn allowed them to apply for and secure Horizon 2020 funding to continue this research and development.

**Public sector impacts Qualitative Impact**

*Direct impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider benefits?*

Though Pennotec and Bug Farm Foods are very small businesses, they are working to have significant public impact. Through the InnovateUK and Welsh Government funded SBRI competition, they have created new food technologies that improve the nutritional composition of ingredients that are on their way to adoption in schools and into the wider food manufacture supply chain, with potential soon to be on supermarket shelves. These products have positive impacts for public health and associated costs, and wider positive environmental impacts.

The novel food solutions improve the nutritional composition in food available for children. VEXo Bolognese contains almost 80% less saturated fat, and almost 40% more protein than the equivalent meat Bolognese, whilst delivering more than 50% of a child's recommended intake of iodine, phosphorus, riboflavin and zinc. Both projects worked extensively with children and parents to ensure their products were liked, and through schools and wider community engagement have been able to increase level of interest in healthy foods. Bug Farm Foods provide educational materials and tasting kits to schools across Wales. Through this collaboration, the two projects have helped food and drink organisations think more about the nutritional composition of their ingredients, and begin to make new choices on food available for children in schools. As such, both solutions are supporting Welsh Government targets around health and well-being of future generations, increasing healthy eating in schools.

Going forward, as these solutions are on school meals menus, and available in supermarkets, there is potential to improve the nutritional composition of children's diets and as such, could have a material positive effect on long-term health outcomes.

Both solutions aimed to make foods healthier and, crucially, cheaper, without sacrificing flavour. As such, the wider economic impacts of the solutions have the potential to be twofold. Firstly, reduced costs of

nutritious food for public sector organisations and families – in the first instance, for schools, though Bug Farm Foods have also had interest from wider public sector organisations in the health and social care industry, and both companies are working to make their products available to purchase directly by consumers. Secondly, in the longer term if material positive effects on long-term health outcomes are experienced due to reductions in rates of childhood obesity, there is an associated public sector saving in healthcare costs.

Finally, both solutions have environmental sustainability at the core of their product design. As such, going forwards if we see these products replace current food staples, there is to be a positive impact on environmental sustainability. Pennotec’s product MilaCel uses waste as a resource, intending to address the global issue of food wastage. Bug Farm Foods’ product VEXo, is actively working to reduce the rate at which greenhouse gases are produced from the food industry. By 2050, meat production is predicted to double due to the Earth’s growing population, but this amount of livestock would have a significant negative impact on the environment. As a result, there is a global need for alternative protein sources, and insects are one of the possible solutions. Insects are very sustainable to farm in high welfare, clean, modern insect farms, requiring little space, water or energy. Insects can contain the same amount of protein as beef, but need very little feed, water and land space and release hardly any greenhouse gas emissions. Unlike with other farmed livestock, the intensification of production does not compromise welfare, as the species of insects farmed have evolved to live in close confines to each other: welfare is higher when they are kept in smaller spaces, which enables them to also be farmed vertically. Insects require 12-25 times less feed compared to intensively-farmed cattle, and 50% less than chickens, to produce the equivalent amount of protein. It takes about 22,000 litres of water to produce 1 kg of intensively-farmed beef, whereas it takes just 1-10 litres of water to produce 1 kg high-welfare edible insect protein.

Through their stakeholder engagement work, academic research and knowledge sharing, both solutions have had further impacts around increased knowledge and awareness of the health, cost and environmental sustainability of food products.

## Conclusions

**Key Lessons and Success Factors**  
*Are there any key factors for why the case study was successful/ unsuccessful?*  
*What went well or not so well?*  
*Are there any suggested improvements for future competitions?*

A number of important lessons and success factors can be derived from this initiative. These include:

- *Collaboration and engagement* – both companies were able to collaborate across Government departments, academia, with business and with schools and communities. This led to developing products that were tried and tested by their target markets and also underpinned by scientific research. Partnering with schools and attending events throughout the competition process built strategic relationships and carved out a route to market for the firm’s new products.
- *Dedicated programme management resource and regular progress reviews* – Welsh Government commissioned Innovation Strategy LTD to provide a full time programme management resource dedicated to the competition. This allowed for time to be spent frequently working with the companies to facilitate the aforementioned collaborations and crucially to put in place regular meetings to track progress throughout Phase 1 and Phase

2. The companies felt they had to regularly monitor and present their progress which kept them on track.

- *Competition flexibility* – Bug Farm Foods considered they were encouraged to change direction to enable them to meet a ‘bigger and better’ vision. Due to the flexibility of the competition, they were able to grasp opportunities as they arose, which was crucial for developing the resultant meat substitute product.
- *Recognition that innovation is incremental and takes time* – though the Phase 2 was extended by two months, it was felt that further time and potentially a Phase 3 would have benefitted the companies’ ability to commercialise the products they had developed. Particularly in Pennotec’s case, it was felt that the expectation that the product would be on the market in 18 months, developing from a TRL 2-3 to 7-8 product was somewhat unrealistic. Innovative businesses can often get stuck in ‘the valley of death’ with a solution developed but inadequate resources to achieve commercialisation.

### **Summary Impacts**

*Headline impacts across departments and firms*

The initiative has delivered a range of important impacts for the public sector sponsors and the participating firm which comprise:

- *De-risking the innovation process* - for both firms, this was achieved through offsetting the costs of investment in R&D to create novel solutions.
- *Accessing new markets* – for both firms, the competition enabled them to access entirely new markets through cross-sector collaboration, market research and relationship building.
- *Generating business development opportunities* – for both firms, they were supported to take their business in a new direction to access higher value markets through developing new products.
- *Creating new technologies that have clear potential for positive public health and environmental impacts* – both firms were enabled to create new food technologies that improve the nutritional composition of ingredients that are on their way to adoption in schools and into the wider food manufacture supply chain, with potential to soon be on supermarket shelves. These products have positive impacts for public health and associated costs, and wider positive environmental impacts.

Source: Steer E-D, 2021



## Retinal 3D

Table F-1: Retinal 3D

Introduction	
<b>Name of Case Study</b>	Retinal 3D
<b>Competition</b>	CRACK IT Challenge 23: Retinal 3D- A Physiologically-Competent Human Retinal 3D Model
<b>Status</b>	Commercialised
<b>Department/Agency</b>	NC3R
<b>Geography</b>	United Kingdom
<b>Information Sources/ References</b>	Dr Mike Nicholds, Newcells Biotech Catherine Vickers, NC3R
<b>Permissions to use information externally</b>	Y
Context, Rationale & Objectives	
<p><b>Public sector context rationale &amp; objectives for the project and for using SBRI</b></p> <p><i>Wider context in which the competition was launched.</i></p> <p><i>Why is this a priority for department and what did it aim to achieve?</i></p> <p><i>What was the Department's motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i></p>	<p>The NC3Rs is a UK-based scientific organisation dedicated to replacing, refining and reducing the use of animals in research and testing (the 3Rs). It operates under the umbrella of the Medical Research Council (MRC), which is part of UK Research and Innovation and uses some MRC and UKRI administrative systems.</p> <p>NC3R funds and supports projects that work towards these core aims. Funding is split between response mode funded projects and 'challenges' that are contract research to deliver specific products and services and require a significant amount of funding.</p> <p>CRACK IT was established with support from Innovate UK in 2011 and is run using the SBRI process. This programme is well established and launches between 3 and 5 challenges per year. Challenges are designed in collaboration with industry and draw on the latest thinking around the 3Rs. Before launching any challenge, NC3R discusses with industry experts to ensure innovations will be truly new and are not being duplicated elsewhere. They are also assessed for their commercial potential and viability as advised by industry and independent experts.</p> <p>A Challenge was launched in September 2016 to establish a physiologically-competent human 3D retinal cell model. The eye comprises three major structures: the cornea, the lens and the retina. For the cornea and to a minor extent for the lens, in vitro models are available that allow R&amp;D to happen without animal testing. However, there are currently no adequate in vitro models available for the retina, mainly due to its complex structure which consists of multiple cells types. This means that R&amp;D work in ophthalmology (the branch of medicine working with the eyes/visual systems) normally requires retina studies to be performed on animals, typically rodents and rabbits. There are currently more than 600 ophthalmology R&amp;D projects in the field worldwide.</p> <p>The Challenge was to develop a model that consists of all the major cell types of the retina to replace the use of animals in the discovery and development of new ophthalmologic drugs. It was sponsored by Roche, Merck and Novartis (pharmaceutical companies) who provided direct in-kind support to the funding support due to their interest as end users of this research.</p>

	<p>It was a two-phase process with the first phase funding three projects to deliver proof-of-concept studies each receiving £100,000 and the second phase funding one project for £1,000,000.</p>
<p><b>Private sector context, rationale and objectives for responding to this specific competition and pursuing SBRI/PCP?</b>  <i>Business context at point of application?</i></p> <p><i>Why did the business respond to competition and what did the business aim to achieve?</i></p>	<p>Newcells Biotech Ltd develop in vitro cell-based assays for use in drug and chemical development. They were already beginning to do some work on retina modelling in partnership with Newcastle University as a key area of both academic interest and as part of their growth strategy. In 2018, the development of drugs for eye disorders was expected to grow to \$14.8 billion by 2022<sup>5</sup>.</p> <p>The competition was an attractive opportunity to obtain funding to progress this research. Additionally, Newcells Biotech Ltd were very attracted by the opportunities provided from the involvement of Roche, Merck and Novartis as sponsors.</p> <p>Newcells Biotech Ltd were successful in their application for Phase 1 and 2 funding receiving £99,982 and £1,000,000 respectively.</p>
<b>Inputs &amp; Activities</b>	
<p><b>Competition delivery</b>  <i>Details of award</i></p> <p><i>Any key points around process, responsibilities, challenges across any phases:</i></p> <ul style="list-style-type: none"> <li>• competition design/award;</li> <li>• Phase 1;</li> <li>• Phase 2;</li> <li>• project close &amp; routes to commercialisation and/or procurement</li> </ul> <p><i>Scope of the project/ technology/ innovation – how did the project seek to achieve its objectives</i></p> <p><i>Overall draw out any valuable perspectives on what worked well, not so well.</i></p>	<p>The competition was launched in September 2016. The fact that the competition was designed in collaboration with industry meant that it was even more attractive to applicants and had commercial promise.</p> <p>Phase 1 was awarded to three project teams in March 2017. Each team was partnered with a different academic team - Newcells Biotech Ltd with Newcastle University. As part of this first phase, three teams were tasked with the development of the initial model and to pass two key deliverables:</p> <ul style="list-style-type: none"> <li>• establish an in vitro culture system which enables stable co-culture of the required cell types in 3D; and</li> <li>• demonstrate cell phenotype stability and viability for at least (72 hours) as indicated by relevant biomarkers/readouts.</li> </ul> <p>From the outset, considerable benefit was seen from working with the industry leads sponsoring the challenge.</p> <p>In Phase 2 was then awarded in August 2017 to Newcells Biotech Ltd whose proposal was judged overall to be well designed and not overly cumbersome. As part of the second phase, Newcells Biotech Ltd were required to further develop the model to ensure the organoids (a simplified version of an organ produced in vitro) are accessible worldwide and to validate it as a tool for efficacy and toxicity screening. Senior industrial-level input from these sponsors was invaluable and would be almost impossible to receive through other means. These inputs really helped shape the model and ensured commercial success at each stage.</p> <p>NC3R adopts a highly structured approach to managing Phases 1 and 2, bringing project sponsors, awardees and themselves around the table at relevant points, keeping up to date with project development, and problem solving throughout. This was particularly pertinent across Phase 2 which was scheduled to last three years. This created a 'no surprises' approach for all involved stakeholders.</p> <p>Phase 2 was expected to finish at the end of June 2021, but the product has already been commercialised and is generating revenue.</p>

<sup>5</sup> Pharmaventures, 2015

## Outputs, Outcomes & Impacts

### **Innovation/Product development**

What new innovation has the product resulted in? What stage of readiness is this at? Is it on the market?

The project developed a retina in vitro model which has been commercialised and is on the market with contracts with multiple firms including Genetech in the United States.

Newcells Biotech Ltd also generated Intellectual Property (IP) in partnership with Newcastle University, and then acquired additional existing IP from the university. This has enhanced their competitive position.

Alongside this innovation, Newcells Biotech Ltd developed a complementary technology (retinal pigmented epithelium) that has commercial applications in ophthalmology R&D which will have additional 3R benefits. This is even further down the commercialisation path and is also generating revenue. This would not have happened without the initial work.

Further innovation and product development are ongoing off the back of this work. A research paper showing work to date was published in June 2020<sup>6</sup> to reflect their work. There has been a lot of interest generated in particular from gene therapy companies to understand the applicability of Newcells Biotech Ltd's model to their work.

### **Business Impacts**

*Direct quantifiable growth impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider impacts?*

The project allowed Newcells Biotech Ltd to clearly demonstrate proof of concept even before the end of the programme. This was attributed to the close relationship with the sponsor companies, including using their testing facilities. For example, shipping materials to Roche for them to test in their labs gave them the confidence in their product that they could ship any future products which is one of the greatest challenges with this type of technology.

The revenue from the sales of the product developed as a part of this competition was £465,000 in FY20-21 and the projected sales for FY21-22 are £1m. At the beginning of the project they recruited three people into the team which were new employees, and another four were recruited over the course of the project, meaning a total of seven additional jobs to date. A further four or five people are expected to be recruited to work in this team over the next year.

Another benefit of working closely with industry partners was being introduced to other departments. For instance, Newcells Biotech Ltd were able to cross-sell other ongoing product work on retinal pigment epithelium cells (RPE) to Roche. This is also expected to generate approximately £1m in the next few years. Whilst this work was already ongoing, the relationship with Roche will accelerate it.

In January 2021, Newcells Biotech Ltd raised another £5.25m of investment for the company. This success was at least partly due to the retina work which has since become a core service area for the firm. They have also been successful in getting additional grant funding, including to use retinal organoids to investigate mechanism of Stargardt's disease and retinal ciliopathies. This grants from the EU Marie Curie Fund totalled £425,000 (2019-2023).

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<sup>6</sup> Georgiou M, Chichagova V, Hilgen G et al. (2020). Room temperature shipment does not affect the biological activity of pluripotent stem cell-derived retinal organoids. PLoS One 15(6): e0233860. doi: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0233860>

	<p>Newcells Biotech Ltd do not think this work would have advanced without this opportunity. Whilst they were aware of the technological advancements in this area via their academic co-founders' group, it is an extremely difficult research area which would have been expensive to progress. Even if something had progressed in this area, it definitely wouldn't have done so at anything similar to the rate and the scale without SBRI funding.</p> <p>Progress of the project was communicated to industry through a series of conferences organised via NC3R this included the:</p> <ul style="list-style-type: none"> <li>• 3D Cell Models Congress (Berlin, Germany) in January 2018;</li> <li>• British Toxicology Society Annual Congress (Gateshead, UK) in April 2018; and</li> <li>• The Association for Research in Vision and Ophthalmology Annual Meeting (Hawaii, USA) in April 2018.</li> </ul> <p>These were viewed by Newcells Biotech Ltd as critical in attracting commercial interest, and the involvement of the industry sponsors (e.g. presenting alongside Merck) provided a 'stamp of approval' to the emerging innovation.</p>
<p><b>Public sector impacts Qualitative Impact</b>  <i>Direct impacts?</i>  <i>Additionality of SBRI?</i>  <i>Indirect/knock-on benefits?</i>  <i>Wider benefits?</i></p>	<p>This product is working towards the NC3Rs core aim in replacing, refining and reducing the use of animals in research and testing. There is a growing market for more human relevant technologies in drug development. The CRACK IT programme ensures technologies are developed fit-for-purpose for industry to deploy through engagement with end-users throughout the process. This unique approach supports delivery of products with significant market potential.</p>
<p><b>Conclusions</b></p>	
<p><b>Key Lessons and Success Factors</b>  <i>Are there any key factors for why the case study was successful/ unsuccessful?</i>  <i>What went well or not so well?</i>  <i>Are there any suggested improvements for future competitions?</i></p>	<p>As a well-established SBRI programme, a lot of learning on processes has been taken from the past ten years and internalised, particularly around programme design and industry involvement, e.g.:</p> <ul style="list-style-type: none"> <li>• Competition design should be firmly grounded in emerging research and current/future market demand and industry sponsors should be engaged in the process from the design stage;</li> <li>• The benefit of an industry sponsor working closely with the competition throughout has wide reaching benefit for product development and then ultimately commercialisation;</li> <li>• Product development of this nature is extremely high risk and will not be brought forward (in any similar timeframes) without the de-risking of the innovation process; and</li> <li>• Close programme management and getting different stakeholders engaged and around the table at key points is critical for project advancement (i.e. beneficiaries and industry sponsors to understand the views of the end users); and</li> <li>• Managing expectations for development of products from concept to commercialisation is important as this normally takes much longer than the 3-4 years provided across Phases 1 and 2. Consequently, there will not always be an end product at project close. NB. NC3R also do run a business growth scheme for additional funding and support for projects that need some further support to progress a product after Phase 2.</li> </ul>
<p><b>Summary Impacts</b>  <i>Headline impacts across departments and firms</i></p>	<p>This competition has had clear commercial outcomes for Newcells Biotech Ltd. Namely:</p> <ul style="list-style-type: none"> <li>• <b>Revenue growth from the core product developed:</b> £465,000 in FY20-21 and projected sales for FY21-22 of £1m;</li> </ul>

- **Employment growth from the core product developed:** Seven additional jobs to date with a further four to five expected to be recruited to work in this team over the next year;
- **Building on new close relationships with industry leads to cross sell other product innovations:** Specifically, cross-selling some other ongoing product work on retinal pigment epithelium cells (RPE) to Roche, which is expected to generate approximately £1m in the next few years;
- **Contributing to the success in the firm's most recent round of investment:** Raising £5.25m of investment in January 2021;
- **Securing further grant funding:** £425,000 from EU Marie-Curie ITN fund over 2019-2023; and
- Likely commercial outcomes for other impacts/products developed. Critically, this product will replace the use of animals in ophthalmology R&D projects and consequently reduce animal testing for rodents, and rabbits and non-human primates.

Source: Steer E-D, 2021

## Transreport's Passenger Assistance System

Table F-1: Transreport's Passenger Assistance System

Introduction	
<b>Name of Case Study</b>	Transreport's Passenger Assistance System
<b>Competition</b>	First of a Kind: Demonstrating Tomorrow's Trains Today (2017)
<b>Status</b>	Procured
<b>Department/Agency</b>	Department for Transport
<b>Geography</b>	UK
<b>Information Sources/ References</b>	Kelvin Davies, Innovate UK <a href="mailto:Kelvin.Davies@innovateuk.ukri.org">Kelvin.Davies@innovateuk.ukri.org</a> Jay Shen, Transreport <a href="mailto:x.shen@transreport.co.uk">x.shen@transreport.co.uk</a>
<b>Permissions to use information externally</b>	Y
Context, Rationale & Objectives	
<p><b>Public sector context rationale &amp; objectives for the project and for using SBRI</b></p> <p><i>Wider context in which the competition was launched.</i></p> <p><i>Why is this a priority for department and what did it aim to achieve?</i></p> <p><i>What was the Department's motivation for using Pre-Commercial Procurement – why best route/alternatives considered?</i></p>	<p>This competition was the first round of many of the Department for Transport's First of a Kind (FOAK) SBRI competitions. First of a Kind: Demonstrating Tomorrow's Trains Today Round 1 (FOAK1) was a £3.6m competition focussed on innovation in technologies to make rail travel faster, cleaner and greener.</p> <p>Innovate UK (IUK) worked with the Department for Transport (DfT) to develop and deliver the competition, due to DfT not having the required resources or expertise in-house. With 6% of the competition budget allocated to IUK for their design and delivery services, IUK were responsible for defining the competition scope, launching the competition, evaluating applications and agreeing winners.</p> <p>The competition objectives are broad, with an overarching aim of catalysing transformational innovation in the railways. Innovation in the industry has been previously hampered by barriers around permissions and franchising; and the complex organisational and commercial structure of the industry. This competition was designed to increase the commercialisation of new technologies in the rail setting.</p>
<p><b>Private sector context, rationale and objectives for responding to this specific competition and pursuing SBRI/PCP?</b></p> <p><i>Business context at point of application?</i></p> <p><i>Why did the business respond to competition and what did the business aim to achieve?</i></p>	<p>Transreport Limited, a technology company, was founded in 2016. Its original purpose was the reporting of faults on the railways, including faulty trains, toilets etc. In 2017, Transreport joined the London Midland Labs programme (LM Labs), one of the first technology incubators for the rail industry. Through working with LM Labs, they became aware of the challenges of using the railways for disabled passengers.</p> <p>For people with a disability, travel by rail can be hugely difficult. Disabled passengers who opted to use the railway needed to provide the train operator with at least 24 hours' notice of their intention to travel if they required assistance. Assistance was 'hit and miss', not always guaranteed, with some stations being unstaffed and no consistent means among train operating companies (TOCs) by which to request assistance. In some cases, fax machines were still used to communicate information about passenger assistance. The needs of this passenger community were not well understood, and the solutions based on conventional technology were insufficient.</p> <p>Transreport were interested in providing support that would reduce the barriers faced by people with disabilities accessing public transport. Through their existing experience working with the rail industry however,</p>

the firm was aware of the complexity of the system and the significant challenges that would be involved in developing a solution that could be rolled out across all 25 TOCs.

Transreport proposed a technology solution to LM Labs to address the passenger assistance issues. The solution was well-received by LM Labs and also by the Rail Delivery Group (RDG), who saw potential for the technology to become an industry-wide solution. Initial development of the technology was challenging – even just for the London Midland network. The idea of developing a product which could be used across the whole industry felt out of reach at that point, and it is not surprising that an industry-wide solution had not been developed by the market.

When DfT launched FOAK1, Transreport immediately recognised the potential to use the fund to invest in further development of the product, such that it could become a solution for the entire railway network.

## Inputs & Activities

### Competition delivery

#### *Details of award*

*Any key points around process, responsibilities, challenges across any phases:*

- competition design/award;
- Phase 1;
- Phase 2;
- project close & routes to commercialisation and/or procurement

*Scope of the project/ technology/ innovation – how did the project seek to achieve its objectives*

*Overall draw out any valuable perspectives on what worked well, not so well.*

The competition was launched in 2018 with £3.5m to fund ten rail technology projects, with up to £350k available for each project.

Unlike many SBRI competitions that require a concept development phase first, due to spending review budget availability, this was a single-phase competition aimed at technologies already at high Technology Readiness Levels (TRLs). Applicants had up to 12 months to provide a demonstration of the technology in a live rail environment.

There were 20 applicants including Transreport, with their technology ‘Passenger Assist’. A broad range of different applications was received. Transreport’s focus on provision of support to disabled passengers was unique. It was also a strong application thanks to the fact that they already had a working prototype and sufficient interest from investors. Without SBRI funding, the development of the technology would have taken considerably longer.

Despite being the first rail innovation SBRI and new to DfT, it was felt that IUK’s management resulted in a smoothly-run competition. Though FOAK round 1 only attracted 20 applications, applications have doubled for each subsequent FOAK round. It was felt that the application process was straightforward, although the application process (and success criteria) has become more stringent in later rounds. For example, for the first round of funding there was no requirement for applicants to partner with a rail company. This was added as a requirement to later rounds (from round 2 onwards) because of the observed relationship between strategic industry partnership and commercialisation. Despite it not being a requirement for FOAK1, Transreport already had in place a strategic partnership with London Midland TOC.

Throughout FOAK1, Transreport built a prototype of their technology, a passenger app and corresponding staff app, and trialled these in London with success. Following competition closure, the working prototype was then procured by RDG and rolled out across the UK’s rail network.

With the system procured and operational, it became clear to Transreport that there was room for further improvement/optimisation. The firm therefore applied for further funding through FOAK3, with the aim of building system enhancements. This funding was granted, and

improvements were made around for example removing conflicts between Passenger Assistance and the legacy systems.

## Outputs, Outcomes & Impacts

### Innovation/Product development

What new innovation has the product resulted in? What stage of readiness is this at? Is it on the market?

Transreport developed 'Passenger Assistance' – a smartphone app enabling real-time assistance for disabled rail passengers.

The Transreport Passenger Assistance app enables rail passengers with specific needs to request in advance any assistance they may require at a station or in-carriage. Staff nearby receive the requests on their smartphones, providing details of the passenger's requirements. If no staff are present in the vicinity, the technology automatically informs a central control system from which the appropriate assistance can be arranged.

For passengers, the system works with or without smartphones, and further allows family and friends to book assistance requests for passengers. The system has replaced the outdated disability booking system, which was based solely on emails and faxes. The system enables disabled passenger to access the assistance they need in a way which is reliable, real-time and easy to use. It reduces the uncertainty and anxiety of travel by train for disabled passengers, and the risk of problematic journeys (which can have significant consequences, such as passengers ending up stranded at a station, or unable to disembark a train at the correct stop).

### Business Impacts

*Direct quantifiable growth impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider impacts?*

The recognition and funding provided by DfT through FOAK increased the attractiveness of the product to private investors, allowing Transreport to raise further funds in private investment alongside SBRI funding. The solution was procured by RDG on a multi-million-pound contract on long term. RDG rolled out Passenger Assistance across the rail network in August 2020, and Transreport experienced significant business growth.

Key impacts for Transreport to date have included:

- Growing the firm's number of employees from four to 22;
- Developing a highly skilled and diverse set of employees. The level and range of in-house expertise has enabled the firm to be agile and resilient in the face of a range of challenges;
- Increasing the firm's annual turnover from £134k to £1m;
- Opening a new office in Glasgow to expand their work into ScotRail and the Office of Rail and Road; and
- Further plans to expand into Europe (which have since been halted due to COVID-19) and plans to diversify into other transport modes.

Transreport have a roadmap set out with RDG, with plans to add further features to the app, including catering for new types of assistance and circumstances.

### Public sector impacts Qualitative Impact

*Direct impacts?*

*Additionality of SBRI?*

*Indirect/knock-on benefits?*

*Wider benefits?*

Disabled passengers historically faced major barriers to using the rail network, and Transreport's app tackles many of these barriers. Rollout of the technology across the UK has resulted in clear public benefits, including:

- Increased the accessibility of the railways;
- Helping disadvantaged groups to make use of the public transport network, giving people the option of travelling in a way that wasn't previously possible;
- Increased flexibility for disabled people in planning their journeys, a better journey experience and lower risk of problematic journeys.



Transreport have received feedback from passengers on how the app has changed their lives: *“Transreport is providing a globally-leading technology designed to support inclusivity for 14 million disabled rail users in the UK. Early adopters and trial participants have shared nothing but positivity on how this technology will transform their lives. Innovate UK funding helped the company grow, and enabled us to recruit, adding to our already talented team.”*

- Jay Shen, Managing Director at Transreport Limited

## Conclusions

### Key Lessons and Success Factors

*Are there any key factors for why the case study was successful/ unsuccessful?*

*What went well or not so well?*

*Are there any suggested improvements for future competitions?*

- Following FOAK1, DfT amended the competition requirements such that applicants must have a relationship with a rail industry partner in place. This enables demonstration of the technology in situ and increases the likelihood that a procurable solution will be demonstrated.
- A key enabler for the FOAK SBRI competitions is IUK’s Steering Group with the railway industry to identify challenges, facilitated by DfT. That being said, limited DfT resource has been flagged as a hampering factor.
- In order to judge the applications, a panel with suitable expertise is crucial. The need to ensure assessors have a solid understanding of the rail industry has been raised as a potential area for improvement.
- FOAK competitions have received more applications with every round (20 in the first round, then 50 in the second, 125 in the third and 209 in the fourth). There is some concern about repeat applications, with applicants applying for subsequent rounds with only slightly tweaked rather than truly evolved applications, and repeat funding being granted in some cases. This raises concerns for the administrative burden of sifting applications (when previously rejected applications need to be re-assessed multiple times) and also for the value for money of the fund – implying each project requires several rounds of funding in order to reach commercialisation. However, the Transreport case study gives an example of a project which did indeed receive multiple rounds of funding, and as a result has developed a highly sophisticated, commercialised project, so it is not necessarily the case that repeat funding results in poor value for money.
- A key success factor in Transreport’s case was the agility and fast-pace capability of the SME compared to more established players in the market. The support and guidance from DfT, IUK, and rail industry experts is what allowed this SME to tackle the difficult challenge in hand.

### Summary Impacts

*Headline impacts across departments and firms*

As a result of this SBRI competition, Transreport were able to trial, finalise and commercialise their Passenger Assistance app, rolling it out across England to support disabled access across the rail network. This first round of FOAK was a success and paved the way for many subsequent rail innovation competition rounds responding to industry’s challenges.

With this success, Transreport grew their employee base to more than five times its size at the competition outset, and 7.5 times the firm’s annual turnover. Transreport are now on the path to expanding Passenger Assistance usage overseas, extending their solution’s current potential to support accessibility for 14 million rail users with disabilities in the UK.

Source: Steer E-D, 2021

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