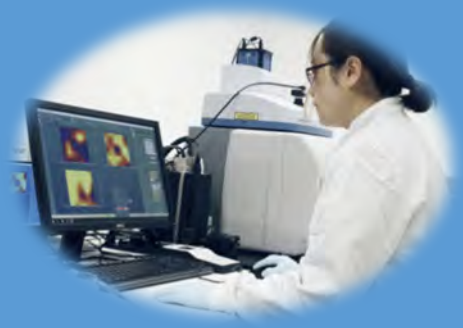

Health Tech Hub Summative Assessment

December 2019

European Union
European Regional
Development Fund

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Executive Summary

This summative assessment of the Health Tech Hub (HTH) project, which is led by the University of the West of England (UWE) and which is funded through the European Structural and Investment Fund, Local Enterprise Partnership Funding, UWE and project partners, took place between August and December 2019. In addition to a review of documentation, drawing on data collated throughout the project period, the research included an independent, on-line survey of 78 project beneficiaries (44 businesses responded) and conversations with stakeholders.

Key findings were as follows:

- The HTH project was designed to address a clearly identified market failure and was well structured for delivering sustainable business growth.
- HTH beneficiary products covered a broad spectrum of health and well-being areas from diagnostics and assistive living to healthy nutrition. Most beneficiaries were micro companies - over 70% of the businesses had less than 5 employees.
- The contracted outputs have all been achieved (some have been exceeded). Because of the nature of the sector / beneficiary products, performance has been strong in relation to new businesses assisted and collaborations with research organisations.
- Beneficiaries have attached high value to the support provided – considerably higher than the market value assessed by the project team. The full range of laboratories/workshops and expertise in the HTH facility were required to provide tailored support to beneficiaries.
- The independent survey revealed that HTH client satisfaction was extremely high, with a Net Promoter Score of 76, compared with the average for an ERDF project of 51.
- Calculation showed the support provided by the HTH has led to the generation of £382,000 of net additional GVA and the creation of 66 net additional FTE jobs in the West of England LEP area. These impacts have been achieved in a very short time period (assistance was completed within a year of the survey for the many of the businesses).
- 62% of beneficiaries reported an increase in R&D investment as a consequence of the support provided by the project.
- Survey respondents were highly positive about the Health Tech Hub – beneficiaries were particularly complimentary regarding the Health Tech Hub experts.
- Project support has had many enduring benefits on participants – increasing individual's knowledge and confidence and also positively influencing behaviour and approaches in all beneficiaries. All elements of the support were commended by beneficiaries with very positive feedback relating to the assistance provided by HTH experts.
- The project has helped beneficiaries' de-risk a variety of challenges; including potential company closure, environmental issues, credibility, regulations/red-tape, BREXIT and the disclosure of IP.
- The beneficiaries and stakeholders felt that the HTH project has been well managed with the HTH team using their experience of many previous ERDF projects to provide advice to businesses, manage expectations and deliver business support effectively and efficiently.
- The comprehensive nature of the baseline data held by the Health Tech Hub was viewed as above average for a typical ESIF funded project and overall a high standard of management of information was evident.
- The management team effectively integrated cross-cutting themes into project delivery.
- A range of examples of best practice and lessons learnt have been identified in both the construction and delivery phases of the project, in relation to both management and operation.
- It is clear that the HTH project has made an impact in the West of England (WoE) region and there remains a rationale for this sort of project in the future.

Section 1: Project Context

1.1 Introduction

This report provides a summative assessment of the Health Tech Hub (HTH) project which is being funded from European Structural and Investment Funds (ESIF), Growth Fund via Local Enterprise Partnership (LEP) Funding, the University of the West of England (UWE) and project partners. The project is being delivered by UWE with project partners, Designability, P3 Medical, University of Bristol, Sirona and the West of England Academic Health Science Network. The summative assessment took place between August and December 2019, drawing on data collated throughout the project period. The evaluation methods and this report were designed in accordance with the Ministry for Housing, Communities and Local Government (MHCLG) guidance.

The objectives of the summative assessment are:

1. To evaluate the performance against targets from HTH business plan, including outputs, outcomes and equality & diversity data;
2. To establish the reasons for businesses seeking assistance from HTH and impacts on the businesses;
3. To understand project added value and the value for money that has been achieved;
4. To assess the wider effects of HTH including on the Health Tech sector, regional economy, society and the environment;
5. To evaluate the project design and delivery methods;
6. To record lessons learnt and good practice.

Primary research methods included an independent survey of 78 beneficiary businesses performed by Business West Insight (BWI). The survey was undertaken through an on-line questionnaire and 44 businesses responded. BWI analysed the data and produced graphs and tables which are included in this report. In addition, stakeholders were interviewed in 1:1/group discussions. Data was also gathered from forms submitted by the beneficiaries and attendees at events throughout the course of the project as well as from management and advisory meetings to understand the wider impacts of the project.

1.2 Aim of the project

The aim of the Health Technology Hub (HTH) project is to increase research and innovation within the West of England (WoE) region by providing a world-class resource, which is accessible to businesses, to assist them in the development of new health technology products, thus reducing time to market, cost and risk associated with product development and improving their rate of innovation. The broader, longer-term goal is to improve the health and well-being of the population, in addition to enhancing economic growth in the WoE region. The project period extended from February 2017 to January 2020. Initially, the project involved the refurbishment of a facility in the University Enterprise Zone on the University of the West of England's (UWE) Frenchay Campus, Bristol. The HTH facility incorporates a range of well-equipped laboratories and workshops suitable to support the development of health technologies ranging from digital health to home diagnostics. In addition, the HTH has an excellent team of core and associated staff with broad range of specialist expertise, from microbiology to mechanical engineering, associated with each laboratory/workshop, which is essential for supporting companies across the breadth of the Health Tech sector. The HTH operates under three strategic themes

1) Innovation into practice
2) Technology development
3) Business acquisition and support

The project logic model is shown below.

Beneficiaries of the HTH are SMEs with a significant presence in the West of England LEP region. The support provided to the beneficiary companies was predominantly technical support delivered by the HTH team using HTH facilities. In a small number of cases businesses directly used the HTH facilities and for others, business support (tailored to the Health Tech sector) was provided. On average businesses were provided with 1 week of expert support.

1.3 Addressing Market Failure

The HTH project addresses an issue that challenges not only society in the UK, but also developed countries across the world. As a result of life style changes and people living longer, the disease burden is shifting much more towards long-term conditions. Longer life expectancy means people live with co-morbidity (co-occurrence of multiple long term conditions) and disability for longer placing greater strains on health and social care systems. At the time of the HTH application, economists estimated that the NHS would have to find a minimum of £30 Billion over the following 5 years in efficiency savings to deliver current care standards. These rising costs have now become a reality.

Most strategy documents that address this issue, for example the *2015 European report on Healthy Ageing* (referenced at the time of the HTH application), cite innovation in health and care through the use of new technology as a core mechanism for tackling this challenge. However, there is limited technology that provides effective support for self-management, particularly related to home diagnostics, health monitoring and automated support. The development of technology to enable users to manage their own care is one of the most pressing issues and represents a substantial market opportunity.

The development of many new healthcare products requires extensive development and testing programmes, which generally involves technological evaluation including the use of specialist equipment or access to biological platforms, and also the testing of technologies with patients and public. In research performed in 2014 by Medilink SW key barriers to market entry in the sector were identified:

- The high costs and lengthy timescales, particularly associated with testing/trialling of technology, from idea to first product commercialisation can be prohibitive;
- The industry is fragmented and there is a particular issue with matching problem holders with technology providers;
- The range of skills required to develop Health Tech are broad and SMEs struggle to access all required expertise plus technologies of universities, healthcare providers and patients/ public are not easily available;
- There is insufficient recognition of the combined industry, NHS and academic activity in the region in the field.

The HTH addresses this market failure by supporting the development of innovative products that can be readily integrated into health and social care pathways. This is done by facilitating access by regional SMEs to a broad range of technical expertise and equipment to support development of their new health tech products, coupled with specific Health Tech sector business support where appropriate. The result is that companies are able to secure investment in and market adoption of their products. They are able to respond to opportunities rapidly and to take a leading international position. The strengthening of the businesses and increasing connectivity will ensure that the regional cluster is well placed to rapidly and continuously adapt to meet market and societal needs.

1.4 Project design

The Health Tech Hub project is focussed on providing technical support to businesses in conjunction with Health Tech specialist business support. It consists of 2 phases in the 3 year project.

The first involved the refurbishment of a 900m^2 facility in the UWE Enterprise Zone. This provided wet laboratories and workshops with specialist equipment to support the following activities, relevant to the development of health and wellbeing products:

- Measurement and analysis of materials
- Sensor system and diagnostic development
- Bioprocessing and biocompatibility analysis
- DNA based technologies and personalised systems development
- Electronic systems development
- Modelling and prototyping
- Product testing in 'real home' situation (living lab)

Full health and safety procedures are in place across all of the facility. The facilities are staffed by technical personnel at grades from technicians (E grade) to research fellows (G grade)) with expertise specific to their laboratory. This spectrum of facilities and expertise has proven to be highly appropriate for the requirements of businesses across the broad spectrum of HTH projects; in fact all eligible/approved companies were able to be supported through one (or more) of the laboratories. As a consequence of the breadth of the skills and equipment, the HTH was able to support (1) new companies spinning-out innovative and sophisticated technologies from the regional universities (9 companies); (2) new companies registered by health professionals, ranging from senior consultants to nurses and physiotherapist (5 companies) and (3) new companies set up by people who had previously worked in business (predominantly in technical roles) (5 companies).

The HTH supported businesses to develop and bring to market a spectrum of types of product, as shown in Fig. 1.1. This showed a good coverage across the range of areas originally envisaged.

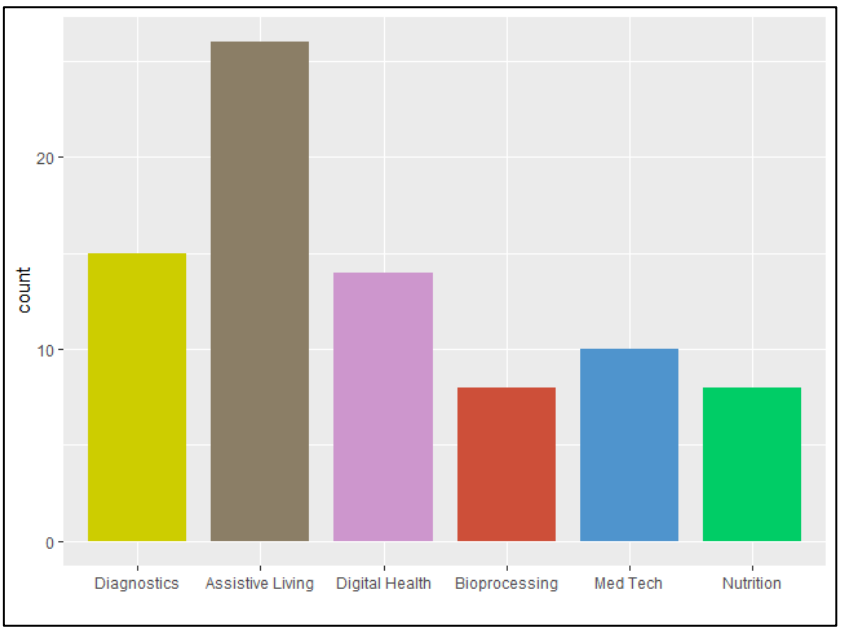


Fig. 1.1 Number of HTH businesses within each product area

The length of time taken to procure the contractor and complete the refurbishment of the HTH facility was greater than originally anticipated. There were two main reasons for this. The first was that the thorough procurement process - this allowed a large amount of time at each stage for potential contractors to engage with UWE to understand the requirements of the contract (particularly the specific ERDF requirements). The second was the environmental standard (SKA rating) to which the facility was built. This required a complex approval process in addition to the supplementary construction requirements. The consequence was that there was a delay in the completion of the facilities, which were fully functional in July 2018. To address this delay a small laboratory within the adjacent incubator facility, 'Future Space', was used to begin to set up equipment (where possible) and to deliver business support activity, such as product/prototype testing and new technology development.

The second phase of the HTH project involves providing businesses with access to the facilities and specialist expertise. Support packages have been tailored to each company's requirement. The HTH operates under three key strategic themes;

- ***Innovation into practice*** – Support has included the following:
    - Product evaluation including technical assessments, health economics evaluations and trialling of technology;
    - Product development support, including access to world class expertise and equipment;
    - Integrating research ideas to develop new products/services;
    - Testing of technologies in near real-world scenarios.
- ***Technology development*** - This strategic theme focuses on user-led R&D projects, carried out in the HTH facility, aimed at creating novel integrated technologies and systems for healthcare. Projects have included a) Development of new biosensor for newly discovered biomarkers, b) Development of wearable biosensing systems for home monitoring of patients with long term condition and c) Creation of novel rapid, low-cost home diagnostics.
- ***Business acquisition and support*** - This theme is aimed at developing linkages to create opportunities, better knowledge sharing and new market opportunities. It comprises:
    - Opportunity identification, including interdisciplinary workshops and specialist events;
    - Improving HEI/NHS/SME interaction, including showcase events and access to specialist knowledge;
    - Providing specialist business support to complement technical product development.

These 3 themes are providing an appropriate structure to deliver the target outputs – the output data is provided in section 2.3. All of the HTH's state-of-the-art facilities were utilised under themes 1 and 2 to deliver business projects and the resulting HTH project outputs. Fig. 1.2 shows the spread of facilities/laboratories that were used by the 44 companies who responded to the survey. Note that 'prototyping' involved a combination of the use of wet labs and electronic/product design facilities. The response of the businesses and stakeholders confirmed that the fundamental features of the project design were right for the economy of the region and the needs of the business at this time.

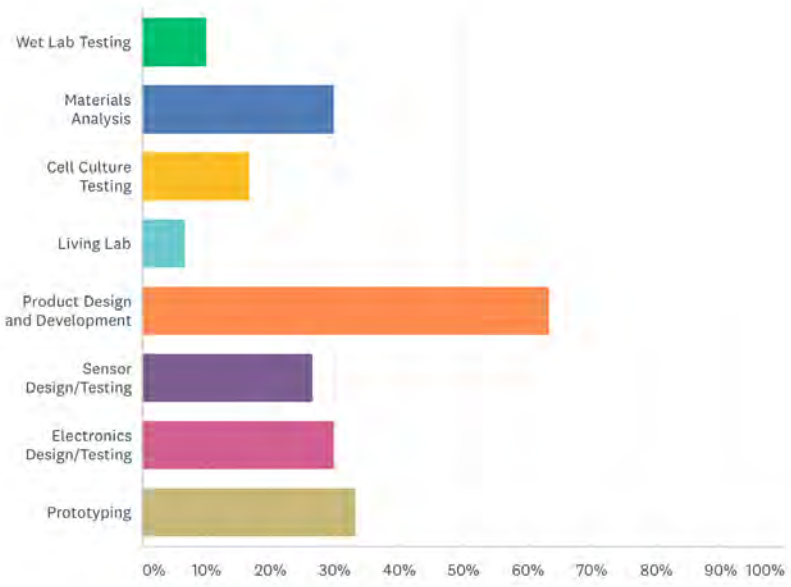


Fig. 1.2 Percentage of beneficiaries using each of the facilities (from survey data)

The strategy for the HTH was to offer specialist expertise and equipment to West of England SMEs for development of health technology, much of which was unique. The independent survey asked; 'Would you have been able to access these kinds of facilities elsewhere had it not been for the Health Tech Hub?' The results, presented in the table below, show that the majority of project beneficiaries would not have been able to access similar facilities without assistance from the HTH, with only 11% reporting they would be able to find these elsewhere. (There was no opportunity for the beneficiaries to add whether they would need to pay for this service and if this would be problematic for the SME.)

Response	% of beneficiaries
Yes	11
No	59
Don't know	30

1.5 Continued Relevance and Consistency

In policy terms, since the project commenced the UK government has initiated its Industrial Strategy White Paper. This is highly relevant to HTH businesses as it has as one of its core themes, 'Innovation to support the aging population' and many other positive messages for business, including increased investment in innovation and 'sector deals' to enhance partnership between government and business to increase productivity. The HTH project therefore remains relevant to policy at a national level. However, since the project commenced, the UK government's decision to initiate leaving the European Union has had a big impact on businesses. Some businesses had deep concerns about the impact on their markets and suppliers. Others reported greater reluctance of companies to invest in new ideas. Evidence that the HTH is important at regional level includes the following:

- HTH has been noted as a regional Centre of Excellence in the *2019 Health and Life Sciences Local Sector Skills Statement,* commissioned by the WELEP
- The HTH was identified as a key enabler to the growth of the MedTech and Digital Health sectors in the *WECA 2019 Local Industrial Strategy Evidence-Based Report*

- The HTH was identified in the *2019 WECA Industrial Strategy Summary* as being a facility to enable regional growth and expertise within the Ageing Society Grand Challenge
- The HTH is part of the WECA network of *Living Labs and the Global Centre of Innovation Excellence*.
- The HTH is identified as a key innovation asset in the TECARC (Technology, Enterprise and Connectivity delivered by Academia, Research & Commercialisation) development within South Gloucestershire.

Section 2: Project Progress

2.1 Progress Against Milestones

The project is progressing well against milestones. As described in section 1.4 the delay in the completion of the refurbishment of the facilities by approximately 5 months, was to some extent, counteracted by utilising a small, temporary facility in Future Space. This allowed the project to catch up, to some extend relative to profiled outputs. However, a Project Change Request (PCR) was approved in April 2018. This included the acceptance that the PO2 that the 'Public or commercial building renovated' – 900m^2 would be completed in 2018. (Further discussion of the PCR will be provided in sections 2.2 and 2.3.) The original milestones for the project are shown in the table below. A note is provided to indicate any deviation from the original due date.

Milestone	Date	Comment on delivery
Project start date	01/02/17	Completed by due date
Collaboration agreement with partners	01/03/17	Completed by due date
Date of submission of first claim	30/04/17	Completed by due date
Refurbishment work completion	01/10/17	This was delayed until 20/02/18
Recruitment of staff	01/12/18	The majority of staff were employed by this date.
Procurement of main equipment	01/03/18	Completed by due date
Practical completion	31/01/20	Completed by due date
Date of final claim	28/02/20	On target

Following completion of the refurbishment, the construction project was analysed by the UWE HTH project team and estates/building project team (including senior managers at UWE). A 'lessons learnt' document was created covering the following and identifying issues as red, amber and green (as an indication of their importance and impact on the completion of the project).

- Procurement
- Design
- Construction
- Contract administration
- Handover
- Defects
- User experience

A selection of the items from the document are presented below. This learning has already been implemented into other building projects at UWE.

Item	Impact	Recommendation
Procurement process appears complicated and protracted process given the size of the project.	Delayed project timelines and delivery of outputs.	Process adopted to follow EU procurement guidelines for funding but was cumbersome.
Incorporation of SKA requirements.	Specification had to be rewritten to incorporate SKA requirements which again caused delay in outputs and added cost to the project.	SKA process worked well for this type of refurb scheme. Generally agreed it is a good process but need to be aware of time and extra effort it takes to achieve. Use of external consultant (SCS) to guide through the SKA process worked
Specialist systems	The project involved ventilation systems along with specialist fume cupboards requiring specialist commissioning.	Include item in specifications for independent specialist commissioning engineer.
BIM	This was the first project the building contractor has worked on requiring BIM deliverables. At time of meeting the final model and asset logs had still not been delivered.	UWE to consider, when awarding contracts, the risk associated with a contractors capability to deliver BIM – seek assurances and put contingency arrangements in place if risk remains.
Stakeholders	Multiple stakeholders involved in the process – ITS, BSCL, security etc. – roles and authority unclear. Worked okay but came to the project late.	Earlier engagement with other stakeholders (beyond main users) should happen.
Health and safety	Noise and dust monitors installed in response to lessons learned from previous construction. Regular communications with neighbours, managed expectations well. No incidents to report throughout the project.	Fully understand surrounding environment, engage with neighbours and implement mitigation strategies to reduce nuisance
Snags	Due to progressive snag and thickening of Supervisor resource the snags at handover were relatively few – quality was good allowing End Users to move in.	Plan snag and handover process well in advance of Completion date.

2.2 Spend Profile

The amendment to the timing of the claiming of revenue and capital expenditure (total including ERDF and match contributions) requested in the PCR is shown in the table below. Since the change

request the expenditure has followed the required profile. At the project close, both the capital and revenue budget were fully spent.

	Revenue		Capital	
	Pre-PCR	**Post-PCR**	**Pre-PCR**	Post-PCR
2017	**£585,313**	**£296,791**	**£2,051,285**	**£2,007,100**
2018	**£939,407**	**£1,153,585**	**£40,811**	**£84,996**
2019	**£905,281**	**£973,207**		
2020	**£61,095**	**£67,513**		

Match funding contribution was provided in the large majority by capital funding associated with the refurbishment of the facility. The major contributors of match funding were the Local Enterprise Partnership and the University of the West of England. But additional small amounts of match funding were provided by the project partners P3 Medical, Sirona and Designability associated predominantly with business acquisition, business project reviewing and management of the project. Partner organisations (University of Bristol and Academic Health Science Network) were originally also intending to contribute match funding. However, the processes within these large organisations made it difficult for them to provide the required level of evidence of defrayal of their salary costs. Hence, no match was claimed associated with the activity of these organisations. Even so, they remained part of the Strategic Advisory Board and supported the project throughout.

2.3 Profile of Outputs

The original targets set for each of the outputs were realistic and the project has achieved (and in some cases exceed) the required figures, as shown in the table below.

		Total project	Audit ready
CO1	Number of enterprises receiving support	100	100
CO4	Number of enterprises receiving non-financial support	100	100
CO5	Number of new enterprises supported	10	21
CO8	Employment increase in supported enterprise	20	20
CO25	Number of researches working in improved facilities	14	14
CO26	Number of enterprises cooperating with research entities	45	54
CO28	Number of enterprises supported to introduce new to market products	19	19
CO29	Number of enterprises supported to introduce new to the firm products	25	25
PO2	Public or commercial buildings built and renovated	900	900

Fig. 2.1 shows below show the range of businesses that were supported by this project, categorised by number of employees. The majority of these were micro companies and many had only one employee. For these companies a key challenge was development of prototypes, for example to be used to obtain investor funding. As nearly all these were high tech, healthcare products, prototype development required skills and equipment that were not available to them without the HTH. Many

of the businesses were developing their first product. The HTH project also supported the development of second or other new, innovative products for established businesses.

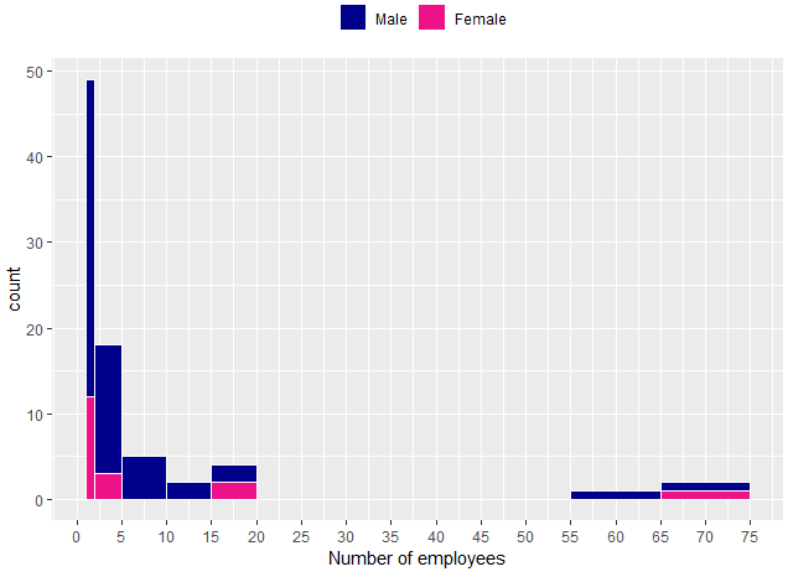


Fig. 2.2 Profile of the number of employees in businesses supported by HTH

The HTH has supported more new companies than was originally predicted. Over half the beneficiaries carried out collaborative projects with research organisations, illustrating the innovative nature of the work. All of the companies that have been supported are developing one or more new products, nearly all of these are highly innovative products and there are no similar products on the market. This figure was realistic as there has been less than a year between the business support activity and the end of the project for many of the businesses and for high tech companies it frequently can take significantly longer than this to gain the investment or revenue from products to allow an increase in employment numbers. However, it is predicted that many new jobs will be achieved within the next 2 years. Finally, 900m^2 has been renovated to create the HTH facilities. The number of people working in 'improved research facilities' has also reached the predicted target indicating that the HTH is a attractor for new research and innovation activity.

Section 3: Project Delivery and Management

3.1 Governance and Management Arrangements

The Health Tech Hub project is managed by a team from the University of the West of England and supported by representatives from partner organisations; Designability, P3 Medical, University of Bristol, Sirona and the West of England Academic Health Science Network. The primary governance mechanism comprises the HTH Management Board at operational level and the HTH Advisory Board at strategic level.

The Strategic Advisory Board provides guidance on matters of policy and strategic directions including decisions on priorities and new areas for activities. In addition, the Board is provided with an overview of the businesses supported and provides guidance on proposal approval criteria. The Board is constitution includes senior representatives from each of the delivery partner organisations, the HTH Directors and the HTH Programme Manager. The Board has met every 6 months, the HTH Director/HTH Management Board Chair providing a report on progress and receiving input to steer

the HTH Management Board. The fact that the group of partners spanned a range of organisations, including businesses, health and social care bodies and another university, gave a wide spectrum of perspectives which was critical in this complex sector. Each partner representative was not only senior members of their organisation, but also well networked in the region which was also highly valuable to raise the profile of the HTH and to ensure the complementarity of the HTH activities with other initiatives in the region.

Decisions on operational delivery and financial accountability lie with the HTH Management Board. The Board is chaired by the HTH Directors and includes the HTH Programme Manager, Finance Officer and representatives from UWE and delivery partner organisations, as appropriate. The Board has met every two weeks throughout the course of the project. The HTH Management Board ensures good management of delivery and working relationships with stakeholders. The Board reviews progress against the activity plan and monitors progress of on-going projects. With guidance from the Advisory Board, the Management Board also makes decisions on whether projects should be supported. This approval process has allowed project proposals to be reviewed and decisions on whether to support businesses to be taken rapidly, thus streamlining the procedure.

In order to evaluate this process the beneficiary survey asked; 'Please rate your experience of working with the Health Tech Hub team'. The results are shown in Fig. 3.1.

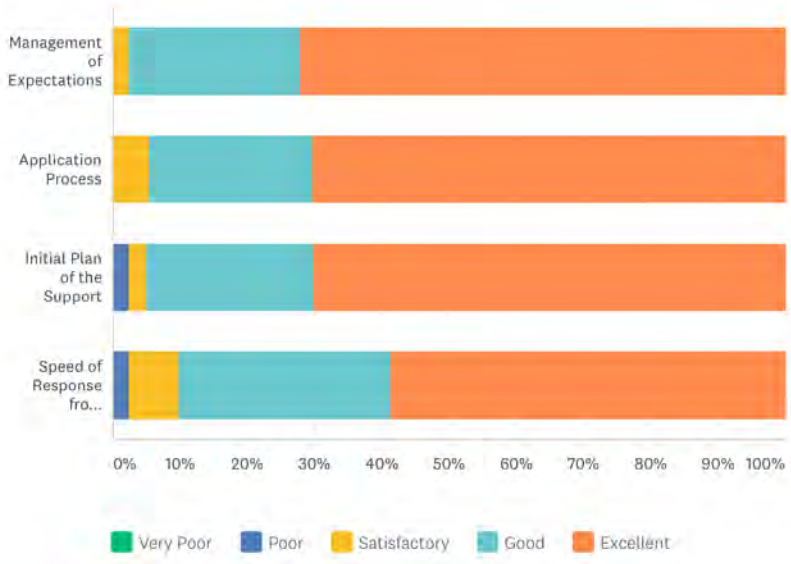


Fig. 3.1 Beneficiary rating of engagement with the HTH team

The majority of beneficiaries rated their experience of working with the team highly. All aspects were deemed as 'good' or 'excellent' by over 90% of survey respondents. This included; the management of expectations, application process, initial plan and speed of response. From the 44 businesses that responded to the survey, the speed of response received the most poor (1 business) and satisfactory (3 businesses) results. This is related to the fact that some scheduling of resources was required to ensure delivery of the all business assists, necessitating some delays in the completion of a few business projects. The positive response to the Management of Expectations question indicates that beneficiaries were kept aware of the timetables (even if they would prefer the work was performed more quickly!).

3.2 Delivery Structures and Team

The Management team consists of the two Directors, the programme manager and the technical manager (each working approximately half-time on the project.) Technical support for businesses is delivered by a team of Technical Specialist. One specialist was responsible for each of the 7 main laboratories. The expertise of the staff covers the following areas: Electronic circuit/system design, Embedded systems, Prototyping, Cell biology, Microbiology, Sensor science, Molecular biology. In addition, when required to deliver business projects other UWE academics/researchers have been brought in to assist to ensure that the deliverables are achieved. The importance of the breadth of expertise is highlighted by the range of products under development by the HTH businesses (see Fig. 1.1) and the range of facilities utilised (see Fig. 1.2).

The admin team for the project comprises: (1) a finance officer to oversee the expenditure to ensure it aligns with the spend profile and to guide staff on eligible spend as well as to cover preparation of claims; (2) a Marketing and Events Officer who is responsible for HTH communications, management of an engagement database and the coordination and delivery of a HTH programme of events and (3) an administrator, supporting the delivery of activities, to gather evidence from beneficiary companies and to ensure successful EU reporting.

The delivery team proved highly effective and committed. Although on fixed term contracts, none of the staff left the HTH project prior to the end of the project.

The partner organisations have been critical in ensuring successful delivery of the HTH project and achieving the associated outputs and outcomes. All partners have been actively involved in the HTH project through the Advisory Board and more frequently, via other meetings/discussions. Examples of where their expertise has been used most frequently required are provided below.

- Sirona (a community interest company that delivers social care support within the community) - insights in to what independent living technologies are needed for home use, the size of the market and how to access this.
- West of England Academic Health Science Network (funded by NHS England) – understanding of the current NHS challenges seeking technological solutions, the NHS processes for procuring technology and methodologies for successfully getting a technology adopted.
- University of Bristol – knowledge of research activities within relevant fields within the UK, allowing appropriate collaboration for the beneficiary companies to be identified.
- Designability (a charity that focuses on development of practical solutions to supporting people with disabilities) – insights in to social acceptance aspects of health technology development.
- P3 Medical (a regional SME) – understanding of the requirements and challenges associated with translation from small volume prototype development to high volume manufacturing of medical devices.

3.3 Engagement with Beneficiaries and Quality of Support

3.3.1 Marketing and promotion

Stakeholders agreed that the HTH marketing and promotion had been effective in attracting good quality businesses. It was noted that some of the promotional activity was carried out in conjunction with the regional organisations, such as the West of England, Academic Health Science Network and the regional incubators. This is an excellent example of the team joining up with other business support providers.

When the HTH commenced, a substantial database of relevant businesses was already in existence from previous projects that the HTH Directors had delivered, from HTH partners and from the data

collection activity that had been undertaken as part of the project development process. The Refurbishment Phase of the project, in 2017 provided a good opportunity to raise awareness of the services offered by the HTH through a series of events. A number were organised by the HTH, whilst others were managed by partners/collaborating organisations, at which a member of the HTH management team presented. Throughout the project period, the HTH team delivered an average of 11 events per year, ranging from specialist workshops with 15/20 people to a major conference with over 150 attendees. The team also publicised the project through social media and has drawn on partners to help with promotion. As shown in Fig 3.2, evidence gathered through the beneficiary survey suggests that the majority of beneficiaries heard about the HTH from representatives of the University of the West of England (probably members of the HTH). Other successful forms of beneficiary recruitment included networking events and direct contact by the HTH team. 'Other' responses were consultants and Oxford Innovation.

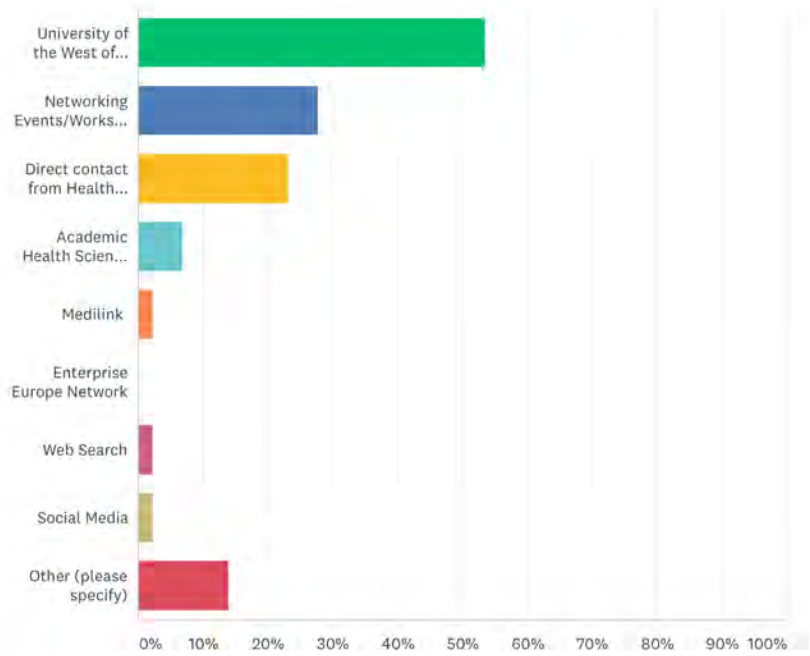


Fig. 3.2 Percentage of companies attracted by various business acquisition routes

During the course of the project a number of case studies were created – examples are provided in Appendix 1. Businesses identified that the case studies were a good method to allow them to understand the types of support available to them through the HTH. In addition, a number of short 2-3 minute "talking head" videos were produced where companies were able to discuss their innovation and how the HTH enabled them to accelerate the development of their products. These short videos are available on the Health Tech Hub Website.

The HTH delivery team themselves have reflected that there was potential for greater promotion of the project's successes and celebration of its achievements and will seek to do this even after the project has ended.

3.3.2 The customer journey

The HTH team has considerable experience of delivering ERDF projects. Building on their knowledge, they created a customer journey that allowed beneficiaries to engage simply and flexibly with the HTH whilst retaining a rigorous evaluation and project preparation process. The HTH has been commended on the comprehensive nature of the baseline data collected from the beneficiaries. Business are attracted to the HTH through Business Acquisition activities, including promotional

activities described in section 3.3.1. Companies were invited to propose possible project ideas. However, in the majority of cases the first step in the process involved meetings between a member of the HTH management team, supported by technical staff, and senior management of the business, regarding their business plan and plans for product development. Through these discussions a project that was both critical to the product development pathway of the business and fulfilled the eligibility criteria for the HTH project was developed. Once the project proposal had been formulated, an Initial Engagement Form was completed by the business. Then both the project and business were reviewed by the HTH Management Board. Projects that fulfilled the eligibility criteria, plus the requirements specified by the Advisory Board, were accepted.

3.3.3 Feedback on business support

Feedback from beneficiaries and stakeholders demonstrated that the SMEs experience of engagement with the HTH was highly positive, informal views being obtained throughout the project and more formal feedback being gathered via the beneficiary survey. For example, in response to the survey question 'Please rate the elements of the help you were given', the beneficiaries replied as shown in Fig 3.3.

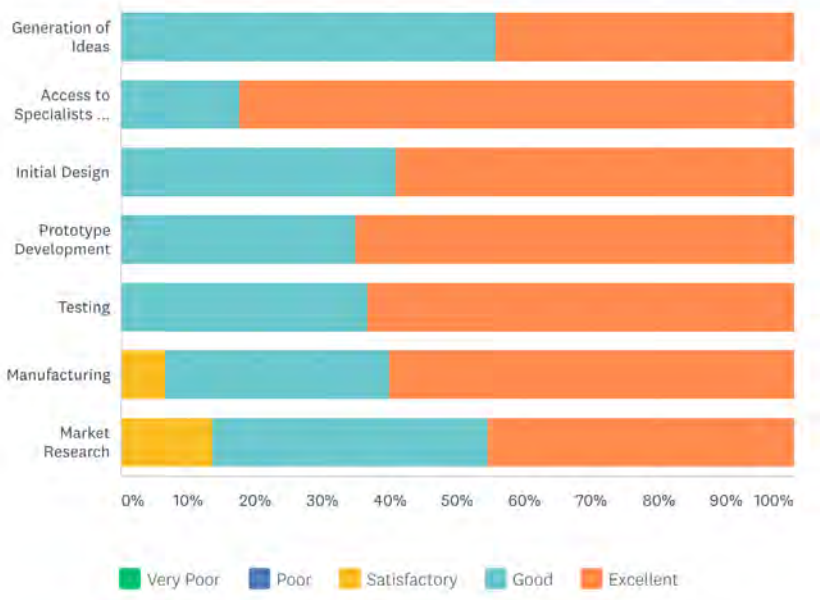


Fig. 3.3 Beneficiary rating of the various areas of business support

All elements of the support provided were well received with no aspect receiving a 'poor or 'very poor' rating. Over 50% of respondents rated testing, prototype development and initial design as excellent. 82% of beneficiaries rated the Health Tech Hub specialists and the equipment provided as excellent.

In the independent survey, the beneficiaries were also asked to rate their HTH experts. Fig 3.4 shows the data obtained. This demonstrated that the academic experts assisting HTH beneficiaries have provided a 'good' to 'excellent' service. 100% of respondents thought the experts where professional, competent and knowledgeable. At least one in two project beneficiaries felt the HTH Experts where 'excellent' in all of the above aspects, making them potential recommenders for the HTH project and for working with a University.

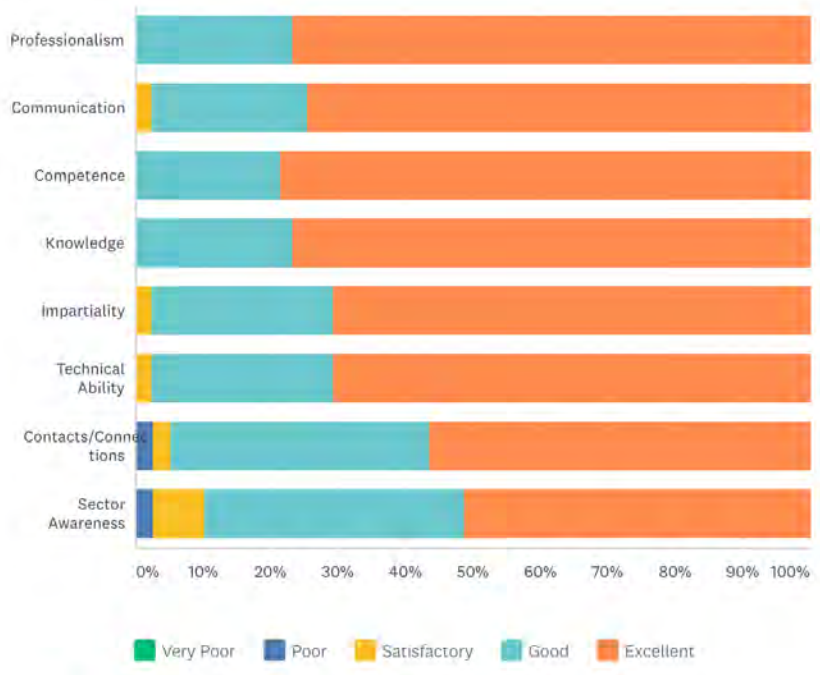


Fig. 3.4 Beneficiary rating of the HTH academic experts

After each event, participants are encouraged to complete feedback forms. We used these to record statistics related to gender and ethnicity of the attendees (see section 3.5.1) and to establish examples of best practice or areas for improvement. Responses from participants concurred with feedback from the many events run by the UWE team previously, i.e. attendees at events liked: (1) a good balance between presentations and networking time; (2) thought provoking and informative presentations and (3) information on business support opportunities. The team ensured that the event programmes fulfilled these requirements. The HTH team also responded to comments that suggested that some presentations were too lengthy, by scheduling shorter (punchy) presentations in subsequent events. In general, this has been very positively received by attendees and was a key feature of events in 2019.

3.4 Engagement with Other Business Support Providers

The HTH team has been active in sign-posting companies to other business support schemes where appropriate. This has meant that even when the HTH cannot provide support directly to a business, other avenues for assistance are available. This was facilitated by the HTH management team and partners wide range of collaborators/contacts across the region. For example, the West of England Academic Health Science Network has a range of business support schemes, which many of the HTH companies also benefited from. The HTH also directed companies to other business support programmes run by UWE, for example the Scale-up for Growth (S4G) programme.

The team has also developed a mutually supportive relationship with the key incubator facilities in the region. The HTH supported many companies located in these incubators, but also sign-posted new, or new to the region, companies to these facilities. All of the regional incubators have associated business support and structures to support networking.

3.5 Cross-cutting themes

3.5.1 Equality & diversity

A number of actions were taken to promote equality and diversity during the project.

- Many businesses has been supported to develop new products aimed at assisting people to live independently, whilst being supported, in their home. This is particularly relevant for older people and those with chronic diseases, promoting equality by having positive impact on human health and disability
- The HTH facilities have been designed so they are fully assessable to people with disabilities - both those who are located on the site and also visitors. There is also assessable parking close to the HTH entrance.
- All job opportunities have been advertise in accordance with UWE equality policy. Part time and flexi-time options have been selected by some members of staff.
- A diverse set of positive role models have been prominent in all events and promotional materials to ensure an open welcome.
- Activities of the HTH have been promoted through a web portal that is fully accessible.

Gender: The gender imbalance in the Tech Sector is pronounced. This was noted in our statistics (see table below) which showed a greater than 3:1 difference in the number of male to female senior management representatives (usually the company CEO) that engaged with the HTH (and signed the Initial Engagement Form). For individuals who were recruited into the beneficiary business following HTH support (New Jobs Form) the difference was smaller (just over 2:1). However, attendees at events buked this trend, with slightly more than 50% of the attendees being women. The fact that events were publicised with diversity in mind and sought to select a balance of presenters to encourage inclusivity, may have had some bearing on this outcome.

	Female	Male	Prefer not to say
Initial Engagement form	23%	75%	2%
New jobs	31%	69%	0
Events (average)	52%	47%	1%

Ethnicity: The ethnicity data showed less pronounced, but similar results to that of the gender statistics (see table below).

	white	Multi-ethnic groups	Asian British	Black/African/ /Black British/ Caribbean	Prefer not to say
Initial Engagement form	83%	4%	3%	2%	8%
New jobs	85%	15%			
Events (average)	71%	5%	6%	2%	16%

Disability: We only requested data relating to disability from beneficiaries (the senior representative of the company who completed the Initial Engagement Form) and for the newly appointed staff in beneficiary companies (New Jobs). 6% of the individuals interacting with the HTH declared themselves as having a disability. It is pleasing that the HTH is sufficiently accessible to encourage individuals with disability to seek product development support.

	Yes	No	Prefer not to say
Initial Engagement form	6%	82%	12%
New Jobs		100%	

Age: Individuals' ages were recorded only from the Initial Engagement Forms and from the New Jobs Forms. A broad spread of ages was recorded in both cases; pleasingly there was both younger talent as well as individuals with greater experience.

	16-24	25-29	30-34	35-39	40-45	46-49	50-54	55-59	60-64	65+
Initial Engagement form	8%	14%	6%	9%	3%	11%	17%	4%	10%	10%
New jobs	8%	46%				8%	23%	8%	8%	

3.5.2 Sustainability

The HTH strategy for sustainability was focussed on the development of the facility. To ensure that the work was completed to a high standard with respect to sustainability, it was carried out under the scrutiny of sustainability consultants, *Sustainable Construction Services (SCS)*. SCS assessed the work relative to the SKA sustainability standard. As this was a refurbishment rather than original build this posed multiple challenges where current systems could only be modified (rather than replaced), without considerable waste and expenditure. Nevertheless, a silver standard for the fit-out sustainability (SKA rating) was achieved.

Section 4: Project Outcomes and Impact

4.1 Impact on beneficiary businesses

Throughout the course of the HTH project period informal feedback had suggested that there had been significant impact on the beneficiary businesses. This was confirmed in the survey when businesses were asked about the key impact of the support. (The aim was to focus on what might have happened in the absence of the intervention in a qualitative sense.) This question received a total of 40 responses, out of the 44 companies which completed the survey. The response was 98% positive with only one response of 'none'. (It is to be noted that for one of the companies, an extensive technical and business survey, performed by the HTH as the business assist activity, indicated that there was no market for the product proposed. Consequently, although this was essential information for the business, it could be interpreted that this had no positive impact. This may provide an explanation for the 'none' response.)

Businesses were also invited to provide a written explanation of the impact. Five example responses are set out below:

1) "Added science and technical expertise to our in-house industry knowledge."
2) "Working with the HTH has led us to the point where we are preparing to launch a highly disruptive service."
3) "The hub has linked our group of service businesses to a range of potential customers that will gain from our skills and provide additional turnover to us."

4) "The work with the HUB has shown that we can remove a range of drugs and other priority substances from wastewater. This will be an important part of our technology USP."
5) "HTH provided data analysis of thousands of data points comparing venous vs. capillary blood test results to ascertain any significant difference in the collection methods. This has enabled us to provide evidence to counteract the belief that capillary samples are an inaccurate form of blood testing."

The HTH beneficiaries reported a wide range of benefits when asked in the independent survey about improvements to their business processes, as shown in Fig 4.1. These were increasing sales, improving operations, accelerating product development/commercialisation, improving understanding of your new products and services, acquiring new skills for entering new markets, enabling access to finance, improving understanding of IP strategies and developing new contacts/ partnerships. Over half of beneficiaries reported that the HTH support had helped them accelerate product development and develop new contacts/partnerships.

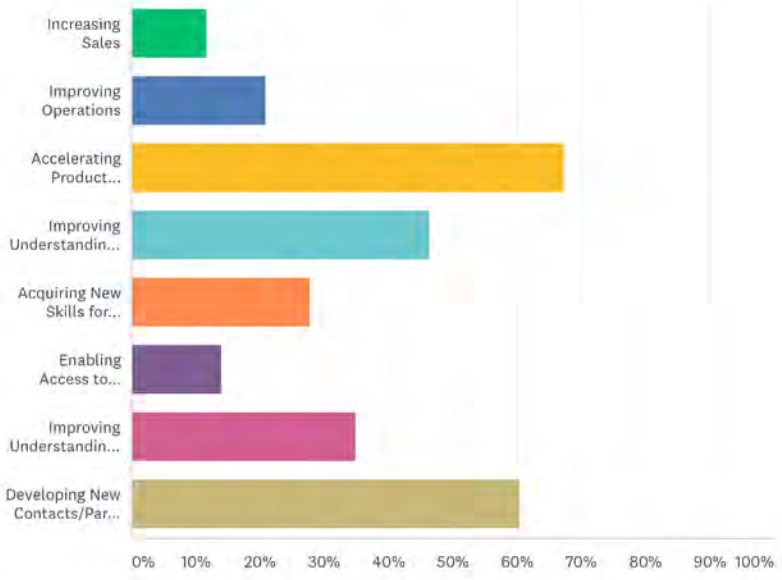


Fig 4.1 Percentage of beneficiaries recording impact in a range of business areas

In order to establish whether beneficiaries believed HTH support enhanced speed of commercialisation of their product, the survey asked, 'By approximately what % has the Health Tech Hub support reduced the amount of time it will take/has taken to commercialise your product'. 71% of beneficiaries said the support provided had reduced the time it has/will take to commercialise their product, as shown in the table below. 31% of these companies have reported support reduced the time it will take by up to a quarter. 17% reported the support had more than halved the time it would take.

% Reduction in Time	Number of Beneficiaries
75% - 100%	4
50% - 74%	3
25% - 49%	9
1% - 24%	13
0%	12

Considering that the beneficiaries were developing Health Tech products and the time to commercialisation is notoriously long (>5 years), these time scales are significant i.e. the reduction in time could be greater than 5 years.

Similarly the survey asked about percentage reduction in costs of commercialisation. 67% of beneficiaries reported that support provided had reduced the costs involved in product commercialisation, with 13% reducing costs by at least half the amount spent prior to engaging with the HTH.

% Reduction in Costs	Number of Beneficiaries
75% - 100%	1
50% - 74%	4
25% - 49%	9
1% - 24%	13
0	13

In the beneficiary survey, businesses reported a range of risks that the HTH project helped them to avoid. This question received 37 responses. Some of these were general, for example:

- Increased cost and delays
- Overcoming regulatory hurdles and red tape
- Maintaining creditability
- Choosing the wrong sector/clients
- Economic disruption caused by BREXIT
- Ensuring the product fits the client's needs
- Avoiding company closure

Whereas other respondents provided more specific examples:

- Allowing better sampling to avoid manufacturing issues and product reliability
- Environmental considerations caused by the spread of waste
- Avoidance of 'un-viable' materials

4.2 Impact on beneficiary behaviour

To understand the impact of the HTH support on behaviour, the beneficiary survey asked firstly, 'Has the help you received positively changed your approach/behaviour?' and secondly; 'Is it still positively influencing your approach/behaviour now?' The results are shown in Figs. 4.2 and 4.3 respectively. All respondents have experienced at least 'A little' change in their approach/behaviour as a result of support. 59% of beneficiaries reported that these changes continued to have a positive impact and influence them, 'Completely' or 'A lot', demonstrating the project has had enduring benefits.

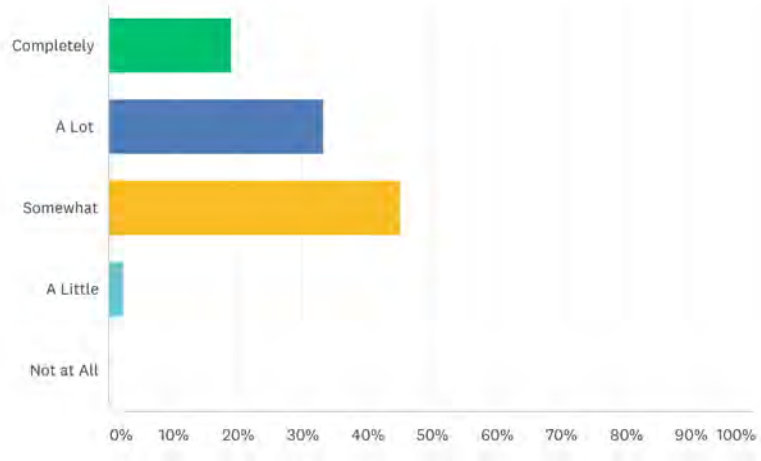


Fig 4.2 Percentage of beneficiaries recognising a change in behaviour

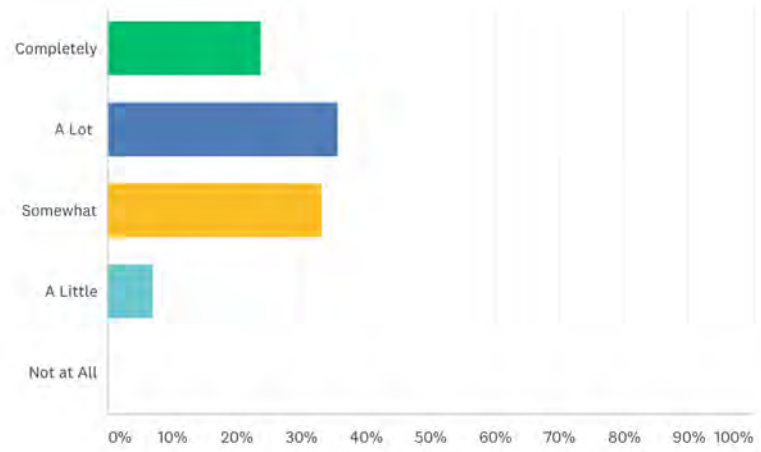


Fig 4.3 – Percentage of beneficiaries still recognising a change in behaviour now

The survey assessed the personal impact on the senior member of staff from the beneficiary company who completed the survey (typically the CEO/Managing Director). This was of particular importance as many of the business supported by the HTH had a small number of, or a single, employee(s) (as illustrated in Fig. 2.2) – therefore the impact on the individual was highly significant for the business. The results from this section of the survey are shown in Fig. 4.4. Approximately one in two of those supported by the HTH recorded that they had received all of the following benefits from the intervention: 'Increased confidence in their approach', 'Acquired new knowledge', 'Confirmed their current approach' and 'Strengthened their network'

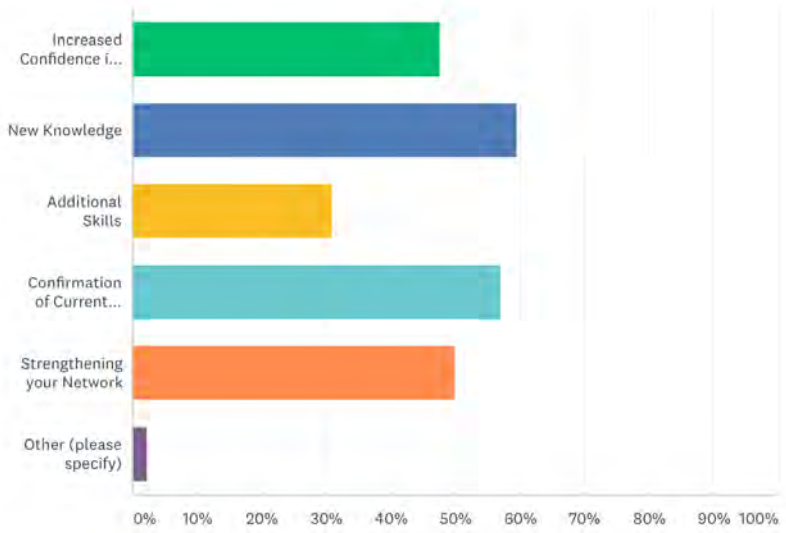


Fig 4.4 Percentage of beneficiaries indicating a personal impact across a range of areas

4.3 Added value

The strategic plan for the HTH project, including the project targets, was summarised in the logic model, (created during the HTH project application stage) and is presented in section 1.2. All of the outputs and outcomes have already been achieved. (The current situation is shown in section 2.3). Progress has already been made towards the impacts defined, but these will continue long after the end of the project. Details of the current status of each is shown below:

Increase in related private sector R&D activity: In order to assess this the beneficiaries were asked 'By approximately what % have you increased your R&D investment as a result of assistance from the Health Tech Hub?' The results from respondents are shown in the table below.

Investment	Number of Beneficiaries Reporting that Increase
100%	2
75-99%	3
50-74	5
25-49	3
1-24	12
0	15

40 beneficiaries responded to this question and from this data the following was concluded.

- 62% of beneficiaries reported an increase in R&D investment as a consequence of the support provided by the project.
- Where there was an increase in R&D investment, the majority of beneficiaries reported an increase of between 1-24%.
- Based on the data available, the project has stimulated at least £1,501,315 of additional beneficiary R&D investment in the 44 companies that completed the survey at this very early stage after the completion of the business support activity.

Increase in number of successful HEI collaborations: The high tech nature of the projects meant that there were many opportunities for businesses to benefit from the expertise available in regional

HEIs. The data on HTH project outcomes shows that 52 (7 over target) collaborations between businesses and research organisations were created to deliver support; 50 of these are with HEI. In addition, other connections were also made by the HTH team between HEI research groups and businesses to support R&D activity beyond the scope of the HTH project.

Strong and vibrant health tech sector: There are several pieces of evidence to show that the HTH has enhanced the Health Tech sector in the region including:

- An new, extensive programme of well-attended events in the region, including the monthly "Teki-breki" for the Health and Life Sciences Sector.
- Increasing numbers of companies joining Medilink South West, the regional expression of Medilink UK (the major Health/Medical Technology trade organisation)
- Increasing number of Health and Life Science companies being reported in the West of England by the Office of Life Sciences
- Overseas companies approaching the West of England as a result of the HTH and the strong networking within the sector.

National and international centre of excellence: Evidence that the HTH is now recognised as a centre of excellence includes:

- Visit from prominent individuals e.g. Tim Donohoe, (Chief Technology Advisor, Department of Health), Chris Skidmore, (Minister for State, Department for Education and the Department for Business, Energy and Industrial Strategy), Mahesh Sooriyabandara, Managing Director, Toshiba Research UK, Prof. Maneesh Nerurkar, Head of Science and Technology, Procter & Gamble.
- HTH is a member of a national network to support companies developing sensor technology. The network includes the National Physical laboratory, Sensor City, CENSIS and the Centre for Process Innovation (CPI). The HTH has a particular focus on point of care diagnostics and biosensors for health monitoring.
- International delegation visits to the HTH to learn how the HTH engages with industry, from the Dutch Ministry of Education, University of César and Technological University of Bolívar.
- Developing an R&D collaboration with Malaysia through CREST (an organisation of high tech businesses and academia) and Taylor's University.

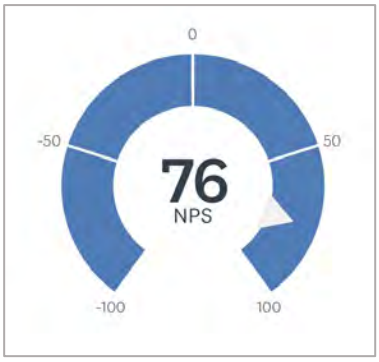
Greater number of people able to manage their medical condition in their own home: To date evidence has been provided for 25 businesses supported to bring new products to market. As majority of the business support has been completed within the last year and there is a long lead time to commercialisation of Health Tech products, at this stage the majority of beneficiaries are still progressing towards commercialisation of their products. Approximately 65% of the businesses are creating products that with be used in the home to support people's health and well-being. Consequently, in due course, there could be as many as 65 new products helping people in their own homes as a consequent of the HTH activities.

4.4 Value to the business

To establish overall client satisfaction, the Net Promoter Score (NPS) method was used. NPS is a commonly deployed index to measure the willingness of customers/clients to recommend an organisation's products/services to others. This method is utilised to assess overall customer satisfaction across a wide variety sectors and industries. The score below is based around this method:

Promoters	Passives	Detractors
Score of 9/10	Scores of 7/8	Scores of 0/6
Had a great experience, will keep buying and tell others	Satisfied clients but unenthusiastic about the	Unhappy clients Negative word of mouth
HTH = 32	HTH = 10	HTH = 0

The total NPS score for the HTH was calculate to be 76. This is an extremely high score. Whilst there are no specific metrics for Business Support in the UK, Temkin Group in the USA published statistics around the range of NPS by sector in 2015. In an analysis of 20 sectors including 10,000 companies, they found the average Net Promoter Score to be just 23.7. As further comparison, Nationwide Building Society in the UK was considered to have the best NPS (45) in a study undertaken in 2017. For comparison Starbucks (a World Leader) has a NPS score of just one more than the HTH at 77. The average ERDF Project NPS is currently 51. This gives real confidence that clients of the HTH not only had an extremely positive experience, but will also tell others about it and encourage others to benefit from the support.



Section 5: Project Value for Money

In order to get an approximate feel for the value of the support to beneficiaries, the survey asked, 'Overall, what value would you place on the help you received? It was obviously very difficult for business to accurately respond to this question. However, 27 beneficiaries offered a variety of values up to £150,000. On average, beneficiaries felt the support they experienced was worth £20,737. Whilst responses were requested in £'s some beneficiaries provided a narrative response. These were all positive and included:

- "Priceless"
- "Tens of thousands, possibly hundreds of thousands in the longer term"
- "It's been a great help thank you"

The two main economic impact/outcome indicators we have assessed are:

1) Full-time equivalent jobs created by the project support
2) Annual gross value-added output directly increased as a result of the support

To assess the economic impact of the project on each indicator the project management information along with the survey of beneficiaries was analysed. In the survey, beneficiaries were asked direct questions regarding the impact of the support they received on each indicator. The baseline situation on each indicator was established from the project management information system.

The gross and net additional impacts of the project support on FTEs and GVA are shown in the table below. The table also shows the direct impact of the project support before any additions were made for supply chain impacts and induced impacts. The direct impact can also be viewed as the 'on-site' impact of the project support. Breakdowns for leakage, displacement /substitution and deadweight have also been provided. Please note that the survey findings have been 'weighted' to reflect all project beneficiaries rather than those that responded to the survey.

	Measure	Unweighted	Weighted
Impact indicator: Employment unit = FTE	Direct Impact	44	86
	Gross Impact	76	148
	Leakage	15	30
	Displacement /substitution	15	30
	Deadweight / reference case	11	22
	Net addition	34	66
Impact indicator: GVA unit £s	Direct Impact	£200,000	£391,000
	Gross Impact	£329,000	£642,000
	Leakage	£68,000	£133,000
	Displacement /substitution	£65,000	£127,000
	Deadweight / reference case	£0	£0
	Net addition	£195,000	£ 382,000

FTEs: The direct on-site employment impact of the project support was that it created 44 - 86 FTEs. This rose to 76 - 148 Gross FTEs in the West of England once supply chain and induced impacts were added. Following deductions for leakage, displacement / substitution and deadweight, the project support led to the creation of 34 - 66 FTEs in the West of England LEP area.

GVA: The direct on-site output impact of the project support was that it created £200,000 - £391,000 of GVA. This rose to £329,000 - £642,000 of Gross GVA in the West of England once supply chain and induced impacts were added. Following deductions for leakage, displacement / substitution and deadweight, the project support led to the creation of £195,000 - £382,000 of GVA in the West of England LEP area.

It is important to note that majority of the beneficiaries had received support within 1 year of the survey (some within 1 month). Consequently unsurprisingly, the turnover of these companies had not increased substantially since recording the value at the Initial Engagement stage. However, the expectation of many of the businesses was that this figure would increase rapidly over the next year. The following have been recently achieved by HTH businesses:

- £12M private investment
- 4 companies awarded Innovate UK grants in 2019 with total value of £1.8M
- 3 companies received innovation awards: British Invention of the Year 2019 Award (The British Invention Show), National Innovation Award (Medilink UK), OBN Business Award for best start up.

Section 6: Conclusions and Lessons Learned

6.1 Overall Assessment

Evidence suggests that there was a strong rationale for the Health Tech Hub (HTH) project at the time of the application and it was designed to address a clearly identified market failure. The project was also well designed for delivering sustainable business growth. The original output targets were appropriate; the project has reached or exceeded all targets.

During the first phase of the project, a 900m^2 facility, with state-of-the-art equipment to support businesses to develop their Health Tech products was developed. The range of types of product and the recorded usage of the facilities made it clear that the range of wet labs, workshops and testing facilities were appropriate for the business support requirements. Furthermore, feedback from the

beneficiaries established that the team of technical experts employed to support the businesses had the appropriate assortment of skills. The HTH team were highly rated by the businesses, all citing their competence and their knowledge as “excellent” or “very good”. The beneficiaries confirmed that the HTH offers, in the main, a unique service as only 11% of respondents to the survey indicated that they could find a similar service elsewhere.

The HTH project has supported a total of 100 businesses. Performance has been very strong in relation to new businesses assisted, and collaborations with research organisations. The fact that both of these targets have been exceeded relates to the businesses that benefited from the use of the HTH expertise and facilities were mostly highly innovative R&D companies. Most companies were early stage and developing their first product (the majority less than 5 years old). Most of the products were high tech requiring expertise in multiple disciplines to create devices/systems that could have positive impact on a citizen’s health and well-being. Even though most of the business projects have been completed less than a year previously, 19 CO28 and 25 CO29 outputs have been recorded.

Overall, there is evidence to show that the project is well managed. The HTH team have a good understanding of ERDF requirements and are able to deliver a compliant project, whilst also providing valuable support to beneficiaries. The HTH capital and revenue budgets have been fully spent. The HTH management team are assisted by a strong Advisory Board, including influential and well–connected partners, which steer the project and oversee the beneficiary project approval. The quality of the data collated throughput the project was noted as being particularly high. The management team were resourceful and although there was a delay of 5 months, associated with phase 1 (the completion of the refurbishment of the HTH facility), the team mitigated this problem by utilising a temporary laboratory in the adjacent incubator facility. However, this still meant that full momentum on business support was achieved later than predicted and a PCR was used to redistribute the CO1 and CO2 outputs to compensate for this. The total numbers remained as defined in the original contract.

Impact of the project is evident in a range of areas. Beneficiaries recognised the importance particularly associated with accelerating product development and developing new connections, including with research organisations. Other demonstrations of the impact of the HTH project include evidence that the HTH is recognised as a Centre of Excellence and the contribution that the HTH has been made to boost the West of England Health Tech sector The HTH project has also initiated a change in the profile of activity of beneficiary businesses, with over 60% already reporting an increase in R&D. After adjusting for additionally, the net economic impact at the time of the survey (October 2018) within the West of England region was calculated to be 66 additional jobs and £298k GVA. The GVA figure, in particular, is quite misleading as it was calculated from annual turnover and considering that for the majority of businesses the business assistance and the beneficiary survey occurred in the same year, it is unsurprising that there was no increase.

Feedback from the beneficiaries proved to be highly complimentary of the support provided with all beneficiaries rating the generation of ideas, access to specialists/equipment, initial design prototype development and testing elements as excellent or very good. Furthermore, the Net Promoter Score (NPS) from the beneficiary survey, i.e. a measure of customer/client satisfaction, was extremely high compared with other ERDF projects, i.e. NPS = 76 for the HTH compared with an average of NPS = 51.

Overall, it is clear that HTH really has made a difference to the businesses in the region and there remains a rationale for this sort of project to continue.

6.2 Lessons Learned

One of the most significant findings to emerge from the evaluation in policy terms is that for rapidly expanding, high tech sectors, such as Health Tech, where a broad range of skills are required to generate a product and highly motivated innovators come from a range of backgrounds, then projects like the HTH are extremely valuable tools for stimulating sustainable business growth. The evaluation findings show that, for the most part, the business growth simply would not have happened (or would have happened much more slowly) in the absence of this external support. The HTH project has been very highly valued by the beneficiaries and a few areas of best practice as well as lessons learnt, which may be useful to future projects, have been identified. These are:

A broad range of skills and equipment within the HTH were essential to respond flexibility to the requirements of beneficiary business and to overcome key obstacles to commercialisation of the business' new products.

In-depth analysis of the business, particularly for recently established businesses, alongside discussion of the project proposed by the business or the HTH team is essential to ensure the best package of work was devised to maximise the value of the intervention.

The scope of the beneficiary project must be clearly defined in an agreed project plan to manage expectations and to prevent 'project creep'.

It is important to have Management Board that meets regularly to assess projects, to ensure an agile response to business project applications.

A detailed programme of follow-up activities with the businesses to collect further outputs/ outcomes (including figures required for GVA calculations) and to provide connections to other business support/investment opportunities, where appropriate should be performed. This should continue after the close of the ERDF project.

Workshops/Networking events should include short, punchy presentations and plenty of time for networking.

In the independent survey, an opportunity for businesses to predict future impact of the intervention, particularly where the timescale between the end of the assistance and the survey is relatively short, could be an important tool to fully understand the benefits of a project.

Where possible, business support should be completed as early as possible within the ERDF project period in order to ensure plenty of time for the benefits of the intervention and additional outcomes to be realised.

Where construction work is included as part of the ERDF project, reference should be made to the lessons learnt from this project (see summary in section 2.1)

Case studies

1. Cerberus Security
2. The BioFactory
3. Walk to Beat
4. Bonnie Binary
5. Altered Carbon
6. Fullfat Technologies

Cerberus Security Laboratories

Designing and building secure IoT Products

Challenge

Detainees are woken up every hour to ensure that they are healthy and ultimately still alive. In addition, often detainees are found with alcohol or drugs in their system, which can have critical health consequences and resulting repercussions, from both a legal and mental health perspective. With new Medical Device Regulations being introduced in 2020; companies must demonstrate that device and connectivity security have been taken seriously, in order to attain a medical licence.

Solution

CSL's product is a tech solution, so fits or seizures can be detected immediately, and take away the risks involved. CSL's sensors have the potential to eliminate the outdated procedures in prison's and detainment centres. Aside from the tracking health and wellbeing benefits, the project could have additional advantages such as aiding the Met's recruitment. Currently potential employees could be deterred about being held responsible for a detainee's health, and worse, they could also be sued for the death of a detainee. CSL's innovative monitoring system could be the answer.

HTH Contribution

Cerberus wanted to develop a sensor that will undertake biometric measurements when placed close to the skin. The Health Tech Hub supported CSL by aiding them in the design and encapsulation of the sensor, using 3D printing techniques, in their fully equipped 3D Printing lab, which is overseen by Paul Worgan. Paul assisted CSL at each stage of the design process, beginning with project scoping, review, product drafting and iteration of the CAD drawing and the eventual iteration of the CAD design and 3D print. This further development of the sensor has meant that The Health monitoring system measures heart rates, bloody oxygen levels and movement of detainee and is currently being piloted at the bequest of the Met.

"We've experienced great interactions with UWE; the academics, the legal clinic and the Health Tech Hub. A key benefit of being based in neighbouring Future Space has been discovering other companies who have benefited from the HTH's tailored support, and being part of the HTH's affiliated organisations and networks. The support we received from the Health Tech Hub meant we were able to develop our product to the highest industry standards, which enabled us to develop far more quickly and confidently than if we'd had to pursue such services independently, and without the specialist technical skills and academic knowledge"

Carl Shaw,

Director of Cerberus Security Laboratories

cerberus-laboratories.com

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The BioFactory

Sustainable sanitation systems for refugee camps in sub-Saharan

Challenge

There are ~3 billion people who lack access to energy depriving them of a clean fuel source for cooking. One billion people do not have access to electricity with 50% found in Sub-Saharan Africa. Additionally 2.3 million people around the world lack access to basic sanitation, with diarrhoea kills more than 1.4 million people per year. The energy and sanitation needs are recognised by the UN and enshrined in Sustainable Development Goals 6 and 7; clean water and sanitation and affordable clean energy. The BioFactory Ltd. are start-up company dedicated to providing novel solutions to the production of clean energy whilst addressing sanitation issues.

Solution

The Biofactory is developing novel portable bio digester units that turn human waste into methane gas. This gas can then be used as a clean source of fuel for cooking. The plan is build units to the dimensions of a shipping container. So that the bio digesters can be shipped and used in such places as refugee camps and villages in Sub-Saharan Africa. Additionally the Biofactory is aiming to use the waste produced from the process as a fertiliser to grow crops for either use by the community or for export. As part of any trial The Biofactory will have to establish that any waste product that is used as a fertilizer for crops is free from bacteria that could cause harm and infestations such as tape worms. In Africa these units will be used far away from laboratories and hence any test has to be easy and simple to use.

HTH Contribution

The HTH supported The BioFactory by helping them to develop a protocol for the field testing of the waste product they wished to use as a fertilizer. The HTH firstly identified what pathogens could be present, and then how best to test for them. The HTH also helped in the redesign of the control system ensuring that it was thoroughly shielded to avoid sparking, and igniting the methane that the units produced.

"The HTH have been fantastic to work with, we really recommend them to companies looking for adaptive technical expertise. After our initial meeting to define a scope for the project, I had the opportunity to be shown around the Labs, which are full of dynamic projects and research. The project ran smoothly, with the work being carried out quickly with little input required from me. Within several weeks, the work was complete and I returned for a final meeting and summary of the research conducted. This was great as I was able to discuss the results in a less formal manner with the researchers. The reports that the HTH staff produced are very well written and go into significant detail. I'm very happy with the outcome of this project."

Eoin Sharkey

Founder of The BioFactory

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Walk to Beat

An innovative assistive technology for Parkinson's sufferers.

Challenge

Product design technology graduate Neha Shadid Chaudhry (UWE), was inspired to invent a 'smart' walking stick after witnessing her late granddad struggle with the disease for seven years, repeatedly suffering falls when his joints seized up. Neha hopes her invention can benefit some of the 127,00 Parkinson's patients in Britain who regularly experience joint freezing and abnormal gait symptoms.

Solution

The device detects when a user's limbs have frozen and they cannot continue walking. Recognising a pause in motion, the stick vibrates to help the patient regain their rhythm and get moving again. Even small vibrations can stabilise their posture or help them to walk without any assistance. The vibrating walking stick is designed to be discreet and indistinguishable from other walking sticks.

HTH Contribution

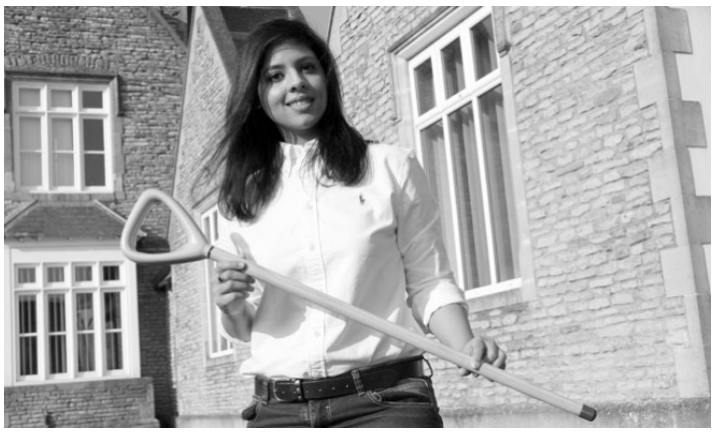
The Health Tech Hub supported Neha in the continued development of the product's circuit board. Moving from hand to machine soldering led to the implementation of boards which subsequently eliminated a large part of the wiring, making the stick streamlined and lightweight. The improved circuit board made it easier to test the sensors more reliably. It also made the product easier to manufacture and market on a large scale.

"In the Health Tech Hub, I was exposed to the highest calibre of specialists in their respective areas. Not only that but through Medilink and the HTH's extensive list of external contacts I was introduced to the right combination of expertise and market links. My project progressed so quickly - my work with the HTH allowed me to move on from prototype to a scalable operation. I would recommend using the HTH to any small company."

Neha Chaudhry

Founder of *Walk to Beat*

walktobeat.co.uk



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Bonnie Binary

Exploring the use of interactive e - textiles.

Challenge

Bonnie Binary founder Annie Lywood is exploring the use of e - textiles and interactive interfaces that make it easier for people to operate technology, in order to support independent living. Bonnie Binary's easy to use textile interfaces make technology more accessible for those who struggle with it. Annie Lywood approached the Health Tech Hub with a proof of concept but with questions regarding the best method to perform product testing.

Solution

Bonnie Binary now have a prototype system which has been thoroughly tested and with this, the company are launching a campaign to release their first product. The product's simple tactile interfaces is intended to benefit people with early stage dementia as well as the elderly.

HTH Contribution

The Health Tech Hub team assisted Bonnie Binary firstly by researching application-specific hand force ranges to understand how this applies to their products. Secondly, they helped to design and provide a testing platform including a computer interface read-out of key sensor parameters. Thirdly, HTH the team advised on appropriate product quality control tests and helped to plan for future product development.

"The Health Tech Hub helped me to narrow down my testing process in order to develop a my product and to think in practical terms, as well as in business terms. I would recommend the Health Tech Hub to smaller companies looking to develop their product as well as their professional network."

Annie Lywood

Founder of *Bonnie Binary*

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Altered Carbon

Developing new sensor technologies.

Challenge

There is an ever-growing demand for highly selective biosensors to detect numerous types of potentially detrimental gases at minute concentrations (as low as parts per billion), within various environments. Areas of application for these sensors are plentiful and are needed on a global scale. They include agriculture, chemical industry, healthcare, food freshness/storage and air quality, to name just a few. This is where Altered Carbon comes in!

Solution

The team at Altered Carbon have worked together tirelessly, drawing on each individual's area of expertise, to formulate a unique solution. A combination of Real-Time graphene-based sensing with data feedback using an AI-embedded platform to relay tailored datasets. The sensors run from super low power source, all of which provides longevity, accuracy and ultimately, a cost effective product.

HTH Contribution

The Health Tech Hub helped to create a way of analysing the quality of the graphene that Altered Carbon receive from their supplier. Consistency is paramount to the production of these products and so testing large batches of the material is very important to have quality assurance in place before sensor product is produced. The HTH also worked to create a grading scale for graphene quality which Altered Carbon use.

"The Health Tech Hub lab space is of great value to us because it's highly advanced, with a wide range of cutting-edge equipment. Working with the HTH, we're able to run checks and to develop our product without worrying so much about extortionate development fees. The HTH also has a strong network, and can help to expose your business to new opportunities"

Ali Rohafza

Founder of *Altered Carbon*

altered-carbon.com

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Fullfat Technologies

Sustainable, reused, repurposed materials for everyday use.

Challenge

Pollution by plastics is a worldwide and increasing problem. Plastic items such as clothing, bottles and bags degrade slowly, eventually breaking down into small particles of micro plastics. Research into micro plastics suggested that the average human could be consuming 70,000 micro plastic particles a year. Little is known of the health consequences resulting from ingestion of micro plastics.

Solution

Fullfat Technologies are looking at alternative bio plastics derived from consumer and commercial waste. FFT are investigating methods of producing plastics derived from casein protein found in milk. Casein protein can be extracted from surplus or liquid dairy waste and used to produce a plastic which will slowly dissolve in water. Unlike traditional plastics micro particles are not formed, the casein polymer is totally soluble in water. FFT are looking at the potential use of casein based polymers in a number of applications ranging from bio-medical sensors to building materials.

HTH Contribution

Staff from the Health Tech Hub looked at the properties of casein polymers, and how they could be adjusted by the use of cross-linking agents and plasticisers. The HTH went on to look at the potential of using casein films as a substrate for biological and chemical sensors. Films have been produced and the potential of printing electrochemical sensors onto the surface of these films is under investigation.

"The real asset of the HTH is the creativity, enthusiasm and knowledge of the staff. The practical support shown at all levels has been second to none. Using the facilities has been very useful in terms of gaining access to professional and state of the art lab and workshop facilities to conduct initial tests and experiments in a highly sensitive and controlled environment. As a Start up SME with limited capabilities, such resources are invaluable for us to be able conduct high quality and competitive R&D to develop our ideas further."

Habib Patel

Founder of *Fullfat Technologies*

fullfattech.com

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