

HEIF case studies 2021: STEM specialists cluster

The Research England-funded Higher Education Innovation Funding (HEIF) supports higher education providers to exchange knowledge with business, public and third sector organisations, community bodies and the wider public, increasing economic and societal benefits from their work.

The case studies below demonstrate the ways that English higher education providers have used HEIF to support knowledge exchange activities, and the impact they have achieved. The STEM specialists cluster includes specialist institutions covering science, technology, engineering and mathematics (STEM).

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The Institute of Cancer Research: Video for schools shows how researchers create new cancer treatments

The Institute of Cancer Research (ICR) has designed a video and activity pack in conjunction with teachers to support the GCSE science curriculum at schools locally in Sutton and across the UK. In the 10-minute video, ICR researchers talk about their pioneering work to discover and develop new drugs in a way designed to bring the GCSE curriculum on the creation of new treatments to life.

The new Creating Cancer Treatments resource is intended to help students learn about drug discovery and development as part of their GCSE course, as well as spark their interest in careers in science. We have promoted the pack to teachers and schools across the UK via email, social media and through the media via coverage in the Daily Telegraph.

We created the video and pack in conjunction with teachers at the Harris Academy Sutton and researchers at the ICR. The video includes key topics featured on the GCSE curriculum such as how researchers identify drug targets, create prototype drugs, carry out preclinical testing and eventually take new treatments into clinical trials.

It explains complex topics through creative use of animations. The accompanying activity pack gives students the chance to assess the most promising prototype drugs based on chemical data, and to design their own clinical trial. It goes beyond the content of the curriculum, introducing new concepts involved in the creation of new treatments to enrich learning and facilitate a deeper understanding of the subject. The pack enables students to link what they learn in the classroom to future career prospects.

The ICR is passionate about inspiring a diverse and inclusive next generation of cancer researchers, and equipping students with the knowledge and skills needed to pursue careers in science and research.

At the time of writing, the video has been watched a total of 393 times on YouTube and the activity pack has been downloaded a total of 24 times from the TES website. The video and activity pack has been used by our own researchers in an outreach event with a local school in Kensington, as part of a Widening Participation programme run by IntoUniversity.

The resource received this feedback from a UK teacher: "This is fantastic. I have this coming up with combined science in the next few weeks. Unfortunately already done with my separates. I usually do a mock drug trial in class (with tic tacs!) so this will make the online version far more exciting. Thank you."

The Institute of Cancer Research: Monte Rosa Therapeutics

Monte Rosa Therapeutics is a company formed as a spinout from drug discovery research at The Institute of Cancer Research, London (ICR).

Monte Rosa Therapeutics specialises in targeted protein degradation, one of the most exciting new fields to emerge in drug discovery in recent years.

The company was formed in 2018 by Versant Ventures, The Institute of Cancer Research and Cancer Research UK from science partly funded by Cancer Research UK-funded at the ICR, with founder scientists the ICR's Head of Chemistry Professor Ian Collins and Professor Raj Chopra, formerly the ICR's Head of Cancer Therapeutics.

Monte Rosa Therapeutics (MRT) secured an initial investment of \$15m when it was founded followed by a further \$17.5m of funding announced when MRT launched publicly in early 2020.

In September 2020, MRT closed a \$96m 'series B' financing and a \$95 million Series C round was raised from investors in March 2021 to support the further development of its drug pipeline.

Protein-degrading molecules co-opt large cellular proteins, called ubiquitin ligases, to drive the breakdown of other target proteins – such as those that drive cancer. MRT's technology leverages the power of nature's protein degradation pathways to target the undruggable proteome and eliminate disease-driving proteins with high precision.

MRT is using a molecular glue-based targeted protein degradation platform to deliver breakthrough small molecule therapeutics. The company is targeting disease-causing proteins that have been impossible to drug across multiple therapeutic indications and using machine learning-based prediction of degrons (a sequence within a protein that targets it for degradation). The company is working on their lead programme which originated at the ICR and which targets GSPT1.

The company, whose library of protein degraders, was originally developed by chemists at the ICR, is poised to rapidly expand the previously undruggable target universe and foster a new generation of therapeutics

The series C financing was led by Avoro Capital Advisors with additional investment from Fidelity Management & Research Company LL and, RTW Investments, LP with participation from MRTs existing investors Versant Ventures New Enterprise Associates, Aisling Capital, Cormorant Asset Management, HBM Healthcare Investments, GV, Amzak Health, Sixty Degree Capital, Casdin Capital and Cambridge Asset Management

Monte Rosa Therapeutics' new funding will enable it to accelerate the development of its pipeline, advance drug candidates into clinical studies, and bolster its platform capability to rationally design and develop precision medicines for genomically defined diseases intractable to standard of care.

Monte Rosa is an excellent example of a business with high growth potential rapidly developing to scale.

Liverpool School of Tropical Medicine: K4D COVID-19 Health Evidence Summary

Description of activity

K4D published weekly Health Evidence Summaries to signpost FCDO and other UK government departments to the latest relevant evidence and discourse on COVID-19 to inform and support their response. LSTM led the K4D response in publishing daily COVID-19 Health Evidence Summaries to signpost FCDO and other UK government departments to the latest relevant evidence and discourse on COVID-19 to inform and support their fight against this pandemic and its consequences. These summaries reach out across the academic and professional community to capture relevant evolving evidence to help FCDO in their evidence-informed decisions.

HEIF funding support

The K4D project team had access to LSTM's dedicated HEIF supported KE staff within the communications and engagement team who were able to work closely within the project providing technical support and activity to support outcome drafting, steer and oversight. This project set out to meet one of LSTM's KE objectives in relation to the synthesis of evidence *in a format that underpins the development of policy and practice by national governments*.

Societal, economic or student benefit

The Knowledge, Evidence and Learning for Development Programme supported the use of learning and evidence to improve the impact of development policy and programmes within government. The main project was funded by UK aid and is designed to assist the Foreign, Commonwealth & Development Office (FCDO) and other UK government departments and partners to be innovative and responsive to rapidly changing and complex development challenges. LSTM was a partner in this consortium led by the Institute of Development Studies in Brighton, UK. LSTM applied HEIF funding as a wrap around to this project, enabling further engagement and knowledge diffusion opportunities.

Paul Knipe, K4D Programme Manager at IDS, said: "These summaries were proving to be a useful resource for FCDO and were also having wider engagement across the development network. K4D demonstrated a big increase in its daily twitter statistics since the daily summaries began". Dr Nadeem Hasan, a Health Adviser from FCDO and part of the commissioning team, also said that "These evidence summaries have supported FCDO, and formerly DFID, to ensure our advisers stayed abreast of the latest scientific understanding of COVID-19 and its impacts, particularly in low and middle-income countries. This has been key in delivering an evidence-based response to the pandemic in these contexts."

LSTM and IDS, between them produced 122 summaries in total arranged to cover themes such as Epidemiology and modelling, Social Science, and the Indirect impact of COVID-19 among many others. Those summaries are now publicly available to all, in one database, so that the journey of the pandemic can be tracked through the journal publications, preprints, commentaries and analyses produced throughout.

Supporting government priorities

The UK R&D roadmap sets objectives to improve the culture of research and the importance of public engagement ensuring equality, diversity, and inclusion as a multifaceted response. This project set out to influence policy and used a synthesis of the evidence base through a series of informed summaries. The project directly contributed to understanding and applying Covid-19 recovery plans which benefits societal skills and economy recovery. This project also supported the BEIS IS "Infrastructure" Foundation. Supporting a levelling up and "Place" based agenda in research knowledge is critical to success in these

objective areas. Having close alignment with RE and OfS activity, ensured that priorities were delivered. Finally, the project set out to ensure that Equality, Diversity, and Inclusion in centre to its multifaceted response.

Liverpool School of Tropical Medicine: AMR Swab and Send

Antimicrobial resistance, or AMR, is now recognised as one of the most serious global threats to human health in the 21st century with bacteria's resistance to antibiotics increasingly spreading from one country to the next.

The UK has a five-year national action plan to tackle antimicrobial resistance (AMR). AMR is not just as a health issue, but as a 'One-Health' issue with enormous social and economic impact. AMR can compromise the achievement of the SDGs, affecting health security, poverty, economic growth and food security. The AMR Funders Forum, has identified key themes to target current and future investments.

Theme 1 (Understanding resistant bacteria) and Theme 2 (Accelerating therapeutic and diagnostics development) is essential to success and research at LSTM has a strong focus in these areas.

In addition to the development of new antimicrobials, part of the recommended response to antimicrobial resistance is increased public awareness campaigns. In order to expand initial antimicrobial discovery activity beyond soil microbes and to circumvent the absence of funding and create a dynamic, long-term, public-engagement activity, the citizen science project 'Swab and Send' was launched in early 2015. It was designed to enable individuals to decide where and what to sample in order to try and find bacteria or fungi, which can produce antimicrobial products against a range of bacterial and fungal indicator strains.

Citizen science is historically rooted in antimicrobial discovery. Swab and Send relies on social media; primarily using Facebook to report results back to participants and Twitter (#swabandsend) to reach potential participants including members of the public, school, colleges and other organisations. Swabs are posted with instructions detailing what to consider when deciding what to sample. Once we receive the samples back in the laboratory, they are streaked onto agar plates and incubated for 4–7 days at room temperature. Each individual morphologically distinct colony is then picked, using a sterile pipette tip, into a microtiter plate well containing growth medium and incubated at room temperature overnight. Following the phenotypic assays described below, the microtiter plates are stored at -80°C, following the addition of glycerol, for future assays.

We analyse the assay plates for zones of inhibition around the colonies originating from the swabs and all the agar plates are photographed along with a template sheet detailing which sample is positioned where within the microtiter plate. These are uploaded onto the dedicated Facebook project webpage with an explanation of the results, highlighting interesting hits we have found. Further updates are provided as the project moves forward, both in terms of results and significant developments in the antibiotic resistance and chemotherapy. This serves as a permanent historical record of all the project activity since its launch and as a useful repository for important reports on antimicrobial resistance.

In addition to the continuing public-engagement activities and the ongoing investigations of antimicrobial producing strains, the project has also resulted in a valuable physical resource. Along with what we have already screened, we have over 10,000 isolates stored, assay-ready, as glycerol stocks in microtiter plates, awaiting antimicrobial assays. The entire isolate library, which is possibly one of the most random microbial isolate libraries in the world, is available for screening should a project with a suitable assay present itself.

Researchers, including students, can take advantage of the library and can use the data in projects that have the objective of determining the target of the compound(s) produced by these isolates.

Royal Agricultural University: Farm491 - the leading UK AgriTech incubator

The RAU Farm491 programme (<https://farm491.com>) has been instrumental in supporting companies from local to international level to identify, share and engage with innovation opportunities in the agri-food sector. With support of UK and EU funding, the RAU's Farm491 was commissioned in mid-2016 as a specialist AgriTech business incubator to facilitate the launch of start-ups and the growth of SMEs in farming, food production, land-management and environmental sectors. The programme works with AgriTech SMEs through all their stages of growth leveraging the unique network of RAU academic, industry and farming contacts and in-house experts to help companies achieve their aspirations.

Farm491 provides SMEs strategic, financial and marketing advice and facilitates inter-business exchange relationships through peer networking and expert workshops. Physical and virtual Farm491 business membership enables the sharing of global best practice with Gloucestershire based businesses. Farm491 also offers office and workshop space in collaboration with the Cirencester Growth Hub, co-located in the Alliston Centre on the RAU campus.

The Farm491 vision is to be recognised as the top AgriTech incubator in the UK, delivering the highest quality of support for AgriTech start-ups. HEIF funding provides the opportunity to achieve this vision by supporting the delivery of relevant activities to boost start-up/SME growth in the sector. HEIF funding allowed increased academic involvement (academic time buy-out) in the Farm491 programme and supports investment in a business and innovation specialist. Furthermore, with support of the HEIF funding Farm491 has organised physical and on-line webinars and workshops and a yearly AgriTech season. Farm491 has also hosted several inward investment and fact-finding visits to Gloucestershire. Recent examples include a DIT delegation of NZ AgriTech companies and FCO delegation visits. Now recognised as an expert on innovations changing the food system, the team has been in demand being invited to over 50 KE events. This includes hosting the Agri-Innovation Den with BASF and judging the World Future Food-Tech Summit in London.

Farm491 activities ensure that RAU research and teaching activities are aligned with industry and needs of smart food supply chains and entrepreneurial and ecopreneurial activities. Since its opening in 2016, Farm491 has directly supported more than 190 businesses, and helped to create 111 new jobs among its members and supported them in raising over £32.8 million in funding to bring innovation to commercialisation. Farm491 has been involved in the development of the Gloucestershire Local Industrial Strategy leading to the inclusion of AgriTech as one of key element of this strategy.

Farm491 has also been involved in national level policy on AgriTech and worked with national and international partners to help reduce the fragmentation in the UK innovation ecosystem. This has led to increased involvement in UK policy making supporting the adoption of innovation into agriculture including Defra's National Food Strategy Advisory Oversight Group and cross-departmental Agricultural Productivity Task and Finish Group. Farm491 has also undertaken research on behalf of the UKRI Transforming Food Production Challenge Fund,

leading to the launch of a new initiative focussed on breaking down barriers to scaling agri-innovation.

Royal Agricultural University: Enterprise and Entrepreneurship Programme and student social enterprise development

Winner of Enterprise Learning Provider of the Year, Institute of Enterprise and Entrepreneurs Awards 2019, the RAU's Enterprise and Entrepreneurship Programme (EEP) (<https://www.rau.ac.uk/study/enterprise-entrepreneurship>) provides an inspiring and supportive environment in which students can share, develop and launch their business ideas. Through this programme the RAU has successfully demonstrated the value to students of developing practical enterprise skills, which can be transferred into either employment or their own start-up businesses.

Through events and interactive sessions, the programme stimulates knowledge acquisition and practical enterprise skills. The HEIF funding has allowed the support on offer to grow in recent years including speaker events, workshop/webinars, mentoring, entrepreneurs in residence, proof of concept funding, competitions, networking, trading opportunities such as our Youth Market and individual expert meetings with business professionals such as lawyers, accountants and IP professionals. Central to this is the annual Grand Idea Competition where students pitch their concept and business plan to a panel of expert judges. The winner receives £2,500 to invest in their business.

Around 100 students are involved in the EEP each year of around 20 students develop their business idea further and around 10 start a business/register as a sole trader. Furthermore, the RAU has two student focused social enterprise projects, Cotswold Hills and Muddy Wellies, to engage students via the EEP extra-curricular offering and real-world learning link to taught modules. Both projects provide students with the opportunity to engage with a live business project and gain hands-on experience. In addition, proceeds from all products sold go into the First Steps proof of concept fund which supports budding entrepreneurs to develop their own ideas. HEIF funding is supporting students with new product development, packaging and label design and production, as well as trade stands at suitable events.

In total we currently have 2 Muddy Wellies products and 5 Cotswold Hills still wines, as well as a fizzy white wine can and 2 new products to launch this year. The fizzy can was a concept generated in a second-year business module because of a need to prevent decanting into single use plastic. The students came up with the fizzy can concept and since then we have gone on to launch the can which has sold over 10,000 units since June 2019. Between them Muddy Wellies and Cotswold Hills are stocked in around 200 retailers across Southern Britain, as well as online. Stockists include Waitrose and Mid-Counties Co-Op, as well as two drink distributors.

Currently we are developing a new competition with the support of a private investor to encourage innovation and new business start-ups in the agri-food chain sector. The competition will be aimed at postgraduate and recent alumni and they will have the opportunity to gain up to £50,000 investment in either their new business or new area of development for their existing

business. Shortlisted entrepreneurs will be offered support to help them write a business plan and present a pitch.

Royal Veterinary College: Application of phylogeography and network analysis for improved understanding of PPR virus transmission in East Africa

Peste des petits ruminants virus (PPRV) causes a highly infectious disease of sheep and goats that has a major impact on livestock keeper livelihoods in many parts of Africa and Asia. In this HEIF-supported Concept Development Partnership project, we carried out research in pastoralist areas of East Africa to explore how the occurrence of PPRV is linked to the sheep and goat trade, and animal movement networks. The study has supported the planning of vaccination campaigns and surveillance activities and contributed to the regional and global PPRV eradication programme.

The research was carried out by RVC in partnership with the **International Livestock Research Institute** (ILRI, see: www.ilri.org) and national and regional animal health organisations. Working together with local veterinary services, PPRV outbreaks were investigated and samples collected for genomic analysis. Data were collected on sheep and goat trade networks as well as non-commercial movements of animals for grazing, water and for social reasons. The results help to define populations of sheep and goats that are closely connected for the coordination of control measures across the region. The ultimate beneficiaries will be sheep and goat keepers in the region who will benefit from a reduced impact of disease on their small ruminant flocks, and therefore improved food security and livelihoods.

The main project output is a new **targeted and scalable approach towards global PPRV eradication tailored to the local characteristics of viral dynamics**. By being quicker and less costly than the current global strategy, which involves prolonged annual vaccination programmes followed by extended periods of surveillance, the outcome will be an increase in the likelihood of disease eradication. As such the project has direct societal benefits for pastoralists, some of the world's poorest people. It will also increase RVC's capability for commercialising its improved knowledge base in this area through providing consultancy services to international and regional health organisations in Africa and Asia.

Project activities were facilitated by means of academic staff buy-out, salary support for research assistants and funding for dedicated KE staff located within the RVC's Research Office.

This work is contributing to multiple objectives of the Government's Plan for Growth (*Innovation and Skills* priorities, formerly *Ideas* and *People*) and the R&D Roadmap – namely *Being at the forefront of international collaboration*; *Driving up innovation and productivity*; and *Inspiring and enabling talented people and teams*, respectively. As such, it will help Research England to meet its strategic objectives as set out in the (2020-21) guidance from BEIS for the use of HEIF monies.

This HEIF-supported work is part of a wider effort by RVC and its collaborators to combat a range of exotic, emerging and endemic infectious diseases. Thus, RVC works with the Government's Animal and Plant Health Agency (a division of DEFRA), with which it hosts a [OIE Collaborating Centre](#) for [Zoonotic Disease] Risk Analysis and Modelling. The College is also an [FAO Reference Centre for Veterinary Epidemiology](#).

Royal Veterinary College: Towards portable and real-time genomic epidemiology of pathogenic veterinary micro-organisms

The MinION (see: <https://nanoporetech.com/products/minion>), produced by Oxford Nanopore Technologies Ltd., is a portable nanopore device for sequencing of samples from viral, bacterial and parasitic disease outbreaks. Nanopore sequencing is rapid (<24 hours) and gives the ability to generate very long reads (>1 Mb), which is invaluable – for example to resolve repetitive sequence regions in *Eimeria* genomes. This RVC-led project, supported by HEIF through the Concept Development Partnership scheme, has produced an integrated system using the MinION platform for performing real-time epidemiology of pathogen populations from genome sequencing based at RVC. The resultant protocols can be employed within current and future research collaborations, such as those within the RVC-led UKRI GCRF One Health Poultry Hub (2019-24), to maximize informative and timely data and allow continual analyses and interpretation. Such integration provides a range of key stakeholders with actionable information to inform both animal and public health interventions and design impactful control strategies.

In this project, the team followed a multi-pathogen integrated approach to develop the capability to undertake and act upon genetic epidemiologic analyses. Three disease systems were investigated: (i) Highly pathogenic avian influenza viruses of the H5 sub-type, which have circulated in poultry since 2003, been re-introduced into wild birds, disseminated regionally and internationally, and pose one of the most significant zoonotic threats to humanity; (ii) Coccidiosis, caused by the protist parasite *Eimeria* – which affects poultry with a global cost in excess of £2 bn per annum; and (iii) Peste des petits ruminants virus (PPRV), which infects small ruminants and is endemic in >70 countries across Africa and Asia, where it threatens 1.7 billion sheep and goats (80% of the global population). PPRV contributes to food insecurity of the world's poorest communities and inflicts a global cost of \$1.5 billion per annum.

For each animal disease system, the team designed and optimized protocols for field-ready sample and library preparation approaches. The project included work-streams designed to:

- 1) Optimise nanopore library preparation workflow
- 2) Develop and test pathogen panels for reliable sequencing
- 3) Develop capability to implement bioinformatics analyses from nanopore sequence data
- 4) Enhance interdisciplinary capacity for real-time genomic and mathematical epidemiology

Project activities were facilitated by means of academic staff buy-out, salary support for research assistants and funding for dedicated KE staff located within the RVC's Research Office.

As a result of this project, there is potential for commercialising the system as a service offering, either as a business unit or a spin-out company jointly owned by RVC and the University of Oxford. Such a service will be of interest to governmental agencies and other large international organisations operating in veterinary and zoonotic diseases. As such, this work is contributing to the Government's Plan for Growth (*Innovation and Skills* priorities) and the R&D Roadmap – namely *Being at the forefront of international collaboration*; *Driving up innovation and productivity*; and *Inspiring and enabling talented people and teams*, respectively.

Cranfield University: CorrosionRADAR Ltd

CorrosionRADAR (CR) is Cranfield University spin-out which designs and supplies long range Corrosion Under Insulation (CUI) monitoring technology for pipelines, refineries and more. The patented system enables the move away from manual inspections to automated monitoring, and from reactive to predictive corrosion management.

The business was spun out in 2017 from Cranfield University by an international team of scientists and business professionals, including Dr Prafull Sharma (Cranfield PhD student) and Professor Hoi Yeung (Cranfield academic), who developed the original technology, COO Dr Mehrdad Silatani, and CEO Dr Chiraz Ennaceur. The company has offices in Future Business Centre, Cambridge and Cranfield University's incubation facilities.

CR has secured four rounds of investment, totalling almost £4m, raised from Mercia Fund Managers, using the MEIF Proof of Concept & Early Stage Fund, the company Founders and Series A investment in 2021 from Saudi Aramco Energy Ventures (SAEV) secured in December 2020. The funding will enable CR to strengthen its operations and widen efforts to address Corrosion Under Insulation (CUI) and other operational challenges through digitalisation. CR currently employs 12 people and is recruiting for growth.

Related website: [CorrosionRADAR | Detect Monitor Predict CUI](#)

Cranfield University: Cranfield Aerospace Business Cluster/University Enterprise Zone

Aerospace has been identified by the UK Government as being strategically important to the economy. Cranfield aerospace business cluster is supporting growth in the sector while expanding Cranfield's University's business incubation infrastructure. The clustering of world class aerospace SMEs at Cranfield, alongside major players in the aerospace market, and the world-renowned aerospace research capabilities of Cranfield University along with an operational airport, provide a unique opportunity to re-build the UK's whole aircraft design and manufacturing capability. University Enterprise Zone/Research England AVIATE+ funding is enabling innovative companies to grow and leverage the success of Cranfield's world recognised initiatives such as the Integrated Vehicle Health Management Centre, the Digital Aviation Research and Technology Centre, the Centre for Air Transport Management, the Aerospace Integration Research Centre and the Safety and Accident Investigation Centre.

Cranfield University already has the Cranfield Eagle Lab, developed in partnership with Barclays, on site. This is a business incubator facility for early-stage companies in the AvTech sector and is supported by the Royal Aeronautical Society, Garfield Weston Foundation and aerospace industry partners. Cranfield Eagle Labs already provides support for early-stage companies and offers office facilities and communal maker space area for businesses at the initial stages of their product design.

Building on this cluster is developing grow on workspace for businesses, providing private workshops and benches, enabling the assembly of larger components with the support of appropriate power and data connectivity. The new infrastructure, along with a programme of support, will particularly benefit AvTech start-ups and SME's with a clear product development pathway and demonstrating high growth potential.

Harper Adams University: AGRI project for SMEs – a collaboration with Aston University

The Agri-tech Growth and Resources for Innovation (AGRI) Project is part funded by the European Regional Development Fund (ERDF) and runs in partnership with Aston University. The project focuses on breaking down barriers to innovation within agri-tech and agri-food sectors and supports eligible SMEs through the transfer of specialist knowledge. The support is free, providing businesses the opportunity to develop processes, products or services that will allow them to operate in a more efficient and productive way. The project started in early 2017 and following a successful bid for continuation funding is now supporting staff posts to continue until late 2022. The project has successfully supported in excess of 110 local businesses by providing sector specific knowledge through a team of innovation experts based at both universities. The support is bespoke and tailored to the individual needs of each company through an innovation review which provides a minimum of 12 hours of time with one of the project innovation specialists. The longer term in-depth support, is not required by all businesses but allows additional work and knowledge transfer to be carried out as necessary, often with student projects. The outcome of both stages is to help the company, to be more innovative, productive or efficient. The support can relate to the business itself or to the development of a new or existing product, process or service.

The benefits vary with short and longer term solutions.

Matt of iSpaniel said of his experience working with AGRI Project: “The team at Harper were relentless in trying to find a solution to one very specific and challenging problem. Finding that there was nothing on the market that could be bought in, they proceeded to try a variety of techniques until they hit upon a potential solution and built a proof of concept sensor. iSpaniel are now in the process of building a prototype tracking device incorporating this sensor designed during the project.

James Wright reflected on White Heron’s journey: “Seeking innovative ways to improve the efficiency of our fruit harvesting operations, we engaged the AGRI project and made an application in March 2018. After an initial site visit by project staff to observe our current processes we promptly received a professional case study report which outlined some innovative avenues of research and potential technological solutions. Having selected a particular project from the case study we then collaborated with a team of students from the university who spent some time on farm investigating and prototyping. The final project report indicates a high level of success with certain aspects which we will definitely pursue further. Engaging with the AGRI team has been hugely rewarding and gave us access to academics and professionals who have really helped turn some of our ideas and concepts into a reality.”

The project continues to support SMEs in Shropshire and Telford & Wrekin, working closely with Agri-tech companies moving into the Newport Innovation Park (Ni-Park) and continuing to develop industry relevant specialisms for each university.

<https://agriprojects.org/>

Harper Adams University: Hands Free Hectare to Hands Free Farm – how to start scaling up to 35 hectares of autonomous farming in the UK

It is widely acknowledged the farming industry must further increase productivity in the next few years to meet the needs of a growing global population. However, with the number of people employed in the sector continue to decline, and skilled labour increasingly difficult to find, robotic machines & vehicles can help alleviate this in the future. To address this challenge, academics and researchers at Harper and a leading UK farming systems company Precision Decisions, proposed the application of autonomous vehicles and drones for use in farming. Use of autonomous machines will facilitate a sustainable system where multiple smaller, lighter machines are used to farm with precision. Each area of the field, and in the near future even individual plants can be treated separately, is optimised to reduce inputs required for farming. The success of the project hopes to attract a new generation of engineers and indeed farmers with imperative digital skills such as AI, big data, IoT, satellite based navigation and data communications.

The Hands Free Hectare started in 2016 with the aim to be the first in the world to grow, tend and harvest a crop without operators in the driving seats or agronomists on the ground. The project commenced with Hands Free Hectare funded through Innovate UK – Satellites and Agri-Food Systems with industry project partners including, Simtech, Yara, Hutchinsons, Linak and Precision Decisions. HEIF funding was used from 2018 to support the participation of a number of academics, researchers and technical staff from across the university to automate a small tractor and combine harvester as well as a scouting robot used for soil and crop agronomy. The project was taken through two successful cropping cycles growing and harvesting a spring barley crop followed by a winter wheat in the second year using autonomy systems designed and developed at the university and retro-fitted onto a traditional tractor and a combine harvester. The project has won a number of awards; including the prestigious BBC Food and Farming Future Food Award and in 2018 Queen's Anniversary Award for Innovative Agricultural Engineering.

The Hands Free Farm commenced in May 2019 to grow multiple crops on multiple fields across 35 hectares farmed entirely by robots. The university will provide a test and development facility that will enable partners to access a real world farming test-bed. The project will create and exchange knowledge on emerging challenges for robotic farming such as fleet management and swarm vehicle logistics, navigation and auto-location and selection of implements. The latter challenge has been offered to a group of masters' students supervised by Precision Decisions. Other areas of knowledge development include:

- Use of IoT sensors to monitor soil conditions, control irrigation, detect crop health etc.
- AI & ML based systems to guide machines to specific locations
- Development of analytical & business software for crop & pest management
- Development of indoor and outdoor localization, path planning and connectivity
- V2G Systems for vehicle to grid solutions for charging
- Use of renewable energy systems – wind turbine, bioenergy, solar and geothermal

Hartpury University: Digital Innovation Farm

Hartpury's Digital Innovation Farm (DIF) provides a test bed for innovations in Agri-Tech and utilises academic expertise and our commercial farm to test new products and services. It has created a network of both Agri-Tech companies and an extensive network of local farms to engage with, driving productivity and providing a valuable service as the interface between Agri-Tech firms and farmers. This knowledge is shared through business engagement events with around 4,000 farmers currently engaged annually.

HEIF provided part funding for our Agri-Tech Centre Manager (the hub of the DIF) and as a result provided capacity to drive the creation of a large-scale network of farms and extensive industry engagement. This funding enabled us to cultivate external business relationships that have invigorated student enterprise and developed an institutional entrepreneurial culture. HEIF funding also enabled capacity through the Centre Manager to facilitate companies to test and demonstrate products through an extensive network of partner farms. This enables Hartpury to offer a full suite of agricultural settings to support innovation. Furthermore, smaller farms are able to evaluate the potential benefits of the technology to yield without the risks of a large investment in technology.

Hartpury's DIF will support at least 75 SMEs. Gloucestershire's agriculture sector is valued at £1.5 billion and provides over 50,000 jobs and there are approximately 25,000 SMEs in the county. Importantly, the DIF is driving innovation through acting as a magnet for firms at the forefront of green/agri tech. For example, Hartpury is working closely with Glas Data. Focussing on the 'internet of things' this business viewed the DIF as an ideal test bed to develop and demonstrate technology which enhances farm management through data automation. Furthermore, HEIF funding has acted as a catalyst to help attract Novazera as an 'anchor tenant' at the DIF. This company is at the forefront of cutting-edge green technologies for agriculture and beyond. Our business facing approach, specialist provision and networks was pivotal in attracting this high growth start up that is developing new renewable environmental technologies. Several of these solve problems connected to modern agriculture such as dealing with waste and contaminants. Also of note are new anti-viral coatings that are under development and testing in the wake of the COVID-19 pandemic. Novazera's registered company address is at Hartpury University and the University is a five percent shareholder in the company.

Hartpury's DIF has been shaped by both Gloucestershire's and the Government's Industrial Strategy priorities for Clean Growth and Transforming Food Production. Gfirst LEP also produced the Gloucestershire Strategic Economic Plan (SEP), which outlines how the LIS will be realised through the following strategic priorities: business promotion; skills; connectivity which are at the heart of our DIF. The farm will also play a key role in developing innovative technologies to support the Government's net zero target by 2050 and will be a Gloucestershire environmental exemplar.