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<p>Institution: University of the West of England, Bristol</p> <p>Unit of Assessment: UOA 6 Agriculture, Veterinary and Food Science</p> <p>a. Context</p> <p>Fundamental and applied research in Agri-Food, Plant and Environment at UWE, Bristol, has delivered outputs with impact on the agri-food and water industries, UK government and the European Commission, charities and trade organisations. Impact relates mainly to industry and society, with an emphasis on economic growth, environmental protection and advising policy (e.g. EU on boar taint; International Atomic Energy Authority on transfer of radionuclides to wildlife). Industrial partners are provided with innovative technologies to develop novel products that safeguard and increase employment, and expand businesses to new markets (e.g. in bio-sensing). Society benefits from improved quality of food, water and the environment, whilst engagement activities inform the public and stimulate debate. Unit members are named in bold.</p> <p>b. Approach to impact</p> <p>Collaborative research, especially with industry, is a key strength of the Unit and accounts for about 60% of research income. The projects address user needs and this approach facilitates the development of impact. Examples include CASE studentships, SPARK awards, and funding from the Technology Strategy Board (TSB), British Pig Executive, UK government departments and laboratories, European Commission, SW Regional Development Agency, and numerous projects directly funded by industry. Engagement with research stakeholders is viewed as being essential to the eventual achievement of impact. Engagement with external partners is embedded in the promotion and personal development review processes for all staff. In collaboration with UWE's Research, Business and Innovation (RBI) team, the Centre for Research in Biosciences (CRIB, Doran, Director) organises events including networking meetings, involving users and funders of research, e.g. the TSB's Knowledge Transfer Network (KTN) managers. CRIB's external advisory board members (e.g. from industry, TSB), provide input regarding user-orientated research.</p> <p>Impact in industry is facilitated through the Institute of Bio-Sensing Technology (IBST, Luxton, Co-Director; http://www.biosensingtech.co.uk/), with dedicated space and administrative support. A joint initiative between the Faculties of Health and Applied Sciences, and Environment and Technology at UWE, it brings together biological, environmental and sensor expertise with electronic engineering expertise (submitted to UOA 15). This Knowledge Exchange Institute was launched in March 2008 and has a database of more than 750 companies. The IBST Advisory Board has representation from 16 businesses and related organisations. The Director of CRIB (Doran) and Co-Director of IBST (Luxton) sit on each other's External Advisory Boards and this facilitates smooth transition of projects from the research to development phase. IBST brokers academic and industrial partnerships, following the fundamental research phase of a project. It provides a strong platform by which Unit research and technological innovations can be developed along the pipeline towards commercialisation. Unit members are encouraged to participate in IBST workshops and conferences, which have strong attendance by industry. Biennial international conferences on Bio-sensing Technology, in collaboration with Elsevier (underwritten by £500k in 2013), are organised by IBST (Luxton) who is also Chair of the Scientific Committee. The 2013 meeting attracted 380 academic and industry delegates from 47 countries. Unit researchers use these meetings to share their research and build new partnerships with industry. Examples of resulting new agri-food initiatives, in addition to the two impact case studies, follow: 1) DePuy (with Hart) developed rapid sensor systems for food quality. 2) Clarity Biosolutions Ltd and Sarum Biosciences Ltd concluded licence agreements in 2011 for novel magneto-immunoassay technology developed by Luxton which were patented in 2004. The strong relationship between the companies and Luxton led to 2 TSB-funded projects (total value approximately £500k) to bring the technology to market.</p> <p>IBST has also been a key player in the European-funded regional Innovation Networks (iNETs) programme, which has provided staff including Hart, Luxton and Reynolds with funding for development work with SMEs, e.g. a project with Agrantec provided information concerning the ability of sensors to identify oestrus in cows.</p> <p>Other interactions with industry are mediated by the Sensors for the Water Interest Group (SWIG,</p>

Luxton Chair), at which **Reynolds** has presented his work, and the BBSRC-funded UK/China partnership on novel technologies for food quality and safety (**Doran**) which includes technology manufacturers including SMEs in the UK and China. Several staff participate in academic/industry meetings such as those organised by the Royal Society of Chemistry (RSC) or industry. A notable recent success that is anticipated to facilitate impact generation in the Unit is the allocation to UWE of £4 million from the regional growth fund to support the growth of businesses in the region. Legal and financial advice and support for commercialising the Unit's research is provided by UWE's Research, Business and Innovation Office.

Staff are encouraged to join government and industry working groups and boards, e.g. **Doran's** work (in collaboration with over 20 organisations from 12 countries) on boar taint in pork resulted in her being an invited consultant to the *Working Group of the Directorate General for Health and Consumers*, and Chair of the *European Association for Animal Production and Boar Taint*. She influenced the EU decision to abandon surgical castration of piglets by 2018 and to look for alternative ways to control boar taint. **Willey's** work with Hyder Environmental Consulting resulted in new guidelines from the Nuclear Commissioning Authority about the selection of plant species for decontamination of soil at Sellafield nuclear reprocessing site. **Willey's** research has also been included in the International Atomic Energy Authority Technical Report for advising policy makers on estimating the transfer of radionuclides to wildlife.

Involvement of Unit staff in public engagement activities is supported through the UWE Centre for Science Communication (SCU, co-hosted by the Unit's parent faculty). UWE co-hosts, with the University of Bristol, the National Coordinating Centre for Public Engagement (NCCPE) (funded by the four UK Higher Education Councils, Research Councils UK and the Wellcome Trust) and is a signatory to the NCCPE Manifesto for Public Engagement. One Senior Lecturer and one Research Associate support the Unit's public engagement activities. A BBSRC Public Engagement Award in 2009 to **Arnold** and **Reynolds** funded an 'Evolving Communities' programme of outreach to schools in the Bristol region and enables showcasing of their research to a younger audience. The Unit is the lead contributor to a science marquee at the annual Festival of Nature in Bristol (the UK's largest free natural history event). Bioblitz (Bristol Natural History Consortium) is an outdoors family event: agri-food staff and students hosted the inaugural event in 2010, and have played a significant role in subsequent years, drawing on their recent research to develop activities. Support for these events comes from UWE's Public Engagement Co-ordinator, based in RBI. **Ellwood's** work on evolutionary mechanisms that underlie global biodiversity has featured in the national press (*Telegraph*, *Daily Mirror*, *Independent*) and is featuring in the forthcoming major new BBC series *Monsoon*. A £50k Biffa Award-funded project led by **Steer** in collaboration with Bristol Zoo is currently restoring wildflower habitats for the benefit of pollinators on the Somerset Wildlife Trust's Catcott Reserve. Pupils at Catcott Primary School and Inaura School grow the plants and transfer them to the reserve.

c. Strategy and plans

One of UWE's four key priorities in its recent 2020 strategy is "Research with Impact: world-class performance in selected areas of research that meets the needs of a sustainable economy and society, and feeds the scholarship and enquiry that underpins our learning and teaching." This has informed Faculty and CRIB strategies. The Unit will address these strategies by supporting research that is planned and undertaken in collaboration with stakeholders, including via IBST and CRIB, as well as effective networking. At a strategic level, Business, Public and Community Engagement are led by the PVC for Research and Business Engagement, with Faculty input at Associate Dean level (**Ames**). RBI also hosts a Knowledge Exchange Community of Practice, with the Unit being represented by **Luxton**. It shares good practice in different types of stakeholder engagement across the University. Unit strategy will be developed beyond the existing well-established routes provided by CRIB and IBST and associated structures for sensor innovations, and support provided by the SCU. Impact will be celebrated as part of the Faculty culture (including events open to external audiences). The first Faculty Impact Day was held in October 2013 and this successful event will be further developed in future years.

Specific actions to deliver the Unit's impact strategy over the next 5 years have been identified. The Unit will further invest Higher Education Innovation Fund 2011-2015 resource by providing dedicated time for staff to support impact-related activities in promising areas. For example, in

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2013/14, funding is being invested in 'diagnostics' work through projects involving business engagement, public engagement and Continuous Professional Development for industry. CRIB will undertake a fresh critical analysis of impact activity and profile, appoint an Impact Champion, devise an action plan to optimise activity, and include impact in its annual reports and events. An indicator of University strategic investment is the appointment since 2008 of around half of the staff included in the current submission. The Impact Champion will ensure the timely development of impact from their research. The main responsibilities of the Impact Champion will be to work with impact-focused colleagues in RBI to ensure 1) delivery of impact awareness sessions for new staff and PGR students; 2) workshops to encourage and support researchers to engage with end-users and the public; 3) mechanisms are developed to maximise and capture evidence of impact; 4) excellent impact case studies are developed for the next REF. They will also support staff to develop an impact plan in parallel with every research application.

A Business Development Manager, based in RBI, will be appointed to work with Faculty, including Unit, staff to facilitate research especially with multinational and other large companies. RBI will enhance its *Client Relationship Management System* to ensure it is fully used to identify and share collaborators to facilitate impact.

IBST will build upon its close working with CRIB to ensure good alignment between research and knowledge exchange with the aim of maximising the impact of research in society. A significant development for the Unit is the IBST-linked 'Centre for Alternative Testing and *in-vitro* Monitoring' (CATIM), established in 2012 and funded by the European Regional Development Fund. CATIM is dedicated to advancing alternative testing methods and developing technologies for monitoring cells and cell systems, with laboratory space adjacent to CRIB labs. It provides enhanced resource and expertise to business including those in the agri-food sector. Unit staff will benefit from new partnership opportunities, especially industry-led projects underpinned by our research. Target areas include bio-prospecting for bioactive compounds, development of new assays, and evaluation of monitoring technologies. Through IBST, CATIM delivers networking events and workshops for industry, and signposts to a variety of other initiatives leading to jointly funded projects that are anticipated to result in impact.

The SCU will build upon its current support to facilitate the translation of agri-food research into events and communication initiatives that engage government, the public and other influential groups in formulating priorities to match the needs of national and global society and that are likely to lead to impact. Unit staff will draw on existing best practice through RBI's KE Community of Practice to achieve this. Through the CRIB Director (**Doran**), Unit staff will work increasingly closely with UWE Marketing and Communications to generate timely and targeted press releases and social media (Twitter, Facebook, YouTube, blogs) coverage of research and its impact, as well as ensuring that stakeholder dialogue with researchers is captured. RBI will continue to facilitate collation of activities leading to, as well as evidence of, impact. The Unit has identified public engagement as an area for growth. It will collaborate with the Faculty 'Social Science in the City' knowledge exchange initiative as one means to achieve this. For example, **Luxton** will lead a debate about public 'fear of technology' during the 2014 Science Week. In addition, the Unit will explore opportunities to run workshops and deliver other activities for people of all ages at regional museums, including the science museum Explore@Bristol, and festivals.

d. Relationship to case studies

The case studies informed and exemplify aspects of the Unit's approach to impact outlined in section b. Both case studies are based on user-led and government/industry-funded research that has resulted in the development of electrochemical sensors utilising screen print technology, fluorescence-based sensor systems, and the development of novel biocides and delivery mechanisms. Legal and financial advice and commercial support, provided by RBI, facilitated these collaborations e.g. through intellectual property protection. Approaches to impact that were specific to each case study follow. *Case Study 1: Reynolds* used IBST's industry database, international conferences, SWIG workshops and Royal Society of Chemistry events to identify potential collaborators. *Case Study 2: Hart* was put in contact with the Gwent Group by IBST.