

Introduction

- i. Cardiff University pursues internationally excellent research with global impact for society. In the 2014 Research Excellence Framework—the most recent national benchmarking and assessment exercise—Cardiff University was ranked 5th in the UK for the quality of research and 2nd for the impact of research, with 87% of research assessed as world-leading or internationally excellent. Our impact case studies included:
 - a. [Reducing violent crime](#) through the Violence and Society Research Group’s development of the Cardiff Model of sharing data between hospitals, police and local authorities. Decreases in community violence in Cardiff have been achieved, as well as an adoption of the Cardiff Model by the UK government and College of Emergency Medicine, and in all seven of Amsterdam’s hospitals, funded by the Dutch government.
 - b. A [study](#) found that the reflection of devolution of political power by broadcast news found that viewers were being routinely misinformed about major policy areas such as health and education in Wales, Scotland and Northern Ireland. Our main findings and recommendations were adopted by the King Report and led to a commitment by the BBC to improve their reporting of devolved political issues.
 - c. [Improving the response to victims of violence](#) by providing insights into how multi-agency working provides a more effective response for survivors of domestic and sexual violence. Our research provided evidence for three of the seven policy objectives in the 2008 UK Government report, “*Saving Lives, Reducing Harm, Protecting the Public*”.
 - d. [Reducing waiting times in hospitals](#) to improve patient care through our mathematical models which unravelled the complex reasons behind delays, waiting times in a range of services in hospitals in England and Wales.
- ii. As Wales’ only member of the Russell Group of 24 leading research intensive UK universities, we believe it is important for the right balance to be struck between support for universities to build critical mass in areas of research strength and expertise which have global impact, and strategically targeted funding for research that is of relevance and importance to the Welsh economy.
- iii. We see our institution as a vital part of society, delivering value at scale; the most recent data showed that in 2016/17 we added £3.23bn to the UK economy, which included £2.37bn to the Welsh economy, generating £6.30 for every £1 we spent. Moreover, our *research activity alone contributed £708.7m* to the UK economy. Beyond economic impact, we want to tackle the challenges that matter to the people of Wales, helping to make the nation safer, smarter and more secure. We also recognise the importance of addressing global challenges and ensuring translation of our research internationally.
- iv. Cardiff University’s recently launched overarching strategy, *The Way Forward 2018-23*, positions the institution as a research-focused organisation with a thriving innovation culture. We aim to excel in connecting business, government and society with our academics and students, including developing a pipeline of highly trained graduates supporting the local economy and Welsh / UK businesses.
- v. Through our Innovation System we aim to create economic and social prosperity in the Cardiff Capital Region, Wales and the UK by turning ideas and innovations into technologies, products and spin-out and start-up companies. Examples of key initiatives undertaken as

part of our Innovation System include working with industry in co-creating propositions and value, for example, establishing the Compound Semiconductor Centre joint venture company with the local semiconductor manufacturing company IQE Plc. We have also founded the Welsh Wound Innovation Centre as a joint venture with, and for the benefit of, NHS Wales and have established *Y Lab* as a public service innovation facility in partnership with NESTA (the UK's Government endowment-backed national innovation foundation).

- vi. In addition, we are also working to support the aim for a bilingual workforce and bilingual nation through our successful bid for two Coleg Cymraeg Cenedlaethol funded Research Scholarships, bringing our total up to 11 funded PhD students at Cardiff University.

1) Welsh Government says that there needs to be a “major increase” in research intended to help solve specific challenges facing Wales (challenge-led research). It also says this type of research needs to be balanced with the more traditional type of long-term research undertaken by universities which pushes the boundaries of knowledge.

a) To what extent do you agree with this view and how can Welsh Government ensure that an increase in one type of research activity doesn't mean the other type loses out?

- i. We agree with the view that Wales needs to increase the focus on challenge-led research. We believe that the benefits of academic breakthroughs should have as wide an impact as possible and would concur that challenge-led programmes provide a helpful focus for research aligned to key societal needs where a step-change in activity is required. This focus on societal (including Welsh) challenges does not necessarily mean a reduction in traditional research: we believe that the two types of research are highly interdependent, with increasing numbers of researchers recognising the value of working with external organisations to enhance translation of their research beyond HEIs.
- ii. Cardiff University is committed to the co-production of research with our collaborators within and external to the University sector, undertaking interdisciplinary and multi-disciplinary research, development and innovation in partnerships across Wales, the UK and worldwide in order to solve specific challenges. Welsh Government funding for research more broadly would add significant value, assuming the right balance can be struck between support for universities to build critical mass in areas where we have international research strength and expertise, and strategically targeted funding for research that is of specific relevance and importance to the Welsh economy. Our international collaborations are critically important for our global visibility and our ability to attract outstanding students and staff to work and live in Wales
- iii. Welsh Government can ensure that an increase in one type of research activity does not come at detriment to another source by fully implementing the recommendations of two of its most recently completed independent reviews: Professor Sir Ian Diamond's independent review of higher education funding and student finance arrangements; and Professor Graeme Reid's independent review of government funded research and innovation in Wales.
- iv. Both the Diamond and Reid Reviews were clear in their recommendations that Welsh Government should implement funding for innovative challenge-led research *in addition* to maintaining the level of quality research (QR) funding. In short, the overall pot of funding should increase rather than being divided differently. This would ensure that Wales does not continue to be at a disadvantage to our UK nations, where there are multiple sources of funding.
- v. The 2016 final report of the Diamond Review recommended that “Welsh QR funding should be maintained in real terms at its current level of £71m per annum over the next five years”

and that Welsh Government should “provide a dual support system of funding knowledge exchange, with around two hubs receiving core funding to enable agile and flexible engagement between HEIs and industry; together with a simple, flexible project based funding of initiatives aimed at projects that will impact on the Welsh economy.”¹

- vi. This year’s final report of the Reid Review recommended that “Welsh Government strengthens the Welsh research base and enables Welsh researchers to attract a greater share of UK-wide funding by implementing Diamond’s recommendation for QR funding and [creates] an additional Future of Wales Fund specifically to incentivise Welsh researchers to win funding from outside Wales.”²
- vii. Welsh Government accepted the recommendations of both reviews and we would like to see these key recommendations, designed to enhance the competitiveness of Welsh research and innovation implemented. QR should be at least maintained, with an additional pot of innovation funding created to support translation of Welsh research to benefit business, industry and society. Indeed, it is our view that such recommendations should be amplified; specifically, the need to *increase the level of funding available to support fundamental QR research which is used to improve research facilities, bring together critical interdisciplinary entities working on cross-cutting research challenges, attract outstanding international researchers and their teams to Wales and provide funds to match-fund external funding bids for Centres / Institutes / capacity building.*
- viii. QR funding is a highly competitive funding source allowing universities to engage in long-term strategic planning for research, and to respond quickly to emerging opportunities, giving them a strategic edge against international competitors. It is also a non-hypothecated funding stream, giving university leaders the freedom to take long-term strategic decisions about their research activities.³
- ix. QR funding underpins all activities, including the nation’s research-led undergraduate teaching of the next generation of researchers / highly skilled graduates. It also supports new high-risk collaborations: universities use QR funding to develop industry, funding and other forms of collaborations and partnerships with a range of organisations. While businesses may find it challenging to invest in risky research, or projects with medium- to long-term returns, QR funding allows universities to share this risk via co-funding, helping to facilitate collaborations between universities and business.
- x. QR also leads to long-term investment and thinking, addressing the challenge that many sources of public funding for research are short-term in nature. By contrast, QR funding is vital in allowing universities to develop and implement long-term research strategies.
- xi. QR leads to research income being secured from other sources: evidence shows universities that have higher research funding (including from QR) are able to generate more research income from other sources.⁴ In other words, the more QR funding allocated to a university, the more evidence of external organisations being willing to pay for a range of research activities and commercialisation.
- xii. QR is the bedrock that enables Cardiff University to compete for Research Council awards, for Doctoral Training Centres and Partnerships, for European and private funding, and for research and innovation to flourish. At £39m, QR funding represents the single largest regular source of research income to Cardiff University’s research activities. These allow

¹ Diamond, Ian, *Review of higher education funding and student finance arrangements* (Welsh Government, 2016), pp. 57–61.

² Reid, Graeme, *Review of Government Funded Research and Innovation in Wales* (Welsh Government, 2018), p. 4.

³ *A Review of QR Funding in English HEIs: Process and Impact*, (Higher Education Funding Council for England / Universities UK, 2014).

⁴ *The Economic Significance of the UK Science Base* (Campaign for Science & Engineering, 2014).

Cardiff University to play a key role in creating and disseminating knowledge, educating a highly skilled workforce for technological and intellectual leadership, and serving the needs of society.⁵

- xiii. Of equal importance is the inequity between England and Wales in relation to access to funding for innovation. The £210M Higher Education Innovation Fund, provided by Research England, is intended to support and develop a broad range of knowledge-based interactions between universities in England and the wider world. There is no equivalent in Wales.

2) Welsh Government has said it wants to bring all research funding together and that this funding should then be available to small and medium-sized enterprises (SMEs), large private businesses, and other organisations as well as universities and colleges.

- a) **To what extent should businesses and other organisations be able to receive Government research funding that might have otherwise gone to universities and colleges? How could this be done without under-funding some organisations – might there be unintended consequences?**
 - i. In order for Wales to prosper it is important that levels of R&D funding available to the higher education sector are competitive with those elsewhere in the UK. Cardiff University would have reservations about any measure which served to reduce the level of research funding available to Welsh universities placing them at a further disadvantage compared to our comparator Institutions (e.g., Russell Group for Cardiff University). As previously highlighted a decrease in the level of funding available to support universities would ultimately have a detrimental effect on areas such as undergraduate and postgraduate education, research excellence, engagement and innovation. This would have a negative effect on income generation, matched funding for large-scale Centres /Institutes, attraction to international academics (likely to be challenging anyway due to Brexit) and support for the next generation of researchers working in Welsh industries, business and public sector organisations.
 - ii. We stress the need for the Welsh Government to at least maintain and, preferably, to grow the level of resources available to support collaborative, challenge-led co-delivery between universities, further education and the private, public and third sectors. The University recognises that each of the various actors within the innovation ecosystem has a part to play in generating economic and social benefit. We again stress the risks inherent in not maintaining, or even worse, decreasing the level of funding available to support the discovery research which underpins R&D activities. A strong underpinning discovery base is imperative to research innovation, and in turn business engagement and prosperity.
 - iii. To strengthen productivity it is imperative that the entire ecosystem is engaged – infrastructure, people, research (across the spectrum of discovery to applied) and development. Therefore, whilst funding should be challenge-led, allocating resource to or through business or other organisations will only prove an effective mechanism if HEIs are mandatory participants, enabling the HEI sector to be a key driver of economic growth through collaborative R&D.
 - iv. To reiterate, QR in universities is often the root sustaining later breakthroughs that address challenges—if QR is not funded properly, subsequent innovation will wither on the vine. By way of example, it was decades of publicly-backed fundamental research into biology, chemistry and medicine that allowed the University's Professor Ian Weeks to innovate the

⁵ Wang, Q., Cheng, Y. & Liu, N. (eds.), *Building World-Class Universities: Different Approaches to a Shared Goal* (Sense Publishers,), pp. 1–10.

use of light-emitting biomarkers for disease diagnosis in clinical settings. In addition to delivering immediate benefits for patients, this discovery was licensed to diagnostics companies with a spin-out company creating highly-skilled jobs locally and reinvesting in further research. The contemporary business successors of the original licensees manufacture and market hundreds of millions of laboratory tests each year for the benefit of patients worldwide. These include diagnostic tests for cancer, infections, diabetes and many other illnesses, as well as blood bank tests that screen donated blood for pathogens such as HIV and hepatitis. It was QR funding that served as the building block for this high-value solution to a clinical/industry challenge.

- v. A more effective course of action would be for Welsh Government to adhere closely to the recommendations of the Diamond and Reid Reviews, maintaining QR funding and establishing additional funds for innovation, as discussed earlier in this response. The absence of dedicated innovation and engagement funding has seen Wales fall behind the rest of the UK, with debilitating implications identified.⁶ Such effects include the diminishing of specialised business engagement teams in universities and a removal of the incentives needed for sustainable partnerships with business. Addressing this gap in our funding streams would place us on an even footing with our competitor Institutions elsewhere in the UK, and allow our excellent research outcomes to be fully translated into impact for society.

3) In a recent review into research funding, it was argued that there was a strong risk of university research and innovation interests overshadowing the research and innovation interests of private businesses. But it didn't then go on to suggest a way of stopping this happening.

- a) **What needs to be done to ensure businesses and their interests are not over-shadowed by universities when it comes to research and innovation funding and activity?**
 - i. Development of emerging technologies and new market opportunities is best addressed by research at significant scale. This is reliant upon universities and the private sector working closely together in partnership and co-investing in programmes of work. We do not recognise the possibility that the interests of businesses may be overshadowed by those of universities in research and innovation space as a significant risk.
 - ii. To delineate between 'business research' and 'university research' is to suggest that industry interests are not supported by university research. We disagree with this view and concur with the principles of the Hazelkorn and Weingarten Reviews—both of which were accepted by Welsh Government—that Wales needs an ecosystem approach building on its strengths as a mixed economy.
 - iii. Framing business interests as being 'overshadowed' by universities also suggests wealth-creation is the exclusive domain of dynamic private organisations. Should such a view be adhered to, it is worth considering again that the University's most recently calculated annual impact was £2.37bn in Wales, with the most recent figure for Gross Value Added in Wales standing at £518m.⁷ Almost 1 in 130 jobs in Wales depends on the University, which supports 12,600 jobs across the UK.
 - iv. Business can be encouraged into research relationships with the university sector by supporting initiatives such as CASE studentships, KTP and small-scale pilot R&D schemes. We gratefully acknowledge the support that the Welsh Government has provided for these

⁶ Morgan, K., et al, *Growing the Value of University-Business Interactions in Wales* (National Centre for Universities and Business, 2017), pp. 1–10.

⁷ Kelly, U., McNicoll, I. & White, J., *The economic impact of Cardiff University* (Viewforth Consulting, 2014)

activities, resulting in initiatives such as the Enhanced KTP scheme. At the other end of the scale, the University is increasing its engagement with the private sector as part of its 2018-23 strategy of developing high level strategic partnerships. Cardiff has been supported by the Welsh Government and HEFCW to do this by the provision of financial support for its involvement in the SETsquared Scale-Up Programme (HEFCW Research and Innovation Capital award, 2018).

- v. There needs to be a process of evaluation of which interventions have proven to be the most effective and also more awareness raising to demonstrate to industry the opportunities presented by co-working with universities.
- vi. The UK Government has committed to work with industry to boost spending on R&D to 2.4% of GDP⁸ by 2027, the majority of this flowing through UKRI. This represents the largest increase in R&D investment in any Parliament since 1979. It is worth noting, however, that no funds are earmarked specifically for Wales, so there is no guarantee that any of that increased budget will benefit the Welsh R&I landscape. In addition, the approach taken by the Cardiff Capital Region City Deal Strategic Business Plan states that there will be a focus on making commercial investments in companies within the region to improve access to capital.
- vii. Growing Value Wales identified a list of calls to action for businesses, universities and government. These included the rehabilitation of I&E funding, supporting new models of innovation and better access points to university expertise and resources. Creating an environment—at both a system and institutional level—that encourages the commercialisation of innovative research is also key to success.

4) In the academic year 2016/17 there were 241 graduate start-ups reported by Welsh universities with an estimated turnover of £56 million, this was almost double the turnover of university staff start-ups in the same year.

a) What is currently in place from universities and Welsh Government to help and support student and graduate entrepreneurs turn their ideas into successful ventures?

Cardiff University provides comprehensive support for those interested in starting their own enterprise, becoming self-employed or going freelance. This support is available to current students and graduates up to 5 years after graduating and includes:

- i. Business mentorship from internal and external mentors;
- ii. Workshops on start-up topics such as ideas generation, accounting, market research and intellectual property ;
- iii. Workshops to develop soft skills such as pitching ideas, networking, communication, customer service and problem solving;
- iv. Access to small amounts of seed funding to kick-start an idea;
- v. Recognition and rewards in our Start-up Awards;
- vi. Bootcamps aimed at accelerating a student and their idea to launch;
- vii. Access to desk space for 3, 6 or 12 months at no charge. This is currently subject to availability although we aim to expand provision through the establishment of new premises on our Innovation Campus (i.e. the Innovation Central building).

⁸ The 2.4% target has been described as “extremely ambitious”. Assuming a modest rate of growth, it would mean R&D spend rising by £22 billion (41%) between 2015 and 2027, from £32 billion to £54 billion. This compares to an increase of £6.6 billion (26%) in the period from 2004 to 2015. If the target was met, it is estimated that there would be a total UKRI budget of around £11 billion by 2027.

All of our service provision is based within the Careers and Employability service and is supported by Welsh Government through the Youth Entrepreneurship Strategy which provides funding and support to help deliver the provision. Available resources include a large pool of local and national role models, small and large scale entrepreneurship events and campaigns to boost awareness of Youth Entrepreneurship.

b) Is this support systematic and consistent across Wales and is there more Welsh Government and others could do?

The support on offer at Cardiff University is similar to that offered in all universities across Wales, due to the fact that the Welsh Government funds and promotes youth entrepreneurship activity across the nation. Locally, Cardiff University prioritises Enterprise education by core-funding some members of the team, allowing us to increase our provision due to the greater resource.

5) The recent review of research made recommendations to help incentivise businesses and universities to work closely together on research and innovation to take their collaborations to “greater heights”.

a) What are businesses and universities able to offer each other when they work in collaboration on research and innovation projects?

- i. Cardiff University’s updated *Way Forward* strategy for the period 2018-23 highlights the importance of strategic partnerships with industry, the public and third sectors. Cardiff is committed to increasing the breadth and depth of our relationships with partner organisations, working together more closely in order to deliver additional benefits for all participating organisations.
- ii. We are also very supportive of the findings of the recent ‘Growing Value Wales’ project which brought together key individuals from the private and higher education sectors to focus on practical ways of harnessing the talent being developed in our universities and our strength in ground-breaking research and development for the benefit of the nation’s economy. The taskforce was co-chaired by Cardiff’s Vice-Chancellor and President Professor Colin Riordan and Dr Drew Nelson, Chief Executive of IQE Plc.⁹
- iii. The speed with which private companies can bring innovations to market is a strength, as is industry’s ability to focus on narrow targets, but so is the space and time universities can invest in advancing the frontiers of knowledge.
- iv. To that end, we are committed to increasing the breadth and depth of our relationships with partner organisations, working together more closely in order to deliver additional benefits for all participating organisations. *Encouraging collaboration, sharing of facilities, secondment of staff and provision of catalyst innovation funding to see ideas through to being taken up by business is the approach we would most support.*
- v. Creating an environment which encourages the commercialisation of innovative research is also key to success, alongside funding. In recognition of this, Cardiff University is investing £300m in the development of its Innovation Campus including £50m to house an Innovation Centre offering high-quality, affordable space, advice and support, together with a Social Science Research Park (SPARK), whose research is contiguous with commercial and public innovation. The new campus will bring together researchers, businesses, public sector backers and students to unlock ideas that drive economic growth. This combination of activities will provide an entrepreneurial environment for the acceleration of University staff and student start-up activities, working alongside existing businesses, professional

⁹ <http://www.ncub.co.uk/what-we-do/growing-value-wales-task-force>

advisors and investors. In addition, start-up companies will benefit from close proximity with academic researchers and professional services to help drive business growth through innovation. We believe that the creation of such creative space to support interdisciplinary, commercial activities will provide an example of good practice for the future.

- vi. On this point, the quality of university infrastructure is an attractive proposition for businesses seeking to research and innovate and the funding of such facilities is worth examination. Although our level of research income secured from UK Research Council and Innovate UK sources (the precursors to UKRI) far outweighs income from EU sources (primarily Horizon and Structural Funds), these sources support activities which are subtly different to those which are supported by European monies in Wales. In particular, the use of Structural Funds by Welsh universities to undertake knowledge exchange activities and large capital projects is well-established. EU funding (delivered via the Welsh European Funding Office) has, for example, provided considerable support for the capital build of our Cardiff University Brain Research Imaging Centre and the industry-facing Institute of Compound Semiconductors.
- vii. Beyond research and innovation collaboration, we are able to offer access to a pool of talented graduates. We are seeking out and responding to opportunities to establish new educational provision in response to industry demand; in response to our successful example set by our National Software Academy. In addition, we are strengthening our provision of Continuing Professional Development and Executive Education to meet the needs of employers.
- viii. An equal partnership between universities and business can deliver knowledge exchange, innovation and the creation of jobs. It brings together practical industry challenges and business-informed horizon scanning with critical mass fundamental and applied research capacity. Properly managed, this can create a highly fertile R&D environment which can drive economic growth. Cardiff is committed to develop the skilled workforce required to energise the economy and our Innovation for All programme is aimed at maximising opportunities for students (as well as for staff) to take part in innovation and entrepreneurship activities, to engage in our societal challenges and work with our external partners. We are seeking out and responding to opportunities to establish new educational provision in response to industry demand, e.g. our successful National Software Academy. In addition, we are strengthening our provision of Continuing Professional Development and Executive Education that meets the needs of employers.

b) Should Welsh Government and others be doing anything differently to bring smaller businesses together with universities to collaborate on research and innovation projects? What is working well and what isn't?

- i. The University is wholly supportive of the Welsh Government's SMART Expertise and related programmes which offers financial support for collaborative projects between industry and Welsh universities, focusing on commercialisation and exploitation of new products and processes and growth in key areas of smart specialisation. As outlined above, we support the development of innovative start-up communities that allow for the sharing of space between researchers and industry. Start-up companies will benefit from close proximity with academic researchers and professional services to help drive business growth through innovation.
- ii. We have, however, also identified a largely unmet need for universities in Wales to have available devolved, in-house funds for proof of concept work which could be deployed more rapidly in an agile and responsive manner in order to accelerate the development of new projects and opportunities. This would mirror the support available in England through

Higher Education Innovation Funding (HEIF), recognised by the Reid Review as a key component which is absent from the innovation ecosystem in Wales.

- iii. We would also refer back to the arguments of the Growing Value Wales project, which found an absence of dedicated innovation and engagement funding to have a particularly negative effect on smaller organisations and, by extension, poorer communities. It noted that whilst “larger HEIs have some capacity to absorb the loss in their overall budgets, smaller HEIs are not in a position to do so, with the result being that the poorest areas will have the least capacity to engage in the knowledge exchange activities that are critical to social and economic regeneration”.

c) What should Welsh Government and others be doing to help businesses use the knowledge gained from research activity and turn it into marketable products or improved services?

- i. The Welsh Government has been highly strategic in supporting the partnership between Cardiff University and IQE Plc to create their joint venture (Compound Semiconductor Centre) and, subsequently, the world’s first Compound Semiconductor Technology Cluster in South Wales, which includes a dedicated Institute of Compound Semiconductors at the University. This has been coupled with subsequent investment from the Cardiff Capital Region City Deal. The importance of the Welsh Government’s role in facilitating these developments cannot be overestimated. This is an excellent model of how internationally-leading co-directed challenge lead research can be supported to the benefit of both business, HEI and local communities.
- ii. In relation to smaller scale collaborative R&D between universities and the private sector which is often supported by grant funding, it would be beneficial for innovation advisors to track these activities post-completion in order to provide companies with further direct support for commercialisation downstream.
- iii. Funds to enable co-produced research and innovation between HEIs and industry are needed to facilitate problem-focussed collaboration and people exchange. The Research Council Impact Acceleration Accounts have proven to be hugely beneficial in this area, allowing for challenge-focussed workshops leading to collaborative R&D projects, and enabling two-way people exchange to cement relationships between these sectors and enable more effective collaboration. A further benefit of these schemes is the short turnaround time of the funds, with projects assessed and funding distributed within a matter of weeks, allowing for timely and targeted support even at very short timescales.
- iv. The University holds Impact Acceleration Accounts from 3 Research Councils (ESRC, EPSRC, STFC) and translational funding from the MRC (Proximity to Discovery and Confidence in Concept). These provide the University with flexible funds to support impact working with a wide range of external stakeholders. Applications are assessed by panels comprising internal and external reviewers, including representatives from business.
- v. The funds have supported more than 84 projects working with 91 companies and supporting 10 secondments/placements between the universities and businesses.

Cardiff University

8th October 2018