

Institution: Cardiff Metropolitan University		
Unit of Assessment: UOA32- Art & Design: History, Practice and Theory		
1. Unit context and structure, research and impact strategy		
<p>Since 2014, our Art and Design researchers have collaborated with 256 organisations from 40 different countries, winning research and innovation funding totalling over £47M. This is an increase of 135% in grant capture compared to the last REF period and a 100% increase in the number of international projects. Other highlights include a 47% increase in the number of publications and a 108% increase in the number of interdisciplinary projects.</p>		
Context and Structure		
<p>For RAE2008 and REF2014, Cardiff Metropolitan University (Cardiff Met) was part of the Wales Institute for Research in Art and Design (WIRAD) UoA 34 submission that included the University of South Wales and the University of Wales Trinity Saint David. Since the 2014 submission, research collaboration between WIRAD partner institutions has continued, and increased. However, due to changes to the structure of partner institutions (including mergers) and revised REF rules making a joint submission considerably less practical, a joint decision was taken to make separate submissions to REF2021.</p>		
<p>Art and Design (A&D) research within Cardiff Met is undertaken at the Cardiff School of Art and Design (CSAD), a traditional art school established in 1865, and the International Centre for Design and Research (PDR), a design focused research and innovation institute. CSAD's research covers a broad range of subjects from Fine Art and Craft to Product Design and Architecture. It is home to many facilities founded on interdisciplinary research and works with partners from a broad range of academic and industry sectors. PDR was established in 1994 to develop new knowledge in product design and development. Its core principle is to champion the role of creativity in the development of transformational research and to challenge established ways of 'thinking and doing' in academia and industry. PDR's research incorporates both exploratory and impact driven research and is often aimed at generating sustainable economic growth and social cohesion.</p>		
Strategic Aim and Impact		
<p>During this REF period, our strategic aim has been <i>the delivery of social and economic benefits nationally and internationally</i> and has centred on three components:</p>		
1. Increasing the range and value of funding streams that we access		
<p>The table below highlights the growth in the number of high value projects over the last period.</p>		
	REF2014	REF2021
Total value of research awards	£20,158,221	£47,381,917
Value to Cardiff Met	£5,817,282	£8,052,300
Number of projects from cherished sources*	14	47
Total awards from cherished sources	£3,407,653	£20,060,411
Value to Cardiff Met from cherished sources	£723,105	£4,083,465
<p>*UKRI, British Council, Major Charities, Horizon 2020, EU Rural Development, EU Creative Europe</p>		
<p>Two examples of projects funded by cherished sources are:</p>		
<ul style="list-style-type: none"> • The Creative Industries Clusters programme, a £5.4M project funded by the Arts and Humanities Research Council (AHRC) and in partnership with Cardiff University and University of South Wales aimed at increasing the R&D potential of screen media and news companies. • A £913K project in collaboration with the NHS and Renishaw Plc, jointly funded by the Engineering and Physical Sciences Research Council (EPSRC) and Innovate UK to 		

automate part of the design and development process for personalised 3D printed medical implants.

This strategy has helped in the development of our national and international networks, enhancing the reputation of our staff and aiding staff development.

2. Growth in interdisciplinary and international activity

The table below highlights the growth in interdisciplinary and international activity compared to the last REF period.

	REF2014	REF2021
Number of interdisciplinary projects	26	54
Total interdisciplinary awards	£9,995,657	£43,374,182
Cardiff Met Value of interdisciplinary awards	£2,786,204	£5,994,653
Number of international projects	9	18
Total international awards	£12,820,489	£12,461,789
Cardiff Met Value of international awards	£1,108,664	£2,223,657

Examples of projects with significant interdisciplinary and/or international dimensions are:

- PRESTIGE - a **16 partner** pan-European Horizon 2020 project examining the development of smart materials and their role in addressing societal problems. This **€7.7m project**, led by *Energie Atomique*, France combines Engineering, Sociology, Polymer Science and Design from institutions in France, UK, Finland, Spain, Sweden, Germany, Austria and Greece.
- Two EU Interreg projects led by Cardiff Met, using design research to develop innovation policies and business action support across Europe. These projects have a combined value of **€3.7m** and involve **14 partners** across the UK, Belgium, Greece, Latvia, Poland, Spain, Ireland, France and Portugal.

3. Enabling growth within our research base

The table below highlights the strategic growth in our research base over the REF cycle.

	REF2014	REF2021
Number of research student completions	14	29
Number of independently research active staff (FTE)	10	24 ¹
Number of research assistants	6	23
Number of Professors	7	10
% Female Research Leaders	24%	47%

Section 2 demonstrates how we have met our strategic ambitions by supporting staff to grow as researchers.

Open Access

We have made significant advances in making our research more open and accessible. For example, we have invested in staff training in the use of institutional facilities such as our DSpace and Figshare repositories, which make research results searchable and shareable within cross-institutional teams and with the public. DSpace hosts open access versions of our academic publications and other dissemination material, making our work available to a wider audience and allowing us to share research findings, best practice and data sets. In this REF period there were **231,147** downloads compared to **37,021** downloads in the last REF cycle. Open access also gives transparency to our processes, enhancing the credibility of our work and providing trust in our findings. Figshare, an online platform that enables data to be shared both publicly and privately with named collaborators, was introduced in 2018. It presents an exciting opportunity for practice-based researchers to make data publicly available and accessible.

¹ One of our independently research active staff is a member of another academic school at Cardiff Met.

Where appropriate, material detailing the research process can be made easily available detailing each step from initial ideas and sketches to finished output and dissemination.

Training delivered in collaboration with the institution's Information Services Department helps staff make their research more open and accessible and increases their knowledge of Intellectual Property, licensing issues, GDPR and research ethics. This ensures researchers can make informed choices about what data can be shared on open access platforms. At the start of projects, researchers produce data management plans (along the lines of those required by Research Councils). These plans ensure all partners are informed of their responsibilities and how the data can be used after the project completes. Staff are supported to adhere to the data management requirements of funders and budgets are available to support publication in open access journals.

Future Strategic Aims

Our overarching strategic aim is to continue our **focus on the delivery of social and economic benefits nationally and internationally**. This is predicated on A&D research having much to offer in addressing global challenges in partnership with other disciplines.

Building on our significant advances in internationalisation and interdisciplinary research, we will help more of our researchers to develop and grow by exploiting funders' interests in Global Challenges. Our future strategy, therefore, is to raise the visibility of A&D research and broaden our impact through greater involvement in strategic issues such as healthy ageing, sustainability, education, global challenges and innovation strategies. While our previous strategy was to be more involved in international, interdisciplinary projects, the future strategy is to play a more leading part in major research projects, including through more PI roles.

Involvement in the £5.4M AHRC Creative Industries Clusters project indicates a level of maturity in some of our research areas, where expertise developed from international collaborations is being used to address industrial challenges in South East Wales. In the next REF cycle, we will expand on our success, participating in more projects that draw on our expertise to address challenges within the UK and beyond. Further, we will seek to increase the numbers of A&D researchers that lead work-packages and funded projects. The development of people will continue to be the driving factor in our strategy, utilising the experience of our Professors, Readers, and other senior researchers to develop Early Career Researchers.

Our research will also contribute to, and pioneer, University level initiatives to increase the quality, reach and impact of Cardiff Met research. For example, Cardiff Met is currently implementing a Global Academies initiative, with one of the new Academies being 'Human Centred Design'. These academies promote international and interdisciplinary collaboration to address challenging global priorities. Additional research staff will be recruited to lead and support the Global Academies. We will continue to use such mechanisms, not only to grow our current research interests, but to develop new research foci such as A&D pedagogy. Increasingly, we will undertake research in ways that encourage and promote open access, making use of the infrastructure investments Cardiff Met has made in open access platforms designed to keep pace with relevant web accessibility standards and which meet the evolving principles of Open Research Data (ORD). We will also work closely with central units to ensure that we remain aware of emerging platforms and practices that enable more effective sharing of peer-reviewed research. This will include improving staff engagement with new platforms and increasing understanding of the benefits associated with Open Research Data

2. People

One of our key strategies has been growth of our research base through a proactive approach to staffing and staff development. A&D has been home to **23 Research Assistants (RAs)** this REF period compared to six in the last, made **24 new academic/research appointments**, and added **16 new research degree Supervisors**. **Six Professorial** awards and **one Readership** award

have been made, and the percentage of **female research leaders** has increased by **133%** since 2014.

Recruitment: Cardiff Met made holding a doctoral degree an essential criterion for academic posts during this REF cycle as part of a strategic drive to increase the University's research base. This significantly improved our research environment, with nine new staff holding doctorates **doubling** the number of staff with PhDs since 2014. This has strengthened existing areas of expertise (e.g. Human Centred Design, Sustainable Architecture, A&D Theory) and developed new areas of interest (e.g. Fashion and Photography).

Progression: Researcher development and career progression at all levels are key to achieving our strategic aims of further research base growth and research income diversification. Formal development structures are in place including mentoring, training, network building, internal funding and performance metrics. Led by the Associate Dean for Research in CSAD and the Research Director in PDR, these ensure research is at the heart of all operations including performance reviews and workload allocation. Of the 23 RAs employed during the period, **Baldwin, McLaughlin, Ruta, Ward** and **Watkins** became Post-Doc RAs. **Ruta, Taylor** and **Waldron** are all engaged on their first RA contracts, while **Baldwin, Burleigh, Fennell** and **Ward** have all been promoted and are on their second contracts. **Watkins** is now a Director of Programmes in CSAD, charged with both Product and Fashion Design. **Alam, McLaughlin, Vigers** and **Zitkus** are employed at other academic institutions (Brighton, Bangor, Bristol and Loughborough respectively).

The strong relationship between CSAD and PDR offers additional routes for career progression within Cardiff Met. Where research interests align, co-supervision and mentoring is provided. Nine staff: **Andrews, Clarke, Eggbeer, Green, Gordon, Kopanoglu, Ruff, Walters,** and **Wong** have progressed their education and careers through a combination of CSAD and PDR. For example:

- **Clarke** - BA and MSc (2008 – 2013) with CSAD, Knowledge Transfer Partnership (KTP) jointly supervised by CSAD and PDR (2013 – 2015); continued employment with industry partner until 2018, now working in PDR's commercial team on projects including the Cooltone product for Allergan (part of a **£2.96M** collaboration and described in our User Centred Design impact case study).
- **Kopanoglu** received a Cardiff Met bursary in 2017 and enrolled as a PDR PhD student, provided Associate Teaching cover in CSAD from 2018 and joined CSAD as a Product Design lecturer in 2020.

Staff Development: The focus of staff development is to provide a responsive infrastructure within which researchers can develop the skills required to produce excellent research outputs with impact. Our research groups are a key vehicle for providing this support and benefit from targeted resources to build and strengthen their capacity, enabling active researchers to develop their portfolios and support emerging researchers to establish their research careers.

The collaborative, diverse and interdisciplinary nature of our research groups have been instrumental in responding to Cardiff Met's strategy to increase research income by broadening the opportunities, range of funding streams, and value of grants open to our researchers. Our aim to develop our interdisciplinary and international research experience is also reflected in the profiles of our four Visiting Professors, **Hall** (Cardiff, Medicine), **Dix** (Swansea, Computing), **Park** (Samsung, Design), and **Weston** (Cardiff, Architecture).

We currently support nine research groups:

- CARIAD - Centre for Applied Research in Inclusive Art and Design (led by **Keay-Bright** and **Treadaway**, CSAD) seeks to improve peoples' lives and address some of the most significant challenges facing society. CARIAD attracted 12 research students in the period, won over £684K in grants from the AHRC, Raspberry Pi Foundation and Welsh

Government (WG) and launched a spin out company.

- Design and Innovation Policy (led by **Whicher**, PDR) takes a macro view of design, looking at national and regional innovation ecosystems and policies to support design and encourage environments that are conducive to the application of design. The group has advised **15** national, regional and local **governments** throughout Europe and secured **£3.3M** funding from AHRC and Interreg Europe.
- Eco Design (led by **Beverley**, PDR) looks at how design can be used to generate services and business models within a circular economy. The group is currently part of a **€7.7M Horizon2020** research project centred on designing for smart materials, with their role being to develop sustainable and circular business models. Beverley also leads an AHRC-commissioned project examining the role of design research in a Net Zero future.
- FAB-Cre8 (led by **Murphy**, CSAD) is a multi-disciplinary research group driven by an interest in emerging technologies, digital fabrication, physical computing, the Internet of Things, and material investigation applied to a broad range of A&D contexts. The group have supported 11 projects, produced 28 research outputs and attracted over **£247K** from funders including the British Council, EU, Higher Education Academy (HEA) and WG.
- FovoLab (led by **Pepperell**, CSAD) is rooted in fine art practice and is primarily interested in how ideas and methods from art and science are combined to study visual perception and its representation. FovoLab has **three international patents** granted, three pending, and has generated a **spin out company externally valued at £10.3M**.
- MetaTechnicity (led by **Thompson**, CSAD) supports interdisciplinary and transdisciplinary research spanning A&D, Technology and the Sciences. Their key interest is the way in which technology affects and is influenced by human consciousness. The group is home to **12 research students** and has increased its membership from two to 25 in the period, spanning A&D, archaeology, creative writing, education, microbiology, philosophy and sport.
- SuRBe - Sustainable and Resilient Built Environment (led by **Littlewood**, CSAD) works in partnership with social housing groups and focusses on sustainable design and construction of dwellings from an ecological perspective. The group supports the work of 21 research students - many of whom are in receipt of competitively won scholarships - and has attracted over £676K in innovation awards and consultancy.
- SPD - Surgical and Prosthetic Design (led by **Eggbeer**, PDR) supports collaboration between healthcare professionals and wider stakeholders in the research, design and development of medically approved patient-specific devices. The group works closely with medical teams, has attracted **£1M+** from funders including the EPSRC and received a 2015 **Queen's Anniversary Prize** in recognition of the impact of their research.
- UCD - User Centred Design (led by **Gill**, CSAD) examines the importance of the human as the target of the design process and the prototype as a focus around which ethnographical research methods can be deployed. The group has supported the work of **16 research students**, many of whom have been in receipt of studentships, and has attracted **£2M+** from a range of funders, including **AHRC**, Medical Research Council (MRC), WG and Innovate UK. Notable consultancy clients include **Principality Building Society, Allergan** and **Kenwood**.

Each group is headed by a Professor or senior researcher and provides a platform for peer-to-peer support, postgraduate research (PGR) supervision, emerging researcher mentorship and support for active researchers to build their portfolios and experience. Groups have the freedom to develop their own approaches; for example, Metatechnicity focuses on research student

recruitment and curiosity-driven research, whereas User Centred Design focuses on securing research and innovation (R&I) grants to deliver applied research. Surgical and Prosthetic Design tends to respond to industry-driven healthcare needs, whereas CARIAD works closely with users and charity groups to support the wellbeing of vulnerable people.

All our researchers have access to support for staff development, growth of international and interdisciplinary research and impact development. This is achieved through formal and informal structures to promote researcher development such as seed funding, training, peer-to-peer support, and activities to foster a collaborative, open and responsive research environment. For example:

- Researchers can apply for CSAD/PDR funding to support research activities. During the period, over **£250K** has been available to support the development of research outputs and new areas of research including small scale field research, funding application development, networking, equipment and training. A total of **28 researchers** were supported to present work at **62 conferences** in **18 countries**.
- CSAD offers a range of A&D specific training including **eight** residential workshops on the island of Tiree, residential R&I skills training in the Brecon Beacons, and two residential workshops organised by research groups. A weekly series of public Research Seminars allow staff to showcase their research and a series of annual events focus on developing specific research skills.
- In 2018, CSAD re-introduced the 'Early Career Research & Innovation Scheme' in recognition of increased numbers of School staff new to academia. This competitive scheme runs for two years, with participants receiving dedicated funding for conference attendance, training, mentoring, and peer-to-peer support. Outcomes include ECR inclusion as co-investigators on the AHRC-funded Creative Industries Clusters programme and partnering in a **£210K** Welsh Government-funded SMART Expertise project on 'Data Physicalisation'.
- Staff are given a minimum **271 hours** per annum pro rata **plus fee waiver** allowance for Doctoral study, and **10** of our staff are currently completing PhDs. Staff also have the option of dedicated research leave.
- Informal peer-to-peer support is strongly encouraged. In addition to the support through research groups, we also operate informal schemes to encourage open discussion between staff. For example, Reading Groups to discuss latest research publications, and PDR's 'Cake Fridays', a dedicated time in the working week for staff to informally get together and share information.

Training and support is designed with both staff needs and strategic priorities in mind. During the period, all CSAD academic staff were invited to complete a **five-year plan** to outline their ambitions in line with School priorities. These individual plans feed into formal Staff Performance Reviews and annual workload allocations. Two new research groups emerged from this process: one focusing on Artistic Practice (**Cazeaux**) and another on Creative Learning (**Loudon**). Staff were also encouraged to think about the enablers behind their plans, including building networks and experience through internal and external committee/board membership and relationships with industry. Researchers are guided towards School, Institutional and external funding opportunities as appropriate.

Our staff are encouraged to take advantage of formal University-wide research and innovation training opportunities such as: Supervisory Training; Women to Professor (designed to encourage more Readership and Professorship applications from female researchers); Early Career Researchers' Forum; Academic Writing workshops; Interdisciplinary funding workshops; and support to attend residential funding workshops at the Missenden Centre. Organisational Development also provide training for skills associated with research and innovation, including

project management, social media, networking, chairing meetings, and technical skills such as designing electronic surveys.

Staff are also supported to take advantage of external training opportunities and Fellowships. Four members of staff (**Begum, Dorrington, Fennell, Walters**) were selected for Welsh Crucible Fellowships, a highly competitive, national programme that focusses on professional development and leadership skills in Welsh universities. **Whicher** was awarded an AHRC Policy Fellowship in 2017 and **Whicher** and **Beverley** were awarded AHRC Design Fellowships in 2020.

Support, Training and Supervision of PGR Students

We are actively engaged in the support, training and supervision of PGR students at School and University level. **Baldwin, Gill, Loudon, Littlewood, Thompson, Treadaway** and **Walters** contribute to the delivery of university-wide training and support and were involved in a review of existing structures to adapt provision in order to better reflect the needs of contemporary PhD Scholarship. This included reviewing application and enrolment processes, monitoring processes, online delivery methods and novel modes of delivery and resulted in the introduction of a new structure in September 2020.

We offer a range of doctoral programmes on a full and part-time basis. During the period, we enrolled **50** new research students and achieved **29 completions**. The completion rate is a **107% increase** compared to REF2014, a reflection of strategic efforts to widen the research base and improve monitoring processes. The majority of research students are aligned to research groups, which promotes a sense of community and provide additional access to subject expertise and support.

We actively seek opportunities to partner with industry to offer doctoral scholarships, so enabling us to support applications from talented applicants who may not be able to afford PGR study without access to a scholarship or programmes aligned with professional commitments. For example, four EU-funded Knowledge Economy Skills Scholarships (KESS2) embedded research students (**Duncan, Gilmore, Jahic, Zaccaro**) in organisations to conduct a body of research of benefit to each respective business. We also secured three competitive Cardiff Met Research Innovation Awards to support research studentships within the period (**Lawrence, Al Batlouni, Kopanoglu**). These studentships involved active sector engagement, with recipients working with NHS patient community groups and Small or Medium-sized Enterprises (SMEs) from the Welsh Food Industries Sector to develop and transfer new knowledge of benefit to the UK economy and society. Our Professional Doctorates are often sponsored by employers because they support an employee to develop a change management programme in their organisation that will lead to a new body of professional knowledge and organisational impact. These initiatives provide our PGRs with additional industry training and experience and bring fresh knowledge into the university, benefitting other PGRs through supervisory exposure to up-to-date industry knowledge. The applied nature of much of our research means this kind of external engagement is not limited to specific schemes with industry partners but is a feature of many programmes of study. Our PGRs have also worked with charities, schools and community groups through their association with research groups.

In 2019/2020 CSAD trialled a 'four-year PhD' initiative for the University. The programme was instigated partly in response both to a University initiative to reduce completion times and a change in student loan regulations. It provides PGRs with additional training and experience, and includes a one-year Masters in Research in preparation for PhD study and a three-year PhD programme. PGRs on this programme start at a single enrolment point, with a view to developing a strong and motivated student cohort with access to supervision and peer-to-peer support.

Our PGRs follow the same regulations and requirements for progression regardless of programme, with each assigned a Director of Studies and up to two additional supervisors. Supervisory teams hold formal progress reviews at three-monthly intervals for full-time PGRs

(six-monthly for part-time), in addition to informal meetings. Progress is formally reviewed annually by School and Institutional Research Degrees Committees and recorded via PhD Manager, an online database accessible by research students and supervisory teams, which enables PGRs to manage their entire research programme. Functions include a Professional Development Portfolio, skills training records, records of supervisory meetings and changes to enrolment.

CSAD has invested **£57K** in PGR support during the period, and A&D PGRs benefit from additional physical and financial resources including access to a dedicated research student room and funds to support research activities and equipment. PGRs in PDR are co-housed with the research team and are eligible for similar support from the research budget. All PGRs have access to an extensive A&D library and online publications and collections. During the coronavirus pandemic, all supervisory meetings and training events were moved online, and a click and collect service was provided by the library. The launch of Cardiff Met's online Doctoral Academy, an interactive support portal for PGRs that includes online training, study resources and communication, was brought forward to deliver enhanced support during the pandemic. As a result, the 2020 Postgraduate Research Experience Survey saw us achieve a **95% overall satisfaction** level compared to the UK average of 73% for A&D.

Cardiff Met's skills development programmes are based around the Vitae 'Researcher Development Framework'. PGRs are encouraged to dedicate 20 hours per year to develop their transferable skills, and to support this, 132 individual research events were held in the period in addition to an annual 'Research Skills week'. This compares to 94 events in the last REF cycle. Research students are strongly encouraged to present 'work in progress' at these events to develop writing and presentation skills. Other support activities included a research methods residential workshop (Brecon Beacons) and an article writing workshop. PGRs are also supported to take advantage of external training at Cardiff University's 'Effective Researcher' programme and to present at conferences and publish their research. Our PGRs have had considerable success in disseminating their research outputs during the period, with eight receiving awards and prizes for their work. Examples include **Eardley (best paper, DIS 2018)**, Hong Kong and Younan being awarded a **research residency** at the ceramic studio in the Faculty of Art and Design, Bandung Institute of Technology, Indonesia (2014).

PGR students are encouraged to contribute to taught programmes and are eligible to apply for formal tutoring or technician roles that allow them up to six hours of paid work per week. During the period Cardiff Met approved a Code of Practice for PGRs who support L&T, which outlines responsibilities and establishes a specific teaching role for PGR students. The student voice is actively sought to enhance decision making and facilitate the co-creation of initiatives and schemes. As a result, research students are encouraged to join committees and boards, such as the Cardiff Met Research Student Committee, the CSAD Research Degrees Sub-Committee and CSAD Ethics panel. This not only provides insight into research processes and practices, but is also invaluable experience in writing applications, communicating research ideas effectively and being part of a decision-making body.

Equality and Diversity

In 2018, CSAD was awarded a departmental Athena SWAN Bronze Award. The application was, in part, prompted by a review of the A&D REF2014 submission and the gender imbalance of submitted staff. The School instigated initial enquires into possible explanations by holding a focus group to explore the question - "Are we doing enough to support the School's female researchers?" Results highlighted areas for change, which were subsequently used to underpin the Athena SWAN departmental application.

Three significant findings from the work were: 'research guilt', where female researchers in particular felt they had to justify spending time on research; a lack of 'head space' or clear time to focus on research during the academic year; and, a higher proportion of female staff seeing L&T management as a route for career progression over research. A number of initiatives were introduced to address these issues. They included:

- legitimising time spent on research by ensuring research objectives are included in all annual staff performance reviews;
- introducing 'meeting free' periods at the end of the Spring and Summer terms, and before school holidays start, to ensure space is formally available for staff to spend on research;
- restructuring Programme Director roles to free up time for R&I activities;
- supporting conversations with line managers to put in place arrangements for research time that fits around caring responsibilities.

As a result, **44%** of A&D researchers returned to REF2021 are female, a significant improvement on the 15% returned in REF2014 and an exact match for the **44%** of our REF eligible pool who are female (compared to 33% in 2014).

36% of our A&D Professors and Readers are female (compared to 30% in 2014) a figure we are the process of maintaining and improving by identifying potential women research leaders at an early stage in their career and encouraging them to attend the Women to Professors Action Learning Sets. Alongside peer-to-peer support and mentoring, the workshops make routes and requirements for promotion explicit and encourage attendees to align objectives in performance reviews with requirements for promotion. Seven female A&D researchers have taken advantage of this programme of support (**Canavan, Gordon, Hayles, Lawrence, Morgan, Rigby, Watkins**).

We have also seen a **47% increase** in the number of female PGR students, a **44% increase** in the number of PGR students over the age of 35 and a **149% increase** in BAME (Black, Asian and Minority Ethnic) students. During the period, four PGRs have taken a combined total of six periods of parental leave. PGRs have the option to change their enrolment during their course of study, from full to part time (or vice versa) or suspend their studies if their personal circumstances change. On return PGRs agree a period over which to phase re-engagement with their research, and if appropriate, update their knowledge of the field before new milestones are established.

In line with Cardiff Met policies, all essential meetings take place within core working hours (10am-3pm) and dates of essential meetings are communicated well in advance to ensure that attendance can be planned. Work is also ongoing to make Cardiff Met's family friendly policies, such as flexible working and parental leave more accessible to staff. This has included developing guidance for line managers on implementing policies. For example, advice on putting in place arrangements to support parental or sickness leave and return to work after an extended period of leave. During the period, researchers working on major projects, or staff on research only contracts, have not needed to implement these policies, but many take advantage of flexible working policies to fit around caring responsibilities and remote working options. The majority of arrangements are informal, but some staff have chosen to put formal agreements in place, which have been shown to work very successfully.

3. Income, infrastructure and facilities

Income

Art & Design researchers captured **£47.4M** in this REF cycle, including **£8M** in research funding reported to the Higher Education Statistics Agency (HESA), an **increase of 38%** compared to the last REF period and includes 16 research council grants totalling **£7.9M**.

Examples of AHRC funding include a **£424K** grant² (PI **Treadaway**) for the Ludic Artefacts Using Gesture and Haptics (LAUGH) project, an interdisciplinary international collaboration that supported people with late stage dementia through designing innovative playful products; **£612K**

² Full grant amount listed, as Cardiff Met staff was Principal Investigator

of a **£5.4M AHRC³** Creative Industries Clusters project grant, supporting R&D in the screen industry in the Cardiff City Region (**Gill, Loudon, Murphy, Pigott, Walters**); and **£160K** of a **£468K** grant for the Design Action Plan project, in partnership with Manchester Metropolitan University to develop an action plan optimising the strategic use of design in the UK's public and private sectors (**Walters, Whicher**).

Other significant grants include Welsh Government funding for three Smart Partnerships with businesses in Wales (**£141K, Barham, Gordon, Loudon**) which support short-term knowledge transfer projects; two Smart Expertise grants (**£395K, Pigott, Treadaway**); the Welsh Government Life Sciences Bridging fund (**£63K, Gill**); a grant from the MRC (**Watkins, £55K of £151K**) to develop and trial a first responder medical pack in Namibia; three Knowledge Transfer Partnerships (**£522K, Barham, Littlewood, Walters**) with manufacturing businesses in Wales; and four Knowledge Economy Skills Scholarships (KESS2) (**£258K, Gill, Hayles, Littlewood**) from the European Social Fund (ESF).

Other income sources include **£1.5M** from nine EU projects and **£76K** from charitable trusts and foundations. Examples of EU projects include 'Design 4 Innovation', a collaborative project led by PDR of eight European partners working together to promote design as a tool for user-centred innovation (**Whicher, £358K of £1.5M**); a European Art-Science-Technology Network for Digital Creativity (EASTN-DC) focusing on time-based digital arts (**Kontogeorgakopolus, £115K of £1.2M**); and the 'Home Grown Homes' project that is creating high-performance and affordable new homes from Welsh timber supply chains (**Littlewood, £197K of £1.5M**).

Edwards was selected by the Arts Council Wales and awarded **£180K** to represent Wales at the 2019 Venice Biennale for his solo exhibition Undo Things Undone, which foregrounded the particular context of working-class experiences and marginalisation within a Welsh community. In addition, **Edwards** was awarded a **Turner Bursary (Prize)** of £10K in 2020, one of ten British artists to receive the award based on his contribution to contemporary art. **Stitt** was awarded a **£25K** Arts Council of Wales, Create Wales Award in 2015 to explore the relationship between painting and installation art. Meanwhile, **Murphy** was one of six artists selected as part of a touring exhibition called 'The Language of Clay' and funded by the Arts Council of Wales (**£78K**).

We generated **£6.6M** in commercial income (including **£354K** from the FabLab – our MIT-accredited digital fabrication workshop) through working with organisations and business on the design and development of new products and services nationally and internationally. A national example is a design research and development project with the Principality Building Society (**£379K**), while an international example is the development of a new product design strategy for Allergan (**£2.96M**), including the design and development of the 'Cooltone' product that is used to strengthen and tone patients' muscle mass. Other income includes two British Council grants to partner Ukrainian academics and industry partners to help develop their creative economy (**Morris, £79K**).

Infrastructure

The University's R&I activities are coordinated by Research and Innovation Services (RIS) with which we work closely to support research and knowledge exchange interactions with business and the wider community. The University R&I Committee is responsible for overseeing all R&I activities including policy, strategy, facilities, operations and performance and reports to Academic Board. The Research Degrees Committee reports to the R&I Committee. The University Ethics Committee (UEC), a sub-committee of Academic Board has ultimate responsibility for the maintenance and monitoring of ethics governance at university level to help ensure research quality and integrity. PDR and CSAD's sub-committees (R&I, Research Degrees and Ethics) report directly to the University level committees.

A&D research activities are overseen by an Associate Dean (Research) in CSAD and a Research Director in PDR. Both are members of their respective management and ethics

³ Cardiff Met income from total grant, as Cardiff Met staff were co-Investigators

committees as well as the University R&I and Research Degrees Committees. Both are also responsible for setting research strategy and encouraging and enabling research within CSAD and PDR respectively. This typically includes supporting staff to set research agendas, identifying opportunities for emerging researchers to collaborate on funding bids with more experienced colleagues, running training workshops, and providing feedback on applications and conference papers.

We work closely with RIS, Finance and People Services to support the development of research alongside the University's objectives. We have attracted over **£4.7M** from central resources to support the development of individual projects, resources, and research groups. For example, the University has invested **£1.7M** in supporting the FovoLab team to: develop their research into human visual perception; create new methods of representing visual experience in media; and launch a spin-out company (Fovo Technology Ltd), currently **valued externally at £10.3M**. Other examples include funding to support the creation of the new Perceptual Experience Lab; funding for Doctoral and Post-Doctoral Scholarships (**Al Batlouni, Kopanaglu, Lawrence, Watkins**); funding to support a number of research projects within the new FabCre8 research group; and a number of 'Get Started' grants to nurture new R&I activities (**Counsell, Hayles, Thomas**).

CSAD's Associate Dean (Research) manages a dedicated annual research budget to support staff and research student activities. This amounted to **£295K** over the REF period: £154K for direct support of research activities (including micro grants) and dissemination; £57K for research student support and external supervision; and £84K for staff training and other costs. Where possible, we enhance central support, for example by contributing to central grants to support the appointment of Research Assistants at a higher grade and via the match funding of **28 interdisciplinary research Micro Grants** to support the development of the FabCre8 research group.

CSAD's Academic Lead for research degrees oversees the management of research degrees and is responsible for PGR recruitment and progression, while a separate Professional Doctorate Coordinator is responsible for the operation and development of the Professional Doctorate Programme. Both role-holders are also members of the CSAD and University Research Degree Committees. Additional management and administrative support is provided by the R&I Manager, who operationalises CSAD's R&I strategy, a R&I Coordinator and an Research Administrator who leads on supporting research degrees, research ethics and supporting the delivery of research projects and budget management. Together this R&I support team, known as CREATE, brings together operational structures to: increase opportunities for research knowledge transfer; increase opportunities to collaborate with external partners; grow Masters and PGR numbers by engaging students with research; and, improving the employability of our graduates by drawing on collaborative partnerships with industry.

R&I activities are predominantly undertaken within research groups structured around a particular area of research or practice. Many research groups are interdisciplinary and often include staff from other schools (e.g. Education and Social Policy, Sport and Health Sciences, Technology, Management) as well as other universities (e.g. University of Cambridge, University of Oxford, University of Bristol, Cardiff University and University of Technology, Sydney). The research groups help researchers - particularly Early Career Researchers (ECRs) – develop their research and apply for funding.

On-going research is disseminated via weekly research seminars and annual research fairs open to staff, PGRs, external organisations and the general public and showcasing the work in progress of various research groups. These activities help foster new connections, opportunities for interdisciplinary research and funding.

In 2019, Cardiff Met introduced a revised Rewards and Incentives scheme which allows staff to benefit from funded research and innovation projects. The level of return is calculated based **inversely** on researcher experience: 20% for emerging researchers; 15% for active researchers;

and 10% for Professors. Revenue generated by the Rewards and Incentives scheme is ring-fenced for the staff who generated it and available for them to spend on supporting further R&I activity, such as conference attendance, training or networking.

Facilities

We have invested **£4.6M** in R&I facilities in the period. Examples include:

- **FovoLab**: 162m² for the Fovography research group, with **£1.7M** investment to develop software and resources for research into human visual perception and the development of new methods of representing visual experience in media.
- **FabLab**: a **£130K**, 169m², purpose-built open access digital workshop, home to the FabCre8 research group and providing a range of fabrication technologies, including high quality 3D printers, flatbed and rotary based CNC machines, large and powerful laser cutters, and 3D scanners.
- **Perceptual Experience Laboratory (PEL)**: a **£147K**, 80m² mixed-reality laboratory used to simulate real world environments through immersive sound, smell, temperature, and vision. PEL uses Fovography™ enabled technology developed by the FovoLab and conducts collaborative research between the UCD group and the Food Industry Centre at the University. PEL is part funded by the HELIX project (**£345K of a £21M** Welsh Government programme to strengthen Wales' food and drink sector) and is being used to improve the competitiveness of Welsh food products.
- **PDR**: a new **£2.6M**, 350m² facility providing space for: research groups; laboratories for user studies and product testing; and a workshop equipped with the latest rapid prototyping technologies for new product development.

The investment in the physical facilities is further enhanced by investment in key support systems such as Figshare, DSpace and PhD Manager. As highlighted in Sections 1 and 2, these support systems enable the efficient management and monitoring of research projects, both within Cardiff Met and for external collaborations. This includes the sharing of research findings, best practice and knowledge data sets to enable visibility, open access and transparency. These support systems are crucial in supporting our strategic aim of delivering social and economic benefits to Wales and beyond through the development of interdisciplinary and international research collaborations.

We plan to develop the capabilities of our researchers and facilities to further interdisciplinary collaborations within Cardiff Met and beyond, particularly through the University's Global Academies initiative.

4. Collaboration and contribution to the research base, economy and society

Our overarching strategic aim has been to use A&D Research and Innovation to deliver social and economic benefits nationally and internationally. This is predicated on the principle that, through collaboration and interdisciplinary partnership, A&D has the power to lead transformational change across a diverse range of communities and sectors. We have primarily reached our goal through growth of interdisciplinary and international activity, increasing the range and value of funding streams that we can access and growing our research base by investing in the development of staff activity. As a result, we have worked with over **50** universities, **163** businesses and **43** other organizations from **40** different countries during the period.

This was partially achieved through access to both unit and institutional level funding to seed collaborations and provide time for staff to engage in networking activities. Researchers are also encouraged to take advantage of external opportunities designed to provide the foundations for future research. These include: the Welsh Crucible scheme, which supports interdisciplinary

networking between academic institutions; Strategic Insight Partnerships (SiPs) that encourage academic staff to spend time based with industry partners; and Reverse SiPs that provide time for industry partners to spend time at Cardiff Met. Examples include Sugar Creative (**Stickler**), Qinetiq (**Treadaway**) and Wilmott Dixon (**Whyman**).

Our aim is to develop these nascent relationships into larger projects by developing associations through opportunities such as: live projects with undergraduate students; KTP partnerships; and Research Student Scholarships. An example of how this approach can deliver national and international social and economic benefits is the Cardiff Trauma Pack. Developed in collaboration with Cardiff University's Phoenix Project over a number of years, the Cardiff Trauma pack originated from **Watkins's** PhD (supervised by **Loudon** and **Gill**, and Cardiff University School of Medicine's Professor **Hall**). The project brought together ethnographic, user-centred design methods with medical expertise to develop an ultra-low-cost, lifesaving pack for use in rural **Zambia** by untrained and illiterate road accident first responders. **Watkins's** research method involved collaboration with over one hundred local villagers in Zambia as well as medical staff working in rural health posts and district and city hospitals. Supported by a Cardiff Met Research Studentship (2012), the Medical Research Council (**£55K** of **£151K**, 2017-2018) and the Life Sciences Bridging Fund (**£63K**, 2017), the research resulted in the development of a range of spin-off designs. These included a first-response kit packed with life-saving equipment for use at the scene of road accidents in **Namibia**. Over the lifetime of the project collaborators have included: Cardiff University's School of Medicine; the University of Namibia (School of Public Health); Namibian University of Science and Technology (Paramedic School); the Namibian Ministry of Health and Social Services; and Namibian Traffic Police. The project team have also worked with a number of stakeholders, who in an advisory capacity, have informed the pack's development, including: International Federation of the Red Cross; Royal Centre for Defence Medicine (MoD); NHS; and Welsh Ambulance Trust. BCB International (a Cardiff-based manufacturer and MoD and International Red Cross supplier) have licensed the pack for manufacture, which is due to be released for sale in 2021.

Another example of delivering social and economic benefits can be seen in our relationship with **P&A Group**, which designs and manufactures garden furniture throughout the UK. P&A wanted to develop their in-house design capabilities further by tapping into our UCD research expertise. In 2017, we secured an initial £23K SMART Partnership funding from the Welsh Government for a 12-month project, undertaking in-depth market research into the opportunities for creating new garden furniture ranges. The successful conclusion of that project led to a two-year KTP (2019, **£141K**) that focused on embedding UCD processes and strategies inside P&A. P&A consequently won **best product** awards in **three categories** at the UK's leading garden and outdoor living trade show (glee) as well as **best overall product**.

International Collaborations

During this REF period we have formed **64** international collaborations covering **40** different countries, encompassing the Americas, Asia, Africa and Europe.



Many of these partnerships have provided opportunities for staff to engage with international platforms and knowledge exchanges. For example, during the period **Granjon** collaborated with teams in France and Luxembourg to create robotic artworks (Guido and Am I Robot?), while **Murphy** was one of four UK academics selected to contribute to the British Council's *Living Research: Making in China* to conduct the first comprehensive study of the maker movement in China. **Morris** captured a British Council *Creative Spark* grant to collaborate with Ukraine's Lviv National Academy of Art (LNAA) and PPV Knowledge Networks (an economic development agency in Ukraine) to incorporate innovation and student entrepreneurship into LNAA's undergraduate curriculum.

Loudon and **Eggbeer** have engaged in separate projects with Indian partners to improve healthcare in the country. Funded by an AHRC Networking Grant, **Loudon's** research focused on the application of user-led design research methods to help improve the healthcare of indigenous communities in Kerala, India. The project was **selected by the AHRC** as one of their twelve Case Studies highlighting collaborative research with indigenous communities around the world. Key collaborators included the School of Engineering, Amrita Vishwa Vidyapeetham; Amrita Institute of Medical Sciences; Amrita Kripa Charitable Hospital; members of the indigenous communities in Kerala; and the Centre for eHealth and Care Technology at the University of Agder, Norway. **Eggbeer's** project, funded by the UK India Education Research Initiative (UKIERI), involved collaboration with the Faculty of Dental Sciences, King George's Medical University, Lucknow. It involved designing medical grade implants for patients needing jaw reconstruction and correction of facial deformities. This project has been showcased by UKIERI as one of the **top 10 global research projects** funded by the British Council.

Interdisciplinary Collaborations

In a number of cases, our input to interdisciplinary research projects has demonstrated the importance of user and beneficiary participation and creativity as part of the research process. For example, **Treadaway's £424K** AHRC-funded research project, LAUGH (Ludic Artefacts Using Gesture and Haptics), explored supporting people with advanced dementia through the design of innovative playful products. It resulted in the production of guidelines on designing for people with advanced dementia, distributed by both Alzheimer's UK and Care England, and the creation of HUG™, a product shown to improve the wellbeing for 87% of people living with dementia. HUG™ is now prescribed on the NHS, while national and international interest led to the launch of a spin-out company in 2020, backed by over **£105K** investment capital including

over £61K from the UK Alzheimer's Society. Another example is **Beverley**, who led work packages of the H2020 funded Prestige project (£254K of £6.95M grant, 2017 – 2020). This project, led by CEA (French alternative Energies and Atomic Energy Commission) explored how new generations of advanced materials and processes can be developed, up-scaled and integrated into novel interactive functionalities. **Beverley** led explorations on the potential for design to both add value to the products themselves and the business models around them, making both more environmentally sustainable.

A further example is **Whicher**, who has run numerous successful EU-funded projects around Innovation practice within SMEs across Europe with a combined value of £3.2M. Her work identified best practice in delivering design support to SMEs in order to develop enhanced ERDF (European Regional Development Fund) operational programmes. Together, these programmes involved 14 European partners, comprised of regional European governments, design centres and innovation agencies and engaged with **1800** SMEs across **15 European Regions**. Building on this work, and funded through an **AHRC fellowship (£157K, 2017 – 2019)**, Whicher began to explore if, where and how design research might enhance policy-making through greater citizen involvement. To achieve this, the project involved collaboration with the Financial Conduct Authority (FCA), HM Revenue & Customs, Scottish Enterprise, Welsh Government, Belfast City Council, Northern Ireland Department of Finance, The Scottish Government, and The Cabinet Office.

Another major project examining how design can contribute to both social and economic impact was Additive manufacture for Design-led Efficient Patient Treatment (ADEPT), led by **Eggbeer**. This **£913K Innovate UK / EPSRC** project (2014 – 2017) was a collaboration with Renishaw Plc, *Abertawe Bro Morgannwg* University Health Board and LPW Technology Ltd. The project sought to automate parts of the design process to increase efficiency in capturing individual patient anatomy to design and 3D print bespoke medical implants. The collaboration won The Engineer's 2016 'Collaborate to Innovate' Award in the Health & Wellbeing category.

One further illustration of interdisciplinary collaboration is the combination of our experience in UCD with expertise from Cardiff University (News Media) and the University of South Wales (Film and TV) to run *Clwstwr Creadigol* (£612K of £5.4M, 2018-2023) part of the AHRC's Creative Industries Clusters Programme. *Clwstwr Creadigol* builds on South Wales' successful film and television industry by helping to develop the R&D capability of the sector. The role of our co-investigators (**Gill, Loudon, Murphy, Pigott, Walters**) is in transferring expert knowledge in the areas of UCD and emerging technologies to Welsh SMEs as a driver for innovation.

Wider Contributions

In order to develop new relationships, projects and partnerships that have positive societal impact during the period, our researchers have actively developed strategic positions of influence, sitting on **44** Advisory, Professional and Steering Boards. These range from, *inter alia*, Community Housing Networks (**Littlewood**) to Educational Associations (**Wrenne** and **Dee**), to Research Council Advisory Groups (**Walters** and **Whicher**). Five of our researchers have been Editors and Associate Editors, 11 have been journal reviewers across 32 journals, and seven have been conference committee members for 18 conferences. We also encourage membership of Peer Review Colleges including AHRC (**Keay-Bright, Treadaway, Pepperell, Walters, Whicher, Gill** and **Loudon**); EPSRC (**Walters, Eggbeer, Littlewood**); H2020 (**Whicher**); ESF (**Walters**); Arts Council of Wales (**Ayscough, Murphy**); and the *Natural Environment Research Council* (**Hayles**). **Beverley, Cazeaux, Gill, Hayles, Keay-Bright, Littlewood, Loudon, Pepperell, Treadaway** and **Walters** have all acted as external PhD Examiners in the period (35 examinations). Meanwhile, **Gill** and **Treadaway** are Visiting Professors at Cardiff University and the University of Technology, Sydney respectively. These activities help to build the visibility of our researchers within the academic and wider communities and contributed to our invitations to conduct **56 invited** public talks and keynote speeches at international conferences.

In recognition of the design work that we have undertaken nationally and internationally during this period, we have won **26 International Design Awards**, including **12 IF Awards**; **seven Good Design Awards**; **three Red Dot Awards**; **three German Design Awards**; and **one San Francisco Design Week Honourable Mention**.

Contributions Beyond this UoA

Our experience in A&D and creativity research was also applied by **Loudon** and **Gordon** to the Welsh Government-funded New Curriculum for Wales project (**£48K** of **£713K**, 2018-2020). As part of the government's plans to develop a new curriculum for all schools in Wales by 2022, it commissioned Cardiff Met, Bangor University and University of Wales Trinity Saint David to use their research expertise to help teachers gain new skills and knowledge in how to conduct professional enquiries. As part of this project, we provided the specialist knowledge and expertise on how creative processes might be used to support professional enquiry. This work has been submitted as an impact case study for the Education UoA, while **Loudon's** creativity research also contributes to an impact case study for the Business and Management Studies UoA.