

Institution: University of Warwick

1. Context and mission

1.0 Mission: Our commitment to research at Warwick is that it will be internationally leading, impactful and provocative. It will change the world, making lives healthier, safer, more resilient, more just and more fulfilled. Our research produces transformative and lasting solutions to multidisciplinary global challenges of both today and the future. Our research will maintain its foundation in disciplinary and interdisciplinary strengths. It will define the frontiers of knowledge and will take place in innovative multidisciplinary spaces.

(Research Strategy Mission Statement 2019)

1.1 Context: This REF period spans a notable time of positive change and marked progress for the University of Warwick (UoW). In recognition of our international reputation for research, we won 62nd place (the 10th in the UK and 16th in Europe) in the research-dominated *QS World University Rankings 2020*. We hold a top 100 position (77th overall, 9th UK university) in the *Times Higher Education (THE) World Rankings* and our diverse academy and student body saw us recognized as the *THE's* 19th "most international university" (2018). An extremely favourable REF out-turn, 7th in the universities' ranking, saw UoW named as the 2014 *Times* and *Sunday Times* University of the Year. Celebrations in 2015 marked the 50th anniversary of Warwick's founding with the appointment of a new vice-chancellor (VC) to commence our second half-century.

1.2 As a research-intensive university and a member of the Russell Group, UoW places Research at the heart of its endeavour. Fully embracing the Impact agenda and embedding it within excellence as a primary driver of research activity, our institutional strategy is *Excellence with Purpose*. Within this, Research and Education are named as the two core missions of the university and each has its own detailed strategy (Section 2 for Research). Both the Research and Education missions are underpinned and spanned by four pillars: Internationalisation, Innovation, Inclusion and Regional Leadership.

1.3 Structure: The University Executive Board (UEB) is the senior management team of the university as formally constituted in the governance structure. This is the weekly forum at which matters, including institutional research questions, are discussed e.g., UEB considered the institutional response to the Stern Review, the Research Integrity Concordat and the Knowledge Exchange Framework (KEF) *inter alia*. It is led by the VC and comprises an *ex officio* membership of nine, including the three Pro Vice Chancellors for Research (PVCR), Education and International. UEB reports directly to Council where the PVCR reports on strategy and assurance regarding matters of research.

1.4 UoW in 2020 has 7655 staff in total of which 3160 are academic. There are 27460 students including 16200 undergraduates and a post-graduate research student (PGR) community numbering 2400. There are 30 Departments, 28 housing Category A eligible staff (*CatAStaff*) that are organised into three Faculties, each of which is led by a Chair of Faculty/Vice Provost with over-arching responsibility for delegated leadership of research, education and administrative matters. Nineteen Departments were ranked in the top ten for

research outputs in REF 2014 and four were the top units of assessment in the country for outputs.

1.5 The research environment at Warwick continues to be strategically reshaped. A new School of Creative Arts, Performance and Visual Cultures (since 2019) brings together Creative Writing, Theatre and Performance Studies, Cultural, Media and Policy Studies and History of Art to expand and enhance the research vitality and future of these disciplines. The School of Cross-Faculty studies offers a range of courses in Global Sustainable Development (GSD) and Liberal Arts, housing a growing coterie of interdisciplinary GSD researchers. Twenty Strategic Interdisciplinary Research Centres of Excellence work across the Faculties giving foci for impactful research, continuing dynamically to reflect the changing research landscape.

1.6 The Departments are largely autonomous in developing their own research directions and priorities. They are maintained in alignment with the university strategy, through a rolling programme of Strategy Renewal, which is led by the Provost. The academy includes:

Faculty of Arts	Faculty of Social Science	Faculty of Science, Engineering & Medicine
Classics & Ancient History	Applied Linguistics	Chemistry
English and Comparative Literary Studies	Centre for Educational Development, Appraisal and Research (CEDAR)	Computer Science
Film & Television Studies	Centre for Lifelong Learning	Engineering
History	Centre for Interdisciplinary Methodologies	Life Sciences
School of Creative Arts, Performance and Visual Cultures <ul style="list-style-type: none"> - Centre for Cultural Media and Policy Studies - History of Art - Theatre and Performance Studies - Warwick Writing Programme 	Economics	Mathematics
	Philosophy	
	Sociology	Physics
	Institute for Employment Research	
	Politics and International Studies	Psychology
	School of Law	
Department of Education Studies	Statistics	
School for Cross-Faculty Studies <ul style="list-style-type: none"> - Global Sustainable Development - Liberal Arts 	Warwick Business School (WBS)	Warwick Manufacturing Group (WMG)
School of Modern Languages and Cultures	Foundation Studies	Warwick Medical School (WMS)

1.7 The Professional Services Group (PSG) numbers 4490 staff including Research and Impact Services (R&IS), the University's research-support function, with staff principally located centrally (75 FTE) but also integral to large Departments such as WMG, WBS and WMS. Small departments e.g., in the Arts Faculty, aggregate to have a strong Faculty-facing team shared across their cognate activities. There is considerable flexibility in the model to allow for the most productive solutions underpinned by Faculty-facing senior Research Development Strategy Managers working to Faculty Chairs, local research committees and to the PVCR.

2. Strategy

2.1 The Research strand of the University Strategy, *Excellence with Purpose*, reflects the development of our research over the REF period and looks towards 2030.

The strategy articulates six priorities, which are:

- Disciplinary and Interdisciplinary Excellence: enhance our existing strengths and develop others.
- Transformative Interdisciplinarity: combine approaches to make a step change.
- Excellence with Impact: extend and apply the best research to make real-world differences.
- Global Reach and Significance: deliver and promote our research on the world stage.
- Partnership: key collaborations with industry, national and international institutions and other higher-education providers.
- Innovation: to be at the heart of everything that we do.

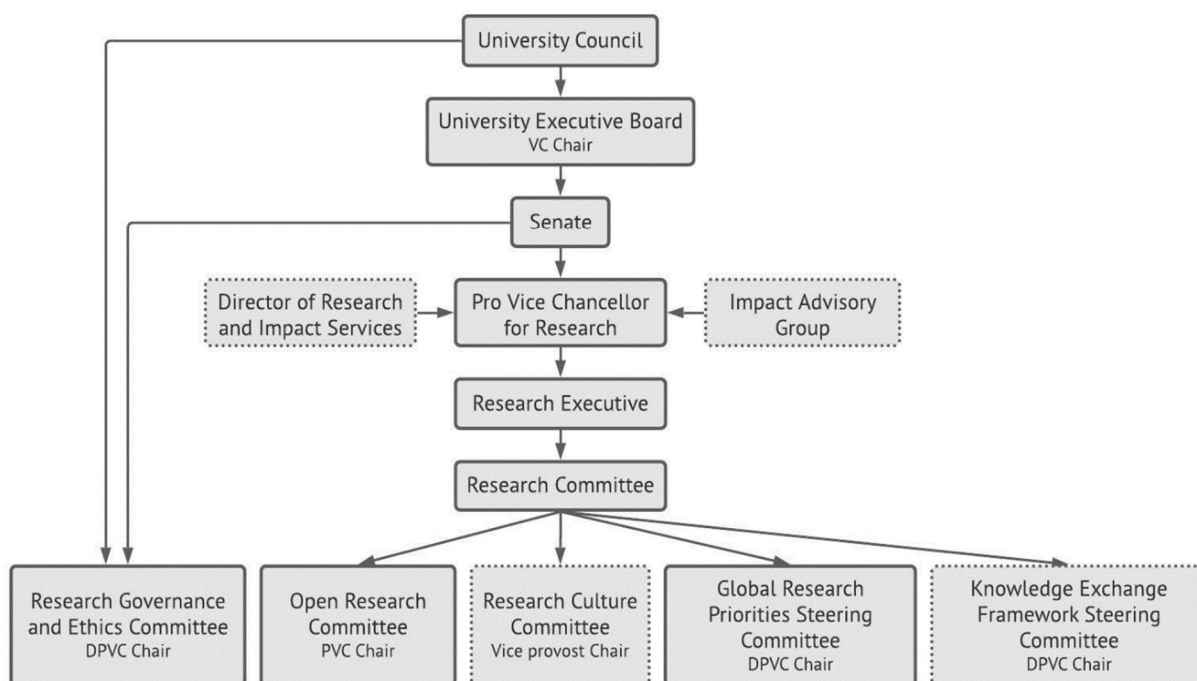
2.2 Achievement and operationalisation of these priorities is underpinned by seven work-strands:

1. Support, foster and showcase the talent and ambition of all our researchers
2. Undertake world-leading research at the forefront of knowledge
3. Spearhead research with relevance for impact and innovation
4. Cultivate world-class interdisciplinary research communities
5. Pioneer state-of-the-art accessible research infrastructure
6. Communicate our research to provide leadership and influence in the global knowledge economy
7. Build an income and partnership platform to sustain and grow our world-leading activity.

2.3 Our Research Strategy (R-Strategy) sets out an overarching philosophy that our research should be internationally recognized with impact and purpose. We expect our research to be inspired by fundamental questions and led by our own intellectual curiosity, and we continue to build on the tradition of bringing our research excellence through from the "bottom up", through the creativity and scholarship of our academics. This said, we are equally excited to see outcomes that are highly applied, inspired by partners and making an impact on or beyond the interface with non-academic users. The strategy sets out nine research themes that encapsulate many flavours of our current research but are not intended to be exhaustive – individual UoA statements naturally dive more deeply into detailed expert descriptions of their own research and impact strategies. The broad institutional themes are: Life Sciences and

Health; Data, Science and Society; Mathematics and its Real-World Applications; Sustainability and Development; Understanding the role and function of organisations and markets; The Engineered World: from molecules to machines; Understanding the Human; Histories, Creativity and Theory; Ethics, Rights and Social Justice.

Figure 1. Schematic showing the structure for institutional management of research. Solid borders signify formal governance relationships. Dotted borders signify working relationships.



2.4 Figure 1 shows how the research management structure is embedded in the institutional governance. The Pro Vice Chancellor for Research (PVCR) is responsible for the R-Strategy on behalf of the Research Committee (RC) and works closely on its implementation with the Director of R&IS. The PVCR is supported by the Research Executive, which includes three senior academic leaders (Deputy PVCs), each with a seat on RC and responsibility for a specific element of the research portfolio: (a) Research Ethics and Infrastructure; (b) Interdisciplinarity, Arts and Social Sciences; (c) Knowledge Exchange and Partnerships.

2.5 There are two formal sub-committees of the RC: (a) Open Research Group (ORG) and (b) Global Research Priority Steering Group (GRPSG). Research Governance and Ethics Committee works closely with Research Committee but is a sub-committee of Senate and Council reflecting the importance of an ethical approach to research across the institution. A recent addition is the Research Culture Committee, which will be incorporated in 2021.

2.6 Our **Impact** strategy is embedded within the R-Strategy, as our philosophy is that impact proceeds from excellent research and that the key to success is early identification and nurture

of impactful opportunities followed by amplification of the outcomes through a focussed effort. To this end, we have made a major investment in expertise and resources: a senior Head of Impact is centrally positioned in R&IS and supports impact activity through an academy-facing twelve-strong Impact team. Impact activity is reported and steered through the PVCRC's Research Impact Advisory Group (RIAG), which invites the opinion of senior academic impact directors and practitioners. Cultural embedding of Impact in research is achieved by:

- the explicit integration of excellent impact activity into both recruitment and promotion criteria;
- support from the Warwick Impact Leave fund (distinct from and complementary to, conventional sabbatical leave arrangements);
- resourcing and implementation of a cross-institutional Impact Capture tool;
- recognition of time spent in the Impact Director roles in academic workloads;
- celebration of Impact e.g., in the film "*Working on the future*", distributed via social media.

2.7 A significant proportion of our Higher Education Innovation Fund (HEIF) is devoted to the Warwick Impact Fund, which is maintained at >£0.4m *pa* to fund impact projects in the academy. The impact team and PVCRC coordinate centrally all interactions with UKRI concerning Impact Acceleration Accounts (IAA's), currently > £1.14m *pa*, responding to the relationship management demands through dedication of senior staff time. Notably, in 2019, in recognition of the need to support early translation activity in the (bio)medical sciences, UoW was invited by the Wellcome Trust to be a Translational Partner. Funded at £0.3m *pa* initially for two years from 2020, we are embarking upon innovative initiatives in the medical and life sciences including Warwick Translation Fellowships, to be awarded for two years in a competitive process to discover and support new approaches to achieving impact.

2.8 Our Technology Transfer Office, Warwick Innovations, is an essential component of the impact landscape. Now part of the Innovation Group, it continues to provide specialist advice and services to support technology transfer and innovation and helped to achieve 110 licences and 32 spinouts in the period. Warwick spinouts raised £76.2m in investment enabling the translation of research outputs into market. Through Innovations, UoW was an early pioneer of the ICURe programme, which builds entrepreneurial capacity among post-doctoral researchers whilst simultaneously providing an evidence base of market demand and commercialisation potential for new technologies.

2.9 **Interdisciplinary research** has been a long-term strength at Warwick and is one of the core activities by which we define ourselves. Interdisciplinarity is supported and enabled by our different *Communities* (R-Strategy, Workstrand 4), which provide a rich and structured landscape, where ideas develop and thrive. Key drivers of this interdisciplinary research environment are:

2.9.1 **Global Research Priorities (GRPs)** belonging to a £6m programme of institutional interdisciplinary research, which have been through a full year of review prior to relaunch in 2019. The ten GRPs are: *Behaviour, Brain and Society; Productivity and the Futures of Work;*

Health; Innovative Manufacture and Materials; Food; Habitability; Connecting Cultures; Cyber Security; Sustainable Cities; and Energy. They function through ambitious and creative collaborative working to shape future ideas and they are designed to be *inclusive* of researchers at all career stages. Over the period, approximately 3500 researchers and partners both within and beyond Warwick have been engaged with the programme through events such as the popular Industry Days and policy roundtables on Food or Cyber-Security. Two new GRPs focus on *Habitability*, which encompasses wide-ranging studies of potential living conditions in the Universe including the climate emergency on this planet, and *Productivity and the Futures of Work*, which speaks to a long-standing expertise in research on employment and policy and adds-in contemporary foci on supply chains, enterprise and wellbeing. Importantly, it draws on the research from our extensive university-based business school (WBS), showcasing their expertise at the heart of this new pan-institutional community.

2.9.2 The Institute of Advanced Study (IAS) Warwick's IAS is dedicated to advancing new research ideas, characterised by: *Interdisciplinarity; Innovation; Internationalisation*. The strategy of IAS calls directly on both the R-Strategy and the International Strategy, which expresses Warwick's determination to be a leading global university by 2030. Warwick's IAS is distinctive among its sister institutions around the world in that it supports the entire postdoctoral community as well as early-career academics and prestigious international visitors. IAS has become increasingly successful in attracting funding from external bodies for example: Fernandes Fellowships funded by philanthropy (2018), two awards from the Marie Skłodowska Curie COFUND scheme (2016, 2020) and a UKRI Rutherford Fund Strategic Partner Grant (2018).

2.9.3 The Institute for Global Sustainable Development (IGSD) provides a focal point for Warwick's sustainable development research, contributing towards the UN Sustainable Development Goals. It supports both the academy's research through intensive bespoke workshops on topics of key interest (e.g., Theory of Change; Responsible research and approaches to equitable partnerships), and the University's own Sustainability Strategy working with the Climate Emergency Task Force. The award of five full-time Fellowships (won through open competition by 3 female and 2 male staff from Law, Politics, Life Sciences, WBS and WMG), with the appointment of two junior faculty to follow, have cemented IGSD as a pillar of our outward-looking interdisciplinary landscape. The 2020 award of a Leverhulme Doctoral Training Centre from 2021 for 5 years is a major coup for IGSD and maps out the future for this important endeavour at the heart of the R-Strategy.

2.9.4 Strategic Interdisciplinary Research Centres of Excellence work across Departments and Faculties on cutting-edge topics in over 20 fields. Two examples of large-scale Centre-driven outcomes are: (i) Warwick Data Science Institute's pivotal role in our successful bid to be a founding partner of the Alan Turing Institute (2014) and in winning £2m funding for a Maths Building extension from the Wolfson Foundation and HEFCE (2016); (ii) Warwick Antimicrobial Interdisciplinary Centre's fundamental part in bringing the Medicine Discovery Catapult to Warwick with a £1m investment in laboratory capacity (2017-2019).

More broadly, our research centres play a crucial role in stimulating the intellectual environment underpinning major research awards and fellowships. Two examples are (i) WCAHRD (now the Centre for Global Health) winning 42 research projects worth over £30m since 2014; (ii) the Systems Biology Epidemiology Centre (SBIDER) securing a £4.9m EPSRC

Centre for Doctoral Training (CDT) in Mathematics for Real Systems. Notably, SBIDER is home to our top epidemiologists involved through SAGE committees with the UK's response to COVID-19.

The Centre for Interdisciplinary Methodologies (CIM), a cross-faculty research centre created in 2012 with University support, builds excellence in interdisciplinary research through methods development, with funding from the Wellcome Trust, NERC, AHRC and the ERC.

2.10 Open Research is embedded in UoW's research culture and practice, exemplified by incorporation of ORG as a subcommittee of RC. Open Access policy is led through the Library and focusses on benefits such as visibility, discoverability and access for both academic and wider societal audiences. Warwick Research Archive Portal (WRAP) is the institutional repository, which is optimised to allow for indexing and visibility in popular search engines. Initiatives championed by the ORG include (a) development of the Warwick Principles for the Evaluation of Research based on the Leiden Manifesto and creation of an institutional implementation plan; (b) inauguration of the University of Warwick Press, an open access press supporting experimental approaches to publishing; (c) development of a data-sharing policy for Warwick's Research Technology platforms; (d) a roadmap for the University's research data management services with a focus on how researchers can make their data FAIR (findable, accessible, interoperable and reusable); (e) implementation of the requirements of the 2021 Wellcome Open Access Policy.

2.11 Research Integrity is formally led through RGEC (Fig. 1) and training through the tool, Epigeum is led by its implementation sub-group. Completion of the training is mandatory for academics seeking institutional funds for research. Over time, the training will be mandated for all research-active personnel forming part of the induction package for all new staff with research responsibilities. The wider cultural implications of responsible and ethical research are being taken forward in a cross-institutional Research Culture sub-group of RC. Linking closely with RGEC and ORG, the Research Culture group will work across the interfaces with all levels of research-active personnel to ensure a fair working environment.

2.12 Institutional partnerships, both internationally and nationally, are highly valued, strongly supported and prioritised in importance for enriching and informing the research environment.

2.12.1 Strategic international research relationships are exemplified by the Monash-Warwick Alliance, which is now in its 3rd phase (£8.4m investment in total) and has renewed research foci on Antimicrobial Resistance and a multidisciplinary approach to Artificial Intelligence. A particular institutional highlight that emphasises Warwick's importance in Europe, the €5m *EUTOPIA* programme, sees funding for research being committed by six universities (University of Ljubljana; Vrije University, Brussels; University of Gothenburg; Universite Paris Seine; Pompeu Fabra University Barcelona; UoW) to enable co-tutelle PhDs and wide-ranging collaborations from Data Science to Arts and Cultural Heritage. A follow-up €2m programme, *TRAINS*, will fund the partners to collaborate on the institutional functions that enable research and a Co-FUND collaboration for exchange of PDRAs will progress. A funded collaboration with Shanghai Jiao Tong University in the social sciences is in its early stages as part of the wider International Strategy.

2.12.2 The Alan Turing Institute: a founding partner with Cambridge, Oxford, Edinburgh and UCL, Warwick's academics are instrumental in shaping the strategy and nature of university collaboration. Institutional interaction is deliberately broader than the original EPSRC-led Mathematical Sciences brief and now CIM, Economics, Engineering, Psychology, PAIS, WBS and WMG all accommodate Turing Fellows (50 in total). Warwick's leading research is exemplified by UKRI's award of three, from only 15 Turing Artificial Intelligence Fellowships in 2020 worth £4m; and our originating lead for the innovative Data Science for the Social Good summer-school. Active discussions around a Turing Phase 2 from 2021 onwards are focussed on Warwick's expertise in Industrial Revolution 4.0 and the UK's NetZero agenda.

3. People

3.1 The make-up of our research-active staff complement is inspiring and demonstrates how we champion the vitality and sustainability of academic research across all disciplines. At the REF census date, Warwick employed 144 staff on independently funded Fellowships from prestigious bodies such as the Royal Society, ERC, RCUK, Wellcome Trust, the Royal Academy of Engineering and the British Academy. Warwick has 14 UKRI Future Leader Fellowships across 11 Departments making it joint 4th in receipt of these awards. Twelve Leverhulme ECRs were awarded in 2018/19, seven in Arts.

Approximately 25% of our REF submission is in the ECR category: this proportion is testament to our institutional willingness to put time, resources and expertise behind burgeoning research careers. This commitment to talent is reflected in the first work-strand (**2.2**) for implementation of the R-Strategy, which applies from PhD/Early career, through the middle years to senior Professors.

3.2 The vast majority (89%) of the 1252 CatAEligible FTE in our REF2021 submission are on R&T contracts, consistent with our twin ambitions of excellence in both research and education. To enable this, we have increased our resource in university teaching, which has seen our number of T-focussed staff increase from 418 (2013/14) to 639 (2019/20). This reflects a deliberate strategy to maintain and accelerate our research excellence in an increasingly competitive funding and publication environment whilst simultaneously enhancing the quality and scale of our educational offering.

Our academic staff (regardless of career pathway) are supported by three types of leave: study leave, leave to accept a research award and unpaid leave of absence. Study leave is normally granted for every six terms served for a maximum period of one year (three terms).

3.3 Considerable reform has been made to our promotion framework since 2016. T&R, T-focussed and R-focussed contract types – “strands” - have a common points-based promotions structure and job-titles from Assistant Professor to full Professor. Individuals can use the promotion process to move between strands as their career develops and their own priorities change. Committee members for appointments and promotions undertake a suite of mandatory ED&I training regarding protected characteristics with additional unconscious-bias and gender-specific promotions training, as required.

Our renewal of the Vitae HR Excellence in Research Award for our 8th year in 2021 in line with the revised Concordat on Career Development of Researchers will continue our progress

towards a harmonised experience for all academic and technical staff and will focus particularly on improved outcomes for contract researchers as discussed at their regular forums.

Furthermore, we have also built and implemented a Technicians' job-family that reaches to Professorial level allowing us to recognise and encourage the excellence of our research support staff and provide them with an equivalent career path to the academic staff with whom they work.

3.4 Inclusion is a cross-cutting strand of the 2030 university strategy applying equally to all staff and students. Ensuring that research staff with protected characteristics can positively progress free from bias is a key goal. In some cases, this is crystallised in institutional efforts towards charter marks – Warwick regained a silver Athena award in 2018 and ranked 123rd in Stonewall in 2020. Signatories to the Race Equality Charter since 2015, we will submit institutionally for the charter mark in 2021. At grassroots, we have a comprehensive suite of staff support groups including LGBTUA+ and Gender Taskforces, BAME, Disabled staff and Parents and Carers networks. Returners' Fellowships for staff ringfence research time after extended periods of maternity, paternity or adoption leave. Staff and student wellbeing is paramount, and a dedicated Wellbeing Support Service leads with the £49m Sport and Wellness Hub opened in 2019 being a central facility.

3.5 The Code of Practice (CoP) was developed in consultation with representatives of the Universities and Colleges Union and fully reflects UoW's Equality objectives and values. All our REF processes were formally conducted under the CoP's auspices. Determinations of Significant Responsibility for Research and Research Independence were made throughout several meeting rounds of the University's REF Submission Steering Group as described in the CoP. In an innovative step, UoAs shared their REF practices in written submissions to the autumn 2019 Senate meeting, thus providing the academy and UEB with a transparent check on consistency of approach across the institution.

3.6 The number of staff submitted to REF2021 is 1252(FTE), an increase of 34% on the REF2014 figure of 931 FTE (at 83.5% intensity). 1195(FTE) staff are ineligible – of these, 544(FTE) are T-focussed staff, ineligible by contract type. The remaining 651(FTE) consist principally of contract research assistants, who are non-independent, and a smaller group of permanent staff whose role is to manage the research of senior staff rather than conducting independent research. The small number of staff on fellowships of unstipulated status *e.g.*, Marie-Curie, COFUND, were considered under the CoP methodology within a consistent approach at UoA level. The resulting distribution of staff resolved to be CatAEligible was reviewed in 2019 against the whole staff pool. No bias in respect of protected characteristics was detected.

3.7 Bespoke ED&I training within a REF context was mandatory for 180 decision-makers and advisors on REF bodies including the Executive Steering Group (ESG), Submission Steering Group (SSG) and all UoA advisory and reading groups. The training employed Case Studies and scenarios in an interactive and discursive atmosphere with the REF2021 and ED&I guidelines at the core.

3.8 Warwick has an unequivocally strong commitment to **doctoral training** as demonstrated by the 73% increase in our financial investment in PGR studentships from £9.4m (2013/14) to £16.3m (2019/20). A typical distribution is 45% on scholarships (including those for overseas students), 20% on co-funding for CDTs and 35% through Departmental allocations. Warwick's PGR population in 2020 numbers 2428, which is an increase of 15% over the REF period. Most of this (+13%) has been in the SEM Faculty although the number of PGRs in Social Sciences has also increased.

3.9 The majority (~70%) of our PGRs are being trained through Departments and individual supervisors. Individual UoA statements describe how excellence and consistency in PGR training is achieved in all our Departments and disciplines for this large cohort (>1500 students). Institutionally ~30% of our PGRs are in cohort-style training and we have supported all Faculties to succeed in funding competitions, some with regional collaboration.

3.9.1 Within the SEM Faculty, CDTs have been operating throughout the period with five funded by EPSRC from 2014 having graduated 107 students to date. The Warwick-led BBSRC CDT in the Midlands has won its third-phase funding from 2019, our NERC CDT has been renewed (from 2020) and our MRC Doctoral Training Partnership (DTP) is invited to extend. The Leverhulme Trust "Bridges" inter-disciplinary research centre involving Psychology, Statistics, Economics and WBS, has graduated 7 students from its first cohorts in 2015-17 with another 10 pending by 2022. Two more 5-year EPSRC CDTs began training research students in 2019 together with four further physical and mathematical sciences CDTs supported by a combination of industrial, institutional funding and EPSRC (£1m for *Analytical Sciences*).

3.9.2 In 2016 Warwick successfully led and now manages, together with Birmingham, Nottingham, Leicester, Aston, and Loughborough, a bid for the ESRC Midlands Graduate School DTP, which offers 17 different training pathways and awards 60 studentships annually in addition to providing advanced research training courses, and other skills development programmes for early career researchers. This builds upon earlier success (from 2011-2016) in the ESRC DTC competition, which supported 27 postgraduate studentships per annum on disciplinary and interdisciplinary training pathways. In combination, 171 students have been graduated.

3.9.3 The Arts Faculty was instrumental in the successful Midlands Four Cities bid for an AHRC DTP between eight institutions: the consortium includes the two leading universities in each city (Coventry, Leicester, Birmingham, Nottingham). This built upon the Arts Faculty's Warwick-funded Centre for Advanced Doctoral Research Excellence established in 2014, which has graduated 21 students to date and continues to support a further 41 in progress.

3.10 Warwick's Graduate School was reorganised in 2018 to establish a Doctoral College for all PGR students distinct from a large post-graduate taught provision, a change designed to enhance our strong focus on quality and consistency across the institution. The Doctoral College reports into the Board of Graduate Studies and has operational and strategic sub-committees including a management committee chaired by the PVCR to provide assurance on cohort-style training.

4. Income, infrastructure and facilities

4.1 Our research **income** has increased by over 50% from £83.7m (2012/13) to £131.7m (2019/20). This has been achieved through a diversification of our research portfolio and a strategy to foster greater collaborations with partners and embrace an interdisciplinary future to develop solutions to global problems combining different expertise and methodologies. The move towards a diversified portfolio has built in resilience and we have supported researchers to become more adaptable and responsive in the context of a fast-moving and challenging funding environment. We remain highly competitive in UK Research Council and European Research Council funding and are Innovate UK's second highest HEI funding recipient demonstrating our capability in industry-led research.

4.2 We have an ambitious Campus Masterplan which aims to manage sustainably our infrastructure and expand capacity. The capital projects completed are:

- the £150m National Automotive Innovation Centre (NAIC), the largest research centre of its kind in Europe, set up in partnership with industry to develop novel technologies to reduce CO₂ emissions through electrification in the quest for NetZero.
- a new £58m Arts & Humanities building (completion 2021) which will co-locate departments in a single space acting as a hub for collaboration, creativity, innovation and public engagement.
- our £28m Mathematical Sciences Building hosting world-class researchers to deliver outcomes that will have a profound impact on our societies, communities, and cities; it hosts much of our interdisciplinary work with the Alan Turing Institute.
- new WMG buildings; £10m Materials Engineering Centre and £14m Advanced Materials Manufacturing Centre which allow us to work closely with the local economy and businesses on application-driven, materials research.
- the £54m Interdisciplinary Biomedical Research Building (IBRB) bringing together three hundred biomedical researchers from Life Sciences and Warwick Medical School, to fight human diseases, develop new biotechnologies and enhance healthcare around the world.
- A refurbishment programme for the Social Sciences Faculty buildings including WBS, Economics and Law to date.

Going forward we will invest in the next phase of the STEM Grand Challenge capital project focusing on the redevelopment of our Physics, Chemistry and Engineering spaces, with a mission to transform their physical research environment into one that fosters greater interdisciplinarity, creativity and innovation. Elsewhere we have initiated the expansion of WBS and renewal of our library building.

An inaugural Director of Transport and Future Mobility works with internal and external partners, developing long-term strategic infrastructure opportunities for road and rail improvement in the region. Our own researchers in WMG are participants in developing smart shuttle and light-rail transport solutions.

4.3 Access to state-of-the-art equipment and technical support is vital, much of this is hosted at relevant departments and we invest £5m annually on refreshing our provision. Alongside this we have developed 9 Research Technology Platforms (RTPs) which provide access to

integrated world-class facilities and technical expertise, these cover Advanced Bioimaging, Bioinformatics, Biomedical Services, Electron Microscopy, Polymer Characterisation, Spectroscopy, Proteomics and X-ray Diffraction. Our Scientific Computing RTP manages our HPC capability and provides support for software development and training through our Research Software Engineering group; this RTP supports the EPSRC funded regional tier 2 HPC facility. Each RTP is led by an Academic Director and has a dedicated technical team, providing world-class expertise and training for users. We also host EPSRC national research facilities in solid state NMR, tomography and synchrotron radiation.

4.3.1 Our equipment and facilities are accessible externally via Warwick Scientific Services (WSS) to deliver cutting-edge, technical measurement solutions, innovative translational research, knowledge and training services. We work with business from across sectors including: energy efficiency; life Sciences (biotechnology and biomedical); materials; high-performance computing; or mechanical modelling. We hold industry days that showcase our RTPs and WSS to foster creative, collaborative relationships with business partners and generate new knowledge and innovation.

4.3.2 Regionally, Midlands Innovation partners (Aston, Birmingham, Cranfield, Keele, Leicester, Loughborough, Nottingham), offer access to a broader equipment base. Separately they convene academic networks and research programmes in energy, health, transport and social science. Future ambitions include a prospectus for the Energy Research Accelerator (ERA) Phase 2, which builds on the 2015 £180m ERA Phase 1 co-investment by Innovate UK, JLR and the universities, with Warwick leading in Battery technology as a founding partner in the Faraday Battery Challenge. The collaborative ethos of Midlands Innovation allows us to support our technical workforce by developing routes to share technical expertise and to up-skill staff through technicians' training (*TALENT*) and post-doctoral skills training in Sustainability (C-DICE) both funded at ~£4m as Research England Development programs.

4.3.3 Fundamental to the University's success is the strength of its Arts and Social Sciences, which influence and contribute to the understanding of culture, society, behaviours, economics and politics across the globe. The University recognises the value of arts and culture to the local community and has significantly invested in its provision with the refurbishment and expansion of Warwick Arts Centre – a major cultural hub for the region, which will play a key part in Coventry's UK City of Culture status in 2021. The Arts & Humanities faculty receive dedicated Digital Humanities support from our team of Academic Technologists, who also underpin a new Centre for Digital Inquiry.

4.3.4 Our Public Engagement (PE) team collaborates with the academy to ensure that widespread PE with research is increasingly professionalised and plays a central role in our regional and national profiles. A recent innovation is the Warwick Institute for Engagement, expanding upon our success in the British Association of Science Festival 2019, which saw the highest ever attendance figures (>16,900). The team will play a key part in the delivery of the City of Culture programme, with a focus on engagement with research.

4.4 In addition to its leadership on Open Research (2.10), the Library is a pillar of our research environment both for its physical collections and its extensive electronic provision. It holds one million printed works, and c.900,000 electronic books available for anyone with Warwick network access and provides unrestricted access to subject-specific databases and 102,000 electronic journals. It houses the Wolfson Research Exchange, a dedicated community space only accessible by research staff and students, which provides a forum for interdisciplinary collaboration, and a Postgraduate Hub that encourages interaction between taught and research postgraduates. Furthermore, the Modern Records Centre is the largest academic archive in the UK.