REF2021

Institution: University of Sheffield

1. Context and mission

Research at the University of Sheffield is distinctive and innovative. We drive intellectual advances and address global challenges. We undertake excellent research that makes a genuine difference: locally, nationally, internationally.

Highlight achievements include:

- **High-quality research environment**: £1.1bn research grant income (55% increase since REF2014). £720m infrastructure investment since REF2014, including £310m on research equipment and facilities.

- **Impact**: sector-leading support for developing research into real-world impact with successes across all sectors.

    o A 40-fold increase in IP revenue to £57.5m, 5th highest in the UK.

    o Expansion of our unique translational Advanced Manufacturing Group, a UK exemplar of university-led economic development. The Advanced- and Nuclear-Advanced Manufacturing Research Centres have developed long-term collaborative relationships with over 160 companies, including many of the UK's leading manufacturers, and host two of seven High Value Manufacturing Catapult hubs (£90m).

- **A pipeline of future talent**: 391 externally funded research fellowships from all major research funders, including Research Councils, Wellcome NIHR, Trust, Royal Society, the Academies, and the EU, with a total value >£103m. A successful culture of PGR recruitment and training with 4,739 doctoral awards (44% women), including 20 competitively awarded CDTs and DTPs.

- **Improving diversity**: a supportive research environment where diversity is valued, as evidenced by being the only university in the Sunday Times 'Top 100 best not-for-profit organisations to work for' three years running; a Stonewall Top 100 Employer for seven years running; and holding an Athena SWAN silver institutional award.

- 15% growth in our research community to 2,961 (1,584 Category A and 1,377 research staff).

Strategic leadership comes from our University Executive Board, which includes Vice-Presidents both for research and for innovation.

We value and nurture **research leadership** in our organisation and support individuals to secure prestigious leadership awards across career stages. Examples include Professor Neil Hunter's ERC Synergy Grant; research professorships including 6 RAEng Research Chairs (all with industrial partners); 10 UKRI Future Leader Fellowships. We value and reward **leadership in the sector** through the academic citizenship component of our Academic Career Pathway (Section 2).

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2. Strategy

Research and research leadership are at the heart of our Vision. Our objective is to enable and actively promote a culture of research excellence across our University community, delivering internationally recognised outputs, supported by sector-leading research income and facilities.

Institutional strategy is developed through Research Strategy Group, comprising Vice-President Research (VP-R) and Faculty Directors of R&I. The University R&I Committee provides oversight and quality assurance. Our strategy supports research activity at different scales to enable excellent research and effective translation:

1) **Individual** support (see Section 3).

2) **Units** are empowered to develop strategies reflecting their disciplinary research strengths.

3) **Institutional** support focuses on interdisciplinary research to tackle broad societal challenges.

We foster **researcher-led interdisciplinary centres.** Our *Insigneo Institute for in-silico Medicine* is an exemplar; it is Europe's largest institute dedicated to biological modelling, imaging and informatics in healthcare. 150 staff from 28 departments have been awarded £54m, leading to improved diagnostic tools for better clinical decision-making.

Sometimes real scale and ambition require '**top down**' direction. Our 2014 programme of institutional investment funded three pilot projects: £8.8m for 16 new academic posts, 5 fellowships, 36 PGR scholarships and £5.45m for new facilities. 'The Florey Institute', 'Imagine' and 'P3' bridged the gap between research and translation in antimicrobial resistance, super resolution imaging and plant science.

In 2018, we evolved this strategy, launching four ambitious **Flagship Institutes: *Energy; Neuroscience; Sustainable Food; and Healthy Lifespan.*** Selected through open competition on the basis of outstanding academic strength, diversity, scale, leadership, societal relevance and partnership opportunities, we invested £10m into professorial and senior research fellowships and £3.7m for 40 PGR scholarships. Early achievements include:

- *Energy* has a bold vision to increase access to affordable, secure and sustainable energy globally through identifying reliable low-carbon solutions to energy challenges. In 2019, it secured £21m from BEIS and ERDF for a Translational Energy Research Centre to investigate industrial decarbonisation.

- *Sustainable Food* takes a systems approach to change the way we think about food from farm to fork. Collaborating across five faculties, it has secured a £7.5m multi-partner, multi-disciplinary UKRI award from the Strategic Priorities Fund, indicating national leadership in the field.

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Research networks and partnerships

Individual researchers are enabled to develop meaningful relationships with national and international partners through visiting positions, secondments, study leave, conference attendance/hosting, joint scholarships and funding for exploratory trips, e.g. Professor Maisha Wester came to our School of English through a Fulbright scholarship, going on to be awarded a British Academy Global Professorship.

REAL-WORLD IMPACT

Long-term collaborative relationships with

over 160

companies

Host **two of seven** High Value Manufacturing Catapult hubs

£90m

81% of our outputs in this period had external co-authors, 45% had international co-authors.

Units support academic collaboration and external partnerships through externally funded grant opportunities. For example, Engineering is a key player in several EPSRC manufacturing hubs, including leadership for the £28m Future Electrical Machines Manufacturing focused on addressing key challenges for UK industry.

Institutionally we fund participation in the Worldwide Universities Network, and, nationally, the N8 (northern research-intensive universities) and the White Rose (Yorkshire), alongside strategic partnerships with the Sheffield City Region, industry, government departments, the NHS and cultural organisations.

- HEFCE and institutional investment of £16m in the N8 Agri-Food programme has delivered 180 collaborative projects and £40m research income.

- Our joint Clinical Research Office with Sheffield Teaching Hospitals enables collaborations with over 70 honorary clinical staff translating research findings into meaningful patient benefit.

- Our strategic partnership with Siemen*s* co-locates their staff in University research facilities to bridge the gap between discovery, product development and process improvement, producing major improvements for wind turbine generators.

Impact, knowledge exchange and innovation strategy

Our objective is to use our transformative research to address the most pressing societal challenges. Our strategy is to provide financial support and relevant expertise to build external partnerships and deliver impact.

We have been well funded to do this, including the maximum Higher Education Innovation Funding (HEIF) allocation (£21.8m), and £7m of UKRI Impact Acceleration Accounts.

The majority of this funding supports **individuals,** and external recognition includes five ESRC Celebrating Impact awards, the 2018 NERC Economic Impact Award, and three AHRC New Generation Thinkers.

Support includes:

- Professional development, including our pioneering *Impact Internship Programme* to give ECRs/PGRs experience of developing and demonstrating impact early in their careers.

REF2021

- Specific recognition of impact in our Academic Career Pathway (see Section 2). Impact can be the basis for reward, promotion, workload allocation and study leave.

- Funding to grow and strengthen a high-quality impact pipeline. During the period, £13.6m has funded 270 proof-of-concept projects, collaborative R&D and secondments. 20% of our impact cases have benefited from this seed funding.

- Generous consultancy arrangements: 267 staff have worked with >280 partners. Consultancy for Public Health England enabled a technology-supported approach that helped 600,000 of the UK's least physically active citizens do more exercise.

Our tech transfer team provides expert support to **commercialise IP** generated by **units**. Our ethos is to use our IP primarily for the benefit of society, rather than to generate income.

We have invested in expanding the team and created an IP Development and Commercialisation fund. Since 2016, £3m has been invested in proof-of-concept and seed-funding for companies to ensure spinouts are significantly more attractive to private investment. External consultants provide market analysis and advise on positioning spinouts. We have funded 64 projects across every faculty, created 16 companies and leveraged external investment of £5m. IP revenue has grown 40-fold to £57.5m; 5th highest in the UK.

Rinri Therapeutics is an exemplar of our approach: £21k proof-of-concept funding in 2017 enabled the spinout to raise £1.2m seed investment in 2019.

REAL-WORLD IMPACT

An IP revenue of

£57.5m

↑ 40-fold increase

5th highest in the UK

A £5m Connecting Capabilities Fund grant from Research England funded our regional collaboration with Manchester and Leeds to create *Northern Gritstone*, an investment company targeting an initial fund of £150m with a further £250-£500m by year four, which will invest in a range of companies based on University IP.

As an **institution**, we have focused on **research-led economic growth and cultural vibrancy**.

We have created the UK's first research-led **Advanced Manufacturing Innovation District.** This demonstrates the economic and social development possible when industrially relevant research drives collaboration with industry, local and central government, leading to massive inward investment. Companies and their supply chain have relocated to this brownfield site, creating jobs in an economically disadvantaged area. **Factory 2050** (opened 2016) translates excellent research jointly with our academic base in data, robotics and VR-prototyping to address real-world challenges in manufacturing and enable industry to de-risk technologies. It is a magnet for further investment: in 2018 Boeing opened its first new-build factory for 30 years, creating 87 highly skilled jobs; McLaren followed in 2019 with its first production facility.

We have extended this successful model to other regions: AMRC Cymru, a £20m state-of-the-art R&D facility in the Deeside Enterprise Zone, described by Welsh government ministers as a 'game changer', opened in 2019. It provided the fabrication location for the Government's Ventilator Challenge in 2020. Other sites include AMRC North West (Preston, 2019, digital manufacturing and battery assembly) and Nuclear AMRC Midlands (Derby, 2019).

Institutional level environment template (REF5a)

Our research influences the city region to support its development as a **cultural destination**. Our **Director of City and Culture,** Professor Vanessa Toulmin, co-creates research projects that add to the region's vibrancy, from festivals and exhibitions to green space and regeneration initiatives. A £350k AHRC award to investigate the impact of COVID-19 on Sheffield's cultural ecology will directly influence regional economic recovery plans and create best practice for other cities.

Our role as 'anchor institution' commits us to enabling local citizens to engage with research and cultural festivals are a directed way to do this. During the period half a million visitors to our festivals have brought £1.2m into the creative economy.

- Our award-winning *Festival of the Mind*, co-created with Sheffield's creative and digital community, brings research to life in exciting and innovative ways.

- *Off the Shelf* is the third largest and most accessible literary festival in the UK with an audience of 80,000.

Progress towards an open research environment

We created our first repository 15 years ago and encourage a research culture that is open for the benefit of society. Exemplary systems include a publication repository shared with Leeds and York, a data repository using the Figshare platform, and a mediated deposit service, reducing the burden on researchers while ensuring compliance with copyright and other stipulations.

OPEN RESEARCH ENVIRONMENT

82%

of our outputs since 2015 are open access

35,500 outputs

deposited during this REF period

↑ annual rate **more than doubled**

We have built on this foundation with effective leadership, policy, training, and advocacy. Institutional policy requires 'green' OA and **82% of our outputs since 2015 are open access** placing us 32nd globally in the 2020 Leiden Ranking. 35,500 outputs were deposited during this REF period, with the annual rate more than doubling. There have been 4.2m downloads of these papers.
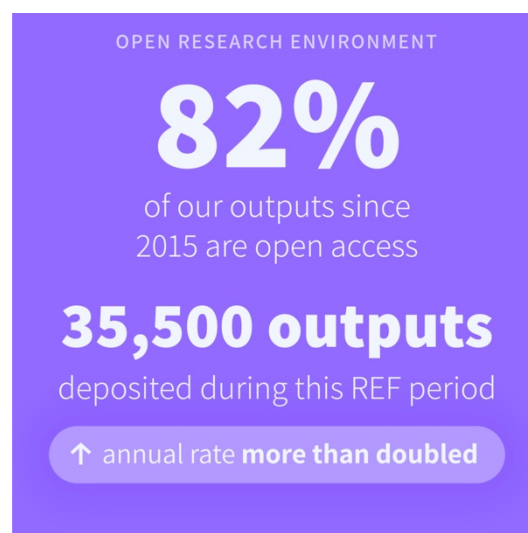
We have invested £250k in the **White Rose University Press**, co-created with Leeds and York in 2016. An innovative digital OA publisher, it can support small and experimental publications and formats, such as data journals, with licences that enable researchers to reuse our work. An OA monograph of the Madeleine Blaess diaries (2018) has >4,300 downloads (the average academic print-run is 400) while the license has enabled widely used resources for KS3-5 teaching.

We recognise there is more to do nationally; we support the move to full, immediate OA (Plan S). Our staff are engaging with the debate through editorial positions and roles in learned societies and supporting sector leadership via the UUK/JISC Collections Strategy group.

Our open data repository hosts some of the most discussed datasets worldwide (Rae, Stafford) and supports the sharing of software, protocols, and reports, encouraging open research throughout the research lifecycle.

Our VP-R chairs an Open Research Advisory Group providing strategic oversight. We are a founder member of the UK Reproducibility Network and have invested in academic leadership. Our **Research Practice Lead** has developed an institutional statement on open research, coordinates

translation of policy into good practice, and encourages grassroots participation and best-practice sharing.

Our researchers are national and international advocates and leaders. Professor Stephen Pinfield is external advisor to UUK and JISC. Professor James Wilsdon chaired the group that produced The Metric Tide report and leads international debate through the £3.2m Research on Research Institute co-founded with Wellcome Trust, Digital Science and Leiden University.

Professional development and support include tailored advice on data management plans ensuring projects have strategies to maximise data sharing. PGRs receive training to embed open research early in their careers; data management plans and OA thesis deposits (>4,500 since 2014) are mandatory.

Major digitised resources are openly accessible, often with innovative digital routes into data collections. Our open-source software benefits the economy, such as the GATE text engineering platform used by Oracle, BBC, and the Press Association.

Research integrity

Research excellence depends on research integrity. We support individuals and units to deliver the highest standards and best practice in research integrity and ethics. Committed to the **Concordat to Support Research Integrity,** we have appropriate policies and procedures to ensure the highest standards of rigour and integrity, and research is conducted according to appropriate ethical, legal and professional frameworks.

To embed a culture of ethical behaviour which is valued and encourages challenge, we set clear expectations, outlining both good and unacceptable practices in areas such as authorship, data management, collaboration, public engagement. Focussed workshops discuss and share best practice in emerging aspects of ethics. We were the first HEI to require PGRs to undertake ethics and integrity training (tailored to their discipline), with 91% of the most recent cohort reporting improved understanding. When defining criteria for responsible research assessment, we are considering how they uphold research integrity and avoid incentivising poor practice.

Transparent, robust, and fair processes manage allegations of research **misconduct**, with impartial investigations using external advice where necessary. Our **whistleblowing** policy enables staff to raise concerns at a high-level without fear of reprisal. In 2019 we introduced 'Report and Support', to enable staff and students who have experienced bullying, harassment, verbal, or physical abuse to report it confidentially.
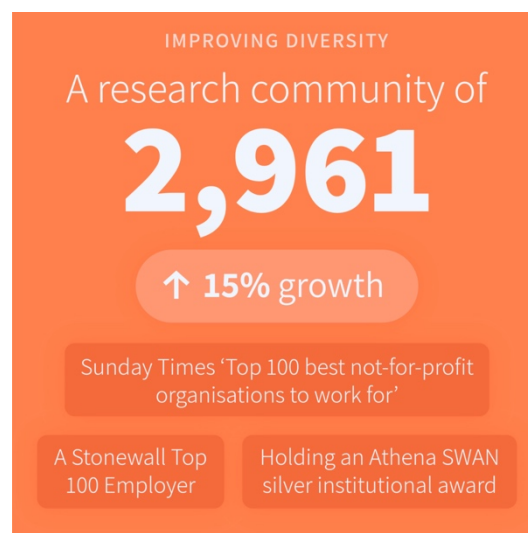
3. People

Our research community has a strong sense of identity and values. Central to this is a commitment to champion diversity and inclusion to deliver excellence.

Staff development

Supporting staff to realise their potential is a key enabler for our research strategy.

We introduced **Academic Career Pathways** (ACP) in 2018 to provide a transparent framework for career development. Within the academic and research-specialist pathways, core and optional criteria allow individuals to focus on, and develop, their strengths in research and leadership. Clear expectations for outputs, impact, income, PGR supervision and professional standing at each career stage are proportionally reduced for those with equality-related circumstances including part-time working, career breaks, family leave and ill-health.

> IMPROVING DIVERSITY
>
> A research community of
>
> # 2,961
>
> ↑ **15%** growth
>
> Sunday Times 'Top 100 best not-for-profit organisations to work for'
>
> A Stonewall Top 100 Employer
>
> Holding an Athena SWAN silver institutional award

Institutional policy for research time and resources flexes to take into account individual circumstances. Our workload allocation model protects time for research, scholarship, and impact; this increases to accommodate funded investigator time and PGR supervision. All academic staff are entitled to research leave, for impact as well as research, after each seventh semester.

Annual progress reviews are complemented by research-specific planning meetings to discuss aspirations for funding, writing and impact, and to signpost relevant support. Consultation identified that targeted support for mid-career researchers to become research leaders, to apply for strategic or large grants are highly valued and we will continue to develop our provision.

We signed the **San Francisco Declaration on Research Assessment** in 2018, prompting a critical review of performance assessment. We focus on using the right indicators, rather than those which are easily accessible: ACP ensures outputs are assessed on their own merit, by those with disciplinary expertise and never relying on metrics alone. We are changing our recruitment practices to match. We will implement feedback mechanisms for staff to report bad practice with an independent panel to review cases and recommend improvements.

Early career researcher support

As future research leaders, ECRs are key to our long-term success. In 2014, we invested £10m in **34 Vice-Chancellor's Fellows** to grow areas of research strength. Tailored support and skills development enabled independent research programmes, collaborations, and significant funding awards. All progressed to academic positions, nine advancing to senior lecturer and one to professor. They have secured £16.9m in external funding, produced 565 research outputs, and lead on six impact case studies.

Institutional level environment template (REF5a)

We invested £1m of GCRF-QR funding in 2019 in **13 Global Challenge ECR Fellows** who work with global partners to address challenges faced by developing countries, from labour exploitation to global food security and tackling plastic waste.

We have had 391 externally funded fellowships in the period. Units have developed strategies to attract and retain excellent ECRs. For example, in 2017, the Faculty of Science introduced guaranteed progression to an open-ended contract for fellowships of over 4-years, attracting 16 high-calibre externally funded fellows.

We have held the **HR Excellence in Research Award** since 2012 (renewed 2019) based on our success in exceeding the requirements of the **Concordat to Support the Career Development of Researchers**:

- The award-winning **Think Ahead** programme is a comprehensive framework that gives ECRs a career trajectory plan and tailored development opportunities corresponding to Vitae's Researcher Development Framework, including skills training to support careers outside of academia. Over 7,000 ECR/PGRs have attended development and work-based opportunities run by our specialist team.

- Our **research-led mentoring** programme has two intakes per year. 667 staff have undertaken the programme since 2014, benefiting from the support of 245 mentors who advise on output writing, grant application, PGR supervision and impact.

- Researchers are entitled to 1 day per month for professional or career development (exceeding the 10 days in the Concordat). Our 'Aspire' and 'Inspire' charters set out clear expectations of ECRs and their managers respectively.

Postgraduate research students

Enhancing our PGR experience is a key priority in our research strategy. We aim to be the institution of choice for PGRs through our research excellence, innovative training, and commitment to career development and wellbeing.

We have a diverse PGR community of around 4,000, representing 106 countries. 46% are women, 7% of UK PGRs are BAME, 13% are disabled. We offer the range of doctoral qualifications including EngD, MD and professional doctorates and have made 4,739 awards during the period.
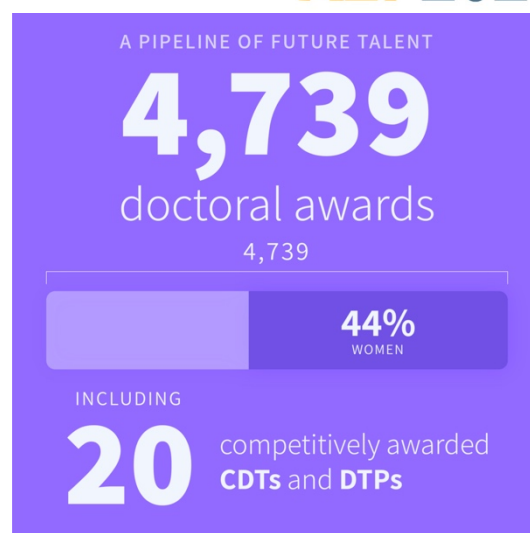
Our hub and spoke governance model sees the University PGR Committee agree policy (such as funded medical and shared parental leave), while Faculty Graduate Schools ensure consistent high-quality student support and a network to share good practice in recruitment and progression across units. Highlight developments include:
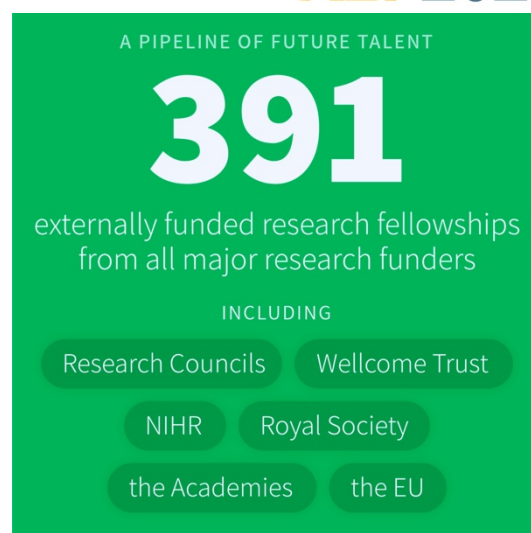
Institutional level environment template (REF5a)

Recruitment: We have shifted our focus from quantity to quality, empowering units to identify the size of PGR community they need for a vibrant environment, balanced against supervisory capacity. We have started to define widening participation in the context of PGR, to ensure we offer support and can further diversify our applicant and recruit pools. The Sheffield-led White Rose DTP has launched a seminal scheme with the Stuart Hall Foundation ring fencing UKRI funded studentships for Black British PGRs.

To ensure we can achieve our recruitment aims, we invested **£186m in PGR scholarships**, including £98m of institutional investment. 20 Centres of Doctoral Training and Doctoral Training Partnerships have £78m of competitive funding from all of the UK Research Councils, Wellcome and others.

A PIPELINE OF FUTURE TALENT

4,739 doctoral awards
4,739

44% WOMEN

INCLUDING
20 competitively awarded **CDTs** and **DTPs**

PGR wellbeing: a project exploring the pressures on PGRs brought together community consultation with the literature to make recommendations for change. Units and students were asked a 'magic wand' question (what one thing would make the most significant wellbeing improvement) which enabled prioritisation. All of the high priority issues have been addressed, including introduction of mandatory supervisor training; new wellbeing advisors in units; a PGR-specific hardship fund; funding for medical leave of absence for our own funded students; a peer mentoring scheme.

Submission in tuition-fee paying period: Our four-year submission rates have improved from 63% to 79%. Since 2018, our focus has shifted to submission within tuition fee-paying period (now a University Council KPI). Our exploration of PGR wellbeing highlighted that unclear and unrealistic expectations are a major source of poor mental health. This led us to redefine the essential criteria and competencies required to achieve a doctorate so that from 2019 all entrants have a programme that gives them a realistic expectation of submission within their tuition fee-paying period.

Progression and development: Effective induction and systematic peer support ensure new PGRs are welcomed into a supportive environment. Confirmation review by 12 months, and submission review at 36, ensure they are on track to submit their thesis within their tuition fee-paying period. There are regular opportunities and funding to present and share research at seminars, journal clubs, retreats, symposia, poster competitions and conferences. 85% of PGRs have attended a conference and 73% have presented a paper or poster. PGRs are supported to secure placements, and we offer three-month bursaries to prepare results for publication and to develop impact post-submission. Business or public-engagement ideas receive support from a dedicated enterprise team.

Our Doctoral Development Programme provides discipline-specific and professional skills training. We recognise that career pathways are increasingly diverse, and our skills training has evolved in response. Training needs analysis provides a personalised programme including taught modules, careers advice and coaching, thesis mentoring, and placements or collaboration with partners. 'Think Further' offers development in bite-size pieces through weekly coaching prompts on monthly topics. We have reviewed our programme to ensure it reflects the revised essential criteria and competencies PGRs need to evidence to achieve their doctorate.

Supervisor support: Ensuring supervisors have the right skills to motivate and guide is a key priority. We have introduced mentoring for new supervisors; mandatory CPD for all supervisors based on supportive peer discussions to explore the practice of supervision rather than simply providing 'tick box' training; and best practice workshops. Our '**Supervisionaries'** programme celebrates excellent supervision and 'associate supervisor' status enables researchers to be recognised for formal and informal roles.

Equality, diversity, and inclusion (EDI)

Our academic and research staff base is diverse: 34.4% are international; 35% are women; 5% self-report as disabled and 20% as BAME. We know there is more to do.

We have introduced measures to ensure EDI is considered in all decision-making. EDI directors sit on executive boards in every unit and faculty. University EDI Committee is chaired by the Deputy VC (herself recognised in 2017 with an Excellence in Diversity Award) and reports directly to Council. It has representatives from staff networks, such as disability and LGBTQ+ to ensure a voice in policymaking.

IMPROVING DIVERSITY
Our academic and research staff base is diverse:

34.4% are international

35% are women

5% self-report as disabled

20% are BAME

Gender: we hold an Athena SWAN silver institutional award alongside 19 unit awards. Pro-active measures have improved gender balance in leadership roles (a third of University Executive and 40% of Senate are women) and 25% of women academics are professors (an increase in all faculties). We have the third smallest gender pay gap in the Russell Group and plan to improve this. Our *Women Academic Returners Programme* provides protected time and funding for research following family leave, addressing disruption to research, career development and progression and helping units to retain female staff. Since 2014, 163 women shared £2.1m and consequently secured over £20m of grants, a return of over 800%. In 2018, UCEA cited the scheme as an example of good practice.

Race: 20% of our staff are BAME. Our 2019 strategy and action plan set ambitious targets to tackle under-representation, progression, and attainment as we work towards the Race Equality Charter.

LGBTQ+: we won a 2018 HR Excellence Award for *Open@TUoS* which empowers staff to create an open, inclusive environment for LGBTQ+ staff and students through focussed events, campaigns, training and initiatives. Disclosure rates have increased by 11% for sexual orientation and by 10% for gender identity. Our work has been recognised in seven consecutive years in Stonewall's Workplace Equality Index: we are in the top 5% of employers and one of only four Russell Group HEIs.

Wellbeing: is at the heart of the experience of working and studying at Sheffield. We signed the Time to Change Pledge (2014) and the Mental Health Work Commitment (2020), committing us to creating a positive environment where staff can talk openly and seek help where necessary. A free, independent, confidential helpline and counselling service 24/7 for staff, students and their families, and a range of online resources support colleagues to manage wellbeing. To identify problems at the earliest opportunity, we fund Mental Health First Aid training, as well as having a network of wellbeing champions in every unit. We are collaborating with the national charity Mind in the
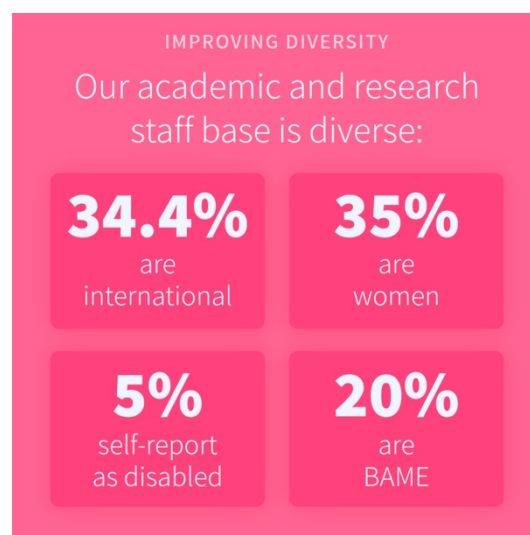
Mentally Healthy Universities Programme to pioneer interventions and share learning with the sector.

Consideration of EDI in our REF submission

We consider EDI in developing all core policies, processes, and guidance, mindful of the impact our decisions have on staff with protected characteristics. Our REF Code of Practice placed EDI at the centre of our preparations, with oversight from REF Steering Group (40% female). All decision-makers undertook tailored training including recognising and countering implicit bias. We have submitted 100% of our Category A Eligible staff. Equality impact assessments on our output scoring and attribution found no evidence of systematic bias. Clear policy statements ensure there will be no detriment to staff either in their independent researcher status or in the number of their outputs submitted.

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4. Income, infrastructure and facilities

Research income

Our strategy is to secure income which enables excellent research and effective translation across the three scales: individual, unit and institution.

Academic leadership from the VP-R and Faculty Directors of Research & Innovation ensures a strategic focus to identify opportunities which match our strengths and ambitions. For institutional bids we wish to support at scale, they offer significant peer support and coordinate match funding in excess of £15m annually. Institutional awards including HEIF, Global Challenges Research Fund QR, Policy QR and NPIF QR allow targeted support and pump-priming of new research and growth in existing strengths.

HIGH-QUALITY RESEARCH ENVIRONMENT

£1.1bn
research grant income

↑ **55%** increase since REF2014

Professional services operate at institutional and unit levels. 175 FTE provide expert support for grant capture, management, dissemination and knowledge exchange. We invest in their professional development and career progression through networks, targeted training, and secondments. **Institutional-level** support for interdisciplinary and cross-faculty strategic research teams recognises the challenges of navigating requirements and processes across the institution. An exemplar of our approach is the combination of academic and professional expertise to manage operational GCRF support and decision-making. Our leading international development researchers act both as academics and service delivery partners, offering training and mentorship to colleagues from disciplines new to ODA projects. This has led to external funding in units new to working in ODA contexts. For example, research on music and wellbeing in Colombia and Mexico. **Unit-level** teams focus on disciplinary strengths. Structures implemented in 2018 have been transformational. E.g. Arts and Humanities units have increased grant applications by 117% and internal funding for time to write funding applications resulted in a ten-fold return on investment.

Specific implementation support for large or complex projects requiring cross-organisational working avoids academic time being unnecessarily taken up piecing together what is required from

across professional services (Estates, Procurement, Finance, HR). 'Orange box' kick-off meetings ensure PIs have confidence in timely delivery of the steps required to start complex grants.

Evidence of the success of our support includes:

- £1.1bn of research income over this REF period (a 55% increase on REF2014)

- 48% of our research comes from grants over £1m.

- Funding from 1,734 individual funders,

- 60% of our grant income was peer-reviewed.

Significant **EU funding** from Framework and Horizon programmes reflects our strength and alignment with EU priorities. We had 248 projects over the REF period with over 1,700 partners.

Industry income rose by 38% to £27m. 38% of our grants in the period involved collaboration with a non-academic partner (£326m), putting us third nationally. For example, in our Flagship Neuroscience Institute, Professor Mimoun Azzouz is academic lead of a €24.5m Pfizer-led Innovative Medicines Initiative.

In-kind income and gifts: we have successfully developed strategic relationships leading to sector-leading levels of in-kind contributions to support research activities, £44.9m in 2018/19 was the highest nationally[1].

Philanthropy supports our research objectives; our new £11m MRI-PET scanner (the only one in the north of England) was part-funded by £2m of public donations to transform understanding of diseases and their treatment. Housed in a purpose-built facility, this opened in 2019, is attached to the Royal Hallamshire Hospital, and forms part of our Neuroscience Flagship.

Infrastructure and facilities supporting research

A mature estate of **physical infrastructure, equipment and facilities** supports novel research and its translation.

A VP-R led group guides and oversees proposals for equipment and capital to ensure quality, sustainability, and reference to institutional and unit research priorities. A dedicated Capital Research Manager ensures other professional support is well coordinated.

Investment of **£310m into new and upgraded research infrastructure and facilities** includes:

- An interdisciplinary initiative of £10m for studentships and equipment developed advanced microscopy to gain new insights into life and disease. Funders and partners worldwide supported state-of-the-art facilities and a team of talented researchers equipped to tackle major challenges in biomedicine.

HIGH-QUALITY RESEARCH ENVIRONMENT

£720m

infrastructure investment
SINCE REF2014

£310m
RESEARCH EQUIPMENT
AND FACILITIES

£720M

including **£310m** on research equipment and facilities

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[1]Source: HEBCI

- The Arthur Willis Environment Centre: refurbished into a state-of-the-art 'GroDome' to simulate plant growth conditions for different global regions. This supports our Flagship Sustainable Food Institute and underpins GCRF partnership research with ODA countries.

- HumLab: offers Humanities scholars an acoustic sound booth and physiological, motion and eye-tracking capability, enabling cutting-edge interdisciplinary research. It was instrumental in winning a £1m Leverhulme Trust Research Leadership Award to understand what speakers know about languages and support foreign language learning.

- Over £80m for industry-scale engineering infrastructure, such as the collaborative Henry Royce Translational Centre, Laboratory for Validation and Verification and the Integrated Civil and Infrastructure Research Centre on the AMP.

- Three new translational research facilities on the AMP in 2018 following a £47m investment from the University, ERDF and UKRI. 3,000m^2 of high-technology facilities enable industrial partners to access our research expertise and investigate feasibility of new technologies.

We play a leading role in the region by hosting very substantial NIHR-funded infrastructure to support health science research. This includes the £5.2m Research Design Service, supporting research across Yorkshire and the Humber, Collaboration for Leadership in Applied Health Research and Care, the School of Public Health and Clinical Trials Research Unit.

Maximising the potential of our infrastructure and facilities to deliver world-class research and impact requires **skilled technicians**. We are a founding signatory of the *Technician Commitment*, a nationwide scheme to address the challenges facing technical staff. Our action plan ensures visibility, recognition, career development, and sustainability for our 600 technical staff. Notable achievements include professional registration support, dedicated 'Our Technicians' website, career profiles, nomination for national awards, reward schemes, TechNet, policies for research output co-authorship, and collaboration with the National Technician Development Centre.

The AMRC also has a three-year apprenticeship programme. 131 apprentices have taken part in the programme during the census period. Apprentices progress to a substantive technical position, supported by a post-apprenticeship development framework. This structured approach allows us to show our commitment to these staff and support their development to become fully rounded technical staff.

We invest in **digital infrastructure** to support researchers in their day-to-day work, enable and promote collaboration, and support successful funding applications. This includes:

- £8m p.a. on a comprehensive suite of research software applications.

- 10TB of shared storage for each research project - over 20TB of research data storage in total.

- Four High Performance Computing platforms (with a 5th planned) are free to all (900 monthly users) and provide resources to run cutting edge analytical techniques and data processes.

- A cluster of more than 120 research virtual machines (totalling nearly 900 CPUs) configured to support the specific needs of research projects including when working from home.

- Cyber Essentials certified assured computing for a secure and protected environment. Over 1,000 researchers have completed the Cyber Essential Plus training and more than 4,000 have completed the Protecting Research Training.

We give researchers the support needed to effectively use technology, including a coordinated upskilling and training programme and unit-based technical support. A team of **research software engineers** (RSE) support individual projects with software for high-performance computing, acting as a critical enabler where recruitment of short-term expertise is difficult. Our RSE service supported the COVID-19 Genomics UK Consortium to create an automated, high speed and robust data pipeline from the gene sequencer into the analysis tooling. This meant that the project was able to identify and track virus mutations and variants at a vastly higher throughput.

To ensure our digital infrastructure is fit for purpose for the next five years, we are investing £10m to deliver our research and innovation IT strategy, developed through extensive consultation with the research community. This includes greater use of **cloud computing** to store, process and analyse research data, making platforms and tools available to researchers at the point that they are needed. Expanding on our RSE model from Computer Science, we are creating a Data Analytic Service to support the use of new methodologies and innovative data exploration methods. Built as a partnership between Maths and IT Services it will support the robust use of Big Data, data analytics, and visualisation throughout the University and with our regional and other research partners.