

Institution:

Heriot-Watt University

1. Context and mission

Mission

To create and exchange knowledge that benefits society.

Context

Our mission is influenced by our heritage as the world’s first Mechanics Institute, established in 1821 to provide the knowledge and skills necessary for emerging industries in a growing economy. We remain true to this heritage but have transitioned into a multinational organisation (62% of our turnover is transacted in the UK, 23% in the United Arab Emirates and 15% in Malaysia), well placed to drive economic growth and address social challenges through educating the future workforce, advancing research, building global collaborative partnerships and commercialising technology. Our international positioning imbibes a diverse research culture in our research and impact network across the University.

Research activities returned in REF21 are undertaken at our campuses in the UK (Edinburgh, Galashiels and Stromness). We are returning to 422.42FTE staff across 11 Units of Assessment with a focus on engineering, science and business-related research, see Figure 1.

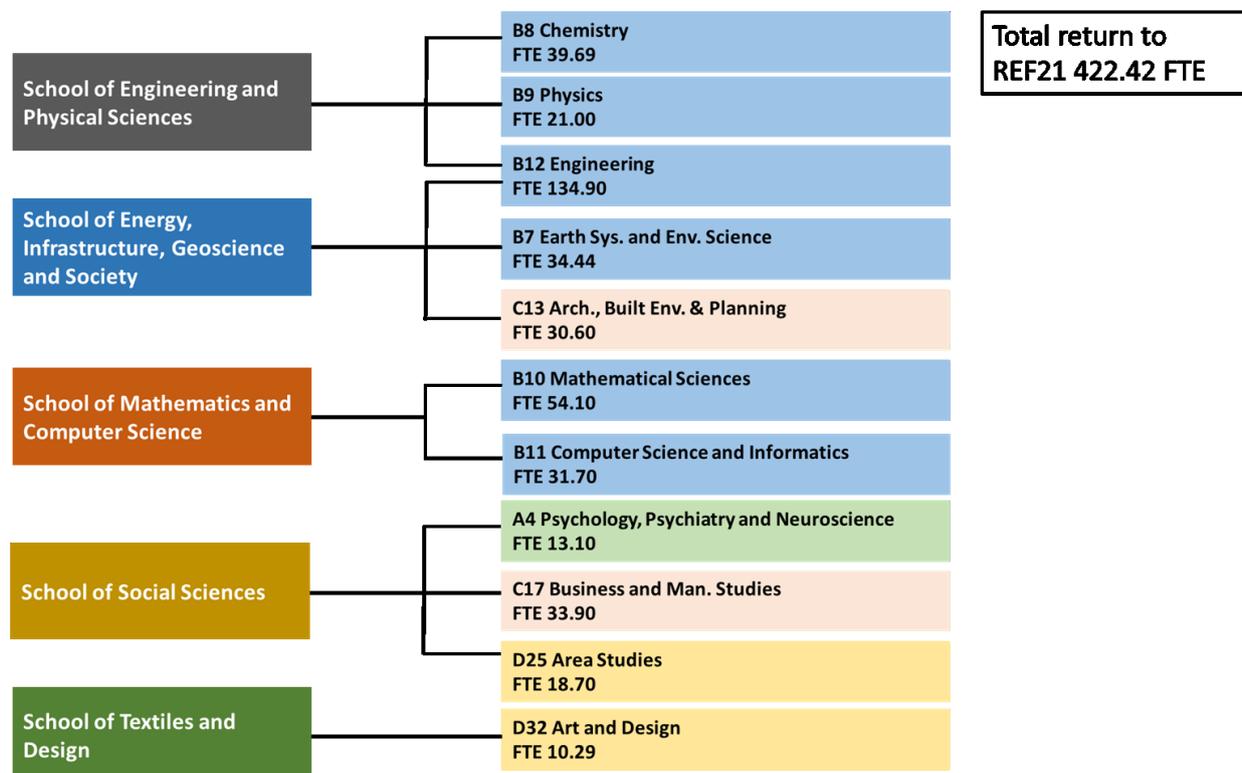


Figure 1: Mapping of Schools to REF21 Units of Assessment

We are strongly committed to the contributions we make to the society and economy of the UK. An independent analysis of our economic impact demonstrates that we directly enhance the economy by generating £278.2 million Gross Value Added each year and supporting 6,254 jobs.

University Strategy

During the REF21 period our strategy has focused on growing our core research strengths by creating **Global Research Institutes** (GRIs) to lead out frontier research, recruiting new research leaders to increase capacity, investing in our research development and enterprise teams to support income growth and impact, and funding PhD scholarships in new exciting research areas. Synergy between research and teaching is critical to the supportive environment we seek to create and we have established a **Research Futures Academy** (RFA) and **Learning and Teaching Academy** (LTA) to support our staff in achieving their full potential in both these areas.

This has led to significant growth in performance metrics when comparing annual averages for the REF14 and REF21 periods: outputs up from 1140 to 1536 (**35% growth**), research income up from £22.6M to £30.2M (**33% growth**) and PhD graduations up from 107 to 158 (**47% growth**). We have doubled our strategic partnerships with industry and grown spin-out creation and investment; having created 9 spinouts since REF14 who we have supported to raise around £3.8m via equity and grant funding. Our global structure has aided in developing international networks; we have 34 active partnerships funded by the Global Challenges Research Fund (GCRF).

Structure

The academic line management structure of the University is our Schools; managed by a Head of School and supported by a School Management Group, which includes a Director of Research (DoR) with responsibility for the development and delivery of School research objectives. To facilitate interdisciplinary research this is supplemented by GRIs. GRIs cut across School boundaries and possess the capacity to develop significant international collaborations and work across a range of Technology Readiness Levels.

2. Strategy

Strategy 2025: *Shaping Tomorrow Together*

Strategy 2025: Shaping Tomorrow Together, reinforces our vision to be at the forefront of academic endeavour that makes an outstanding impact on society. It is values led and was developed with the active participation of our staff, students, alumni and partners and is co-delivered by this global community through four interconnected themes - *Building Flourishing Communities*, *Pioneering in Education*, *Excelling in Research and Enterprise*, and *Globally Connected*. The implementation of the *Excelling in Research and Enterprise* theme is jointly led by the Deputy Principal (Research and Innovation) and Deputy Principal (Business and Enterprise), DP(R&I) and DP (B&E). The theme aims to achieve:

- Excellence and growth in research.
- Thought leadership that shapes the global research agenda.
- A globally connected enterprise eco-system connecting students, staff and society.

- A global reputation for transformative economic and societal impact that addresses Grand Challenges and contributes towards Sustainable Development Goals.

These aims are supported by a commitment to provide a supportive environment for staff and students to achieve their full potential. Central to this has been the creation of the Research Futures Academy, supporting all research staff and students to achieve excellence.

Achievements

The research culture our strategy has created has promoted excellence and enabled many of our research staff to advance their careers during the REF21 period with 62 promotions to Professor and 160 promotions to Associate Professor. Our *Fellowship College* has been a source of proactive support for Early Career Researchers (ECRs) seeking externally funded research fellowships with 30 awarded during the REF21 period.

Our unit level environment statements and impact case studies provide details of the research outcomes and impact we have achieved in REF21. These extend across a wide range of topics. For example, we have:

- Enabled 70,000,000 deaf signers to access society, by shaping policy teaching of British Sign Language in schools and informed changes to the jury system allowing signers to serve as jurors.
- Influenced the Homelessness Reduction Act 2017 to radically expanded single homeless people's entitlements in England (backed by £72.2M of government funding).
- Protected critically important biogenic habitats and ecosystem services by shaping policy objectives in international maritime spatial planning through the designation of Marine Protected Areas in Panama, Colombia, Galápagos and Europe.
- Invented and developed a critical asset Environment and Health Monitoring System (EHMS) that optimises asset operations, installed, as a world-first, onto critical aircraft handling equipment on HMS Ocean, the UK's helicopter carrier and Fleet Flagship of the Royal Navy.
- Developed pressure garments used globally to treat hypertrophic burn scars, improving medical outcomes and patient quality of life.

To strengthen our 'policy voice' we appointed a Chief Scientist and believe we are the first UK university to do so. With public support from 17 Nobel Laureates we have renovated **Panmure House**, former home of Scottish Enlightenment economist Adam Smith, as a venue for public debate on topics of global importance. The debates cut across all research activities, i.e. the *Adam Smith Lecture Series* brings together the world's best economic thinkers and Nobel Laureates to deliver keynote lectures of global relevance, and the *Hutton Series on Climate Change* recognises the increasing need for reasoned debate between industry, NGOs, government and the public on energy provision, climate change and resource utilisation.



Figure 2: Panmure House – former home of Adam Smith – shaping policy

In 2016 we opened the **Lyell Centre for Earth and Marine Science and Technology** to host our partnership with the British Geological Survey. The Centre utilises our combined expertise to create an interdisciplinary centre addressing global challenges in earthquake prediction, mass extinction of marine organisms, world-wide traceability of seafood products and sustainability in seafood supply.

With the University of Edinburgh, we are partners in leading the UK and Scottish Government’s investment (£751M) in the innovation strand of the **Edinburgh Region City Region Deal**; an ambitious plan to establish the City Region as the ‘Data Capital of Europe’. Through this initiative we are constructing the **National Robotarium** on our Edinburgh Science Park.



Figure 3: Architects Design for the National Robotarium - driving research translation

The **National Robotarium** will support pioneering research, develop wide ranging academic and industrial partnerships, train new generations of researchers, engineers and innovators, and create a unique ecosystem fuelling the rapid transition of ideas into new products and innovation.

We have created two GRIs based on **Lyell Centre** and the **National Robotarium** capability and will launch others in **Net Zero Carbon**, **Medical Technology** and **Social Inclusion** in 2021.

We lead and partner in major UKRI funded projects that will deliver future impact. The Robotics Hub for Offshore Robotics for Certification of Assets (ORCA) (EP/R026173/1, £14M) brings together our robotics expertise with over 30 industry partners; the EPSRC Centre for Sustainable Road Freight (EP/R035202/1, £1.8M; EP/S032061/1, £0.9M) is working to achieve deep reductions in CO2 emissions from the road freight sector. The Innovate UK-funded collaborations in Quantum Technology (EPSRC, EP/T001011/1, £24M and EPSRC, EP/T00097X/1, £22M) is enabling partnerships with over 30 industry partners to commercialise quantum technology research, and the ReFLEX (Responsive Flexibility) project in Orkney supported by £28.5M investment from Innovate UK will demonstrate a first-of-its-kind Virtual Energy System (VES) interlinking local electricity, transport, and heat networks into one controllable, overarching system.

Postgraduate research students add greatly to our research culture and we have invested around £10.5M throughout the census period into James Watt Scholarships to recruit 40 talented research students per annum. This investment sits alongside the £11.4M we have received from EPSRC DTP awards (EP/T57999/1, EP/V520044/1, EP/R513040/1, EPN509474/1, EP/M507866/1, EP/M506333/1, EP/L504774/1) and our success in securing EPSRC and NERC Centre for Doctoral Training Centre awards (8 awards with a total value of £41M).

Enterprise activities delivered through our **Global Research Innovation and Discovery (GRID)** programmes are designed to maximise the uptake of our intellectual property, support our start-ups and spinouts and strengthen and develop new partnerships with industry. This activity is closely linked with our coordination of the **Converge Challenge** on behalf of the Scottish Funding Council. The **Converge Challenge** is open to university staff and students from across Scotland and provides a springboard for new business creation through training and prizes. An economic evaluation undertaken by Biggar Economics in 2020 concluded that it generated £21.5 million GVA and supported 524 jobs in 2019 in Scotland.



Figure 4: Global Research Innovation and Discovery Building - supporting enterprise

In 2015, the excellence of our geoscience research was recognised with the award of a Queen's Anniversary Prize for the translation of computer modelling methodologies from geoscience to life

science. Our transformative policy interventions at the crucial interface between government, frontline services and those in hardship resulted in the award of a second Queen's Anniversary Prize in 2019.

Partnerships

We are committed to working with other peer universities in local, national and international partnerships. For example, the Edinburgh Research Partnership in Engineering and Mathematics (Heriot-Watt and University of Edinburgh) underpins our joint submissions in Mathematical Sciences (**Maxwell Institute**), Engineering (**Edinburgh Research Partnership in Engineering**) and Architecture Built Environment and Planning. Our funded research projects support collaborations with 2,491 partners (1,213 industry, 772 universities, 251 charities, 156 professional societies, 86 government establishments and 13 NHS trusts). We are a strong supporter of the Scottish Funding Council's research pooling initiative, with active membership of 8 pools. These pools facilitate collaboration and facilities sharing across the Scottish research community.

Over the REF21 period we have grown our strategic partnerships with business which include, AWE, DAR, Schneider Electric, Cisco, ASML, Chromacity, Renishaw, Shell and Energi Simulation. These are built on long-term joint planning, shared facilities, staff exchanges, and joint projects spanning different technology readiness levels.

Public Engagement

Public engagement is an important element of our research culture and we have used our **Strategic Support for Embedding Public Engagement with Research** grant from UKRI (£89k) to revitalize our public engagement strategy (launched in 2020). Highlights from our Public Engagement calendar include: *Engaging Research Day* - an annual showcase of public engagement activities; *Explorathon* - Scotland's event for EU Researchers' Night, a public celebration of research taking place in more than 300 cities across Europe; our 'Year of' campaigns, to date we have held Years of Light, Robots, the Sea and Health, showcasing and celebrating our contributions to research in these topics.

Research Governance

The Research and Enterprise Strategy Implementation Group is responsible for driving strategic change across the organisation. Co-chaired by the DP(B&E) and DP(R&I), membership consists of research leaders and DoRs from all schools and campuses. Initiatives implemented by the group include the identification and development of GRIs, the creation of the Research Futures Academy (RFA), definition of its development programme, and the launch of our revitalised public engagement strategy. Actions arising from Group decisions are cascaded through the organisation via DoRs and School Management Teams.

The formal aspects of research governance are provided through the *University Committee for Research and Innovation* (UCRI). UCRI is a committee of the University Senate with a reporting line to the Executive on staffing and resourcing issues. It is chaired by the DP(R&I) and its membership includes DoRs (5), elected members of the Senate (3), a Dean (1), a member of the research student body, an elected officer of the Student Union and the Chairs of the University's Research Ethics Committee (UREC) and Research Degrees Committee (RDC). The RDC oversees all matters relating to research students. UREC oversees research ethics and its terms of reference follow UKRIO best practice guidelines, thereby ensuring appropriate ethical standards

are adhered to for all our research projects. The DP(R&I) is an Ex-officio member of both UREC and RDC.

Strategic Targets

We have set ourselves ambitious Strategic Performance Indicators for research and enterprise within Strategy 2025:

- Growth in annual research income to £65M; with a focus on societal and economic challenge-led activities in GRIs, and
- Attainment of a top 250 position in a World University Ranking; especially though improving output quality and international collaborations.

Progress in the first is being achieved through our strategic commitment to research excellence, the development of our GRIs aligned with national priorities, e.g. UK Research and Development Road Map (July 2020), the UK Industrial Strategy and place-based initiatives to support economic growth.

We are currently ranked 301st in the QS World University Rankings and in the top 250 in 6 of our subject groupings (Chemical Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering, Mathematics and Accountancy & Finance) and have plans in place to enhance these and improve the positioning of other subject groups.

3. People

People Strategy

Recruiting, retaining and supporting high calibre research leaders and developing them through our values led approach is the foundation of our research culture. Our values are:

- **Collaborate** - working in partnership to shape the future.
- **Inspire** - curiosity to learn and find solutions that transform lives.
- **Celebrate** - excellence and take pride in the achievements of our students, staff and alumni.
- **Belong** to a diverse, inclusive international community working together across boundaries and cultures.

Recruitment

Our *Bicentennial Research Leaders* programme is the cornerstone of Strategy 2025 and we have recruited 246 research leaders on teaching and research contracts across our UoAs during the REF21 period. Recruitment is and led at an institutional level to align with research priorities (almost always interdisciplinary), where new academic appointments complement our existing staff enabling us to tackle new and important research challenges.

Retention, Promotion and Remuneration

The positive working culture created by our values is critical to retaining high performing staff. Supporting this is our approach to career development, promotion and remuneration.

We pride ourselves in offering competitive remuneration packages for all staff. For the academic community these are reviewed annually based on an objective assessment of individual

achievement and performance via academic scorecards where the criteria are aligned to the institutional strategic targets and benchmarked against UK discipline norms.

To support career development, we hold annual workshops to explain the key requirements for progression and the processes that support this. Academics are encouraged to use their annual Performance and Development Review (PDR) as an opportunity for career planning and to engage with the RFA to develop their skills. Attendance on external personal development courses is supported where appropriate, for example 121 female leaders have attended the Aurora Leadership programme in the REF21 period.

Recognising that staff may have personal circumstances that impact their research, we have adapted the learning from REF14 to ensure staff for whom flexible working is appropriate and where confidential special circumstances exist are not disadvantaged in their career progression.

Support

We recognise that excellent research requires time, and support this through a published methodology for workload allocation. This ensures staff are treated equitably and recognises individual circumstances and aspirations. Data on research productivity held on university systems such as PURE together with time “bought out” by external sponsors are key metrics in determining the time allocation for research. Staff workload allocations are reviewed annually and published on school intranet sites.

To ensure the necessary standard of excellence is understood and enacted, annual meetings are convened by the DP(R&I) with all research institutes and centres to set clear research and impact performance standards. School DoRs ensure these discussions flow to an individual’s objective setting within PDR. Individuals requiring support to achieve suitable objectives are encouraged to undertake personal development through the RFA.

Staff and Post-Graduate Development

The RFA plays a major role in creating a supportive environment within which staff and students can achieve their full potential. Its creation has transformed uptake in personal development activities (40% increase since its launch).

The current development programme includes:

- *Supporting our Researchers*, a structured personal development programme across all career stages. ECR - *Getting Grant Funding* and *Publishing Your Work*, Mid-Career – *Managing a Research Group*, *Developing Industrial Partnerships*, Professorial – *Growing Your Influence*.
- *Inaugural Lecture Series* (monthly) and *Festival of Research and Enterprise* (annually) are University-wide events to showcase and celebrate our research and researchers.
- *Bicentennial Research Leaders Network*, *Crucible* and *Research Connect* events stimulate academic networking and interdisciplinary research collaborations.
- *Ethics Inductions* for academic staff provide essential information on ethical responsibilities and specific University policies on research ethics, data protection and GDPR issues.
- *Research Culture Grants Scheme* enables peer-led collaborative projects to enhance the research culture experience of Postdoctoral researchers and PhD students.

Quantitative and qualitative feedback is used in a continuous cycle of improvement and course and event engagement statistics are reported annually to UCRI.

We evaluate and benchmark our career development provision at all stages through participation in national and institutional surveys, notably the Culture, Employment and Development in Academic Research Survey (CEDARS) and in the Postgraduate Research Experience Survey (PRES).

Early Career Researchers

In 2020, the University successfully retained its *HR Excellence in Research* award. The action plan for 2020-2022 is based on the revised Concordat for Researcher Development. This work is supported by our Research Staff Forum which provides feedback on employment and career development. The forum is chaired by the Global HR Director and ensures that national agendas are embedded within our organisation. Initiatives implemented include improvements in the management of fixed-term contracts, new promotional procedures for researchers, enhanced career support, leadership development, support for enterprise activities and public engagement activities.

Research Students

Our research students form a vital part of our research activities, each is co-supervised by two members of academic staff and for many a third industry-based supervisor is also appointed. Our PhD supervisors undertake supervisor training (including mandatory refresher training after 3 years). PhD students are required to meet monthly with their supervisors using 'PGR Portfolio' to record agreed action points for future reference. Academic progress is formally assessed via annual Progress Review Panels involving the relevant School Director of Postgraduate Study and experienced supervisors as panel members.

Research students create and maintain a 'Personal Development Plan' (PDP) to help plan their annual training and development. The PDP programme is mapped to Vitae's Researcher Development Framework and includes:

Year 1: Getting started - e.g. citing and referencing, managing research data, critical thinking.

Year 2: Progressing your research - project management, time management, communicating research, personal effectiveness, and research writing.

Year 3: Completing your degree - thesis writing, publishing, viva preparation and career planning.

Equality and Diversity

We are committed to equality and diversity in all its forms. Our Equality and Diversity Advisory Group coordinates initiatives to support all protected characteristics and equality and diversity training is mandatory for all new staff and embedded in manager training for academics undertaking a leadership role. This is underpinned by a range of activities and policies under the umbrella of Equality Outcomes, designed to support our staff in protected characteristic groups. HR report annually to the University Court and Executive on these outcomes.

We are a member of the Athena SWAN Charter. In 2020, we successfully renewed our Bronze Award; this has been conferred to 2026 reinforcing our commitment to EDI. All our STEM schools (employing 80% of our researchers) also hold Athena SWAN Bronze awards. The Athena Swan Steering Committee oversees the monitoring and progress of an action plan that includes workstreams to ensure consideration is given to EDI in research, for example, timing of meetings,

providing RFA training for 'on demand' engagement, actions to support academics returning after a career break (funds to restart research, reduced teaching responsibilities etc.).

We also hold an EPSRC Inclusion Matters grant Disability Inclusive Science Careers (EP/S012117/1, £500k) which aims to overcome the barriers experienced by disabled researchers in pursuing scientific careers.

4. Income, infrastructure and facilities

Income and Growth

The trajectory of our underlying income metrics over the REF21 period has been one of growth, average **research income per year has grown from £22.6M in the REF14 period to £30.2M in the REF21 period (33%)**. This rate of growth is set to increase by virtue of a significant increase in new grants awarded, from £32M to £51M between 18/19 and 19/20. This is mainly attributable to our success in aligning our research with UK Government priorities.

Support for Research and Impact

Our dedicated **Research Engagement Directorate** (reporting to the DP(R&I)) supports our academic community to achieve our research targets. A total of 45.4FTE staff are employed in the Directorate, with teams aligned to key research and engagement support activities: grant development, post-award, business development, GCRF, policy, strategy, impact, public engagement, communications, legal and the RFA. In 2019, we invested £1.5M in the creation of the *Research Engagement Hub* to provide a single point of support for research.



Figure 5: Flexible collaborative and working spaces in the Research Hub (images courtesy ADP and Paul Karalius).

The Hub is described as “A *new high-water mark for collaborative work spaces*” by ADP Architecture (adp-architecture.com). Aligned with this our **Enterprise Directorate** (reporting to the DP(B&E)) employs 8FTE staff supporting commercialisation, intellectual property, and science park development. Research Engagement and Enterprise activities are designed as flexible services accessible to all.

Infrastructure and Facilities

Reorganisation of research activities since REF14 has enabled us to refocus our activities in A4 Psychology, Psychiatry and Neuroscience, B7 Earth Systems and Environmental Science and C17 Business and Management Studies; each has been supported by significant infrastructure investments.

- In A4, £500k investment in a *Kinematic Suite* along with associated *Body and Emotion Laboratory* facilities has provided new easily accessible, state of the art facilities.
- In B7, our strategic partnership with the British Geological Survey has been supported by £23M investment from NERC, the Scottish Funding Council and the University to create the *Lyell Centre for Earth and Marine Science*. In addition, to the new building the investment has created state-of-the-art research facilities to support biogeochemical, microbiological and geenergy research. Additional investment from the Wolfson Foundation of £250k supported the creation of the ‘*Wolfson Aquarium for Climate Change Research*’.
- In C17, £2M has been invested in restructuring academic space within the Edinburgh Business School to create new open plan research facilities aligned with the multi-disciplinary research vision for this unit. This refurbishment included the creation of 30 incubator units for start-up businesses linked to the unit’s research activities. Aligned with our strategic objective of thought leadership to shape the global research agenda, C17 has also benefitted from £5.6M investment to renovate *Panmure House*, see section 2.3.

Significant infrastructure investments are aligned with our joint submissions.

- Recognising that research excellence in the mathematical sciences requires international conversations and intellectual competition, work in B10 (*The Maxwell Institute*) has been supported through £8.8M investment by EPSRC in the *International Centre Mathematical Sciences* (EP/P000487/1, £0.7M; EP/R015007/1, £3.1M; EP/V521905/1, £5M).
- In B12, we have refurbished over 350m² of laboratory space at a cost of £1.5M to support our teams working on carbon capture utilisation and storage. Aspects of our research contributing to the *EPSRC Quantum Hubs* (B9) is aligned with our engineering research in signal and image processing where we have invested £0.5M in enhanced computational facilities. Recognising the research opportunities afforded from the construction of HS2 we invested £150k in the construction of the *Geo-pavement and Railways Accelerated Fatigue Testing facility* (GRAFT2) a unique research facility to test high speed track dynamics. We have also co-invested £3.7M with the Advancing Manufacturing Challenge Fund to create the *Medical Device Manufacturing Centre*.
- Our work in Robotics and AI spans both B12 and B11. An initial investment of £6.1M from EPSRC (EP/J015040/1) to create enhanced robotics laboratories including our ‘*Living Laboratory*’ was instrumental in our success in securing the *Edinburgh and Southeast Scotland City Region Deal* to establish the £22.6M *National Robotarium*.

Details of significant investment in infrastructure to support other UoAs is provided below.

- B8 benefits from £3.4M investment in shared facilities and infrastructure, aligned to support the Unit's strategy of interdisciplinary research through close collaboration with industry. *FlexBio* (funded with £1.1M from the *Industrial Bioprocessing Innovation Centre*, IBioIC and £1M from Heriot-Watt University) provides open-access pilot scale bioprocessing, filling the UK-wide gap in facilities. We lead (with the University of Edinburgh) the *Edinburgh MRC Super-Resolution Imaging Consortium* (ESRIC, £1.9M from UKRI and £800K from Wellcome). ESRIC provides open access state-of-the-art imaging technology to address fundamental questions in human biology and disease.
- B9 has benefitted from our commitment to the *Quantum Hubs* through an expansion of our large nanofabrication centre at a cost of £1.5M together with £0.6M investment from EPSRC in a two-dimensional photonics fabrication facility. A further investment of £800k in 2016 created a quantum technology laboratory suite to support our experimental physicists.

Shared Facilities

Equipment sharing is facilitated by Schools listing suitable facilities on our intranet. These facilities range from the new two-dimensional photonics fabrication facility and geochemistry laboratory in the Lyell Centre to our established wave tank and anechoic chamber facilities. Technical support is provided for each as required. All are available for use across the university and in some cases for use externally at commercial rates.

Our membership of the Scottish Funding Council research pools, particularly the Edinburgh Research Partnership in Engineering and the Scottish Universities Physics Alliance, provide opportunities for national sharing of equipment/facilities to support research within Scotland.

Cross-cutting issues

Each of our UoAs has an important role to play in the successful delivery of Strategy 2025. Monthly meetings take place between our DP(R&I) and (B&E) with DoRs ensure that this is understood and that interfaces between Schools and UoAs are managed appropriately. All UoAs have benefitted from access to our strategic investment funds for academic staff recruitment and PhD studentships, with decisions to invest based on strategic fit.

We are a signatory to the San Francisco Declaration on Research Assessment (DORA) and are committed to improving the ways in which researchers and the outputs of scholarly research are evaluated.

We utilise PURE as the platform for our research outputs and publicly available data. Where appropriate we deploy our UKRI block grant to enable Gold Open Access for research outputs. This process is managed by our Library Team who provide training to support understanding of open research. In 2020, we have gone beyond the minimum requirement by implementing a comprehensive system to enable our researchers to manage their research data.