Institution: University of Surrey

1. Context and Mission

The academic heritage of the University of Surrey stems from the founding of the Battersea Polytechnic Institute in 1891. The Institute was among the first to receive the designation 'College of Advanced Technology' in 1956, and in 1966 the University received its Royal Charter. Since then, the academic span of the University has broadened to incorporate the humanities, arts and social sciences, whilst enriching its traditional strengths in science, engineering, and industrial engagement.

Research is at the heart of our mission to create new knowledge and innovate for the benefit of society. Our overarching objective is to achieve research outcomes that are internationally leading, contribute economic and social benefits, and support our ambitions in teaching and learning.

The University is organised into three faculties: Faculty of Arts and Social Sciences; Faculty of Engineering and Physical Sciences; and Faculty of Health and Medical Sciences. The Faculties comprise 22 schools and departments, which are home to some 15,376 undergraduate/postgraduate taught students, 1,236 postgraduate research students (1,041 full-time, 195 part-time) with a total academic and research community of 1,250, of whom 588 are engaged in teaching and research, 357 are research-only and 305 are teaching-only. This total represents a 23% increase compared to the commencement of the REF period, when the total academic and research community was 1,018, of whom 552 were engaged in teaching and research, 293 were research-only and 173 were teaching-only (all staffing figures in FTE).

Since 2014, our research and impact objectives have centred on: enhancement of excellence and scale of our research overall; concentration in areas including hospitality and tourism, 'One Health', 5G telecommunications, computer vision and artificial intelligence; and creating interdisciplinary research themes in: Lifelong Health; Sustainability; Technology and Society; and Urban Living. In 2017, a new Corporate Strategy: The Surrey Advantage, was launched followed in 2019 by a refreshed and integrated Research and Innovation Strategy which, together, have further increased our focus on research intensity. A University-wide Doctoral College was created in 2016 to support our strategy and strengthen our postgraduate research (PGR) student training and performance.

Major investments during the assessment period include: the £60m School of Veterinary Medicine, opened by Her Majesty the Queen, which quickly became a significant part of the 'One Health' agenda; and the 5G Innovation Centre (5GIC), supported by £12m in RPIF funding and more than £75m of industrial backing, which is pioneering the next generation of wireless telecommunication technologies.

Eight subjects are ranked in the Academic Ranking of World Universities (ARWU) top 100: hospitality and tourism, telecommunication engineering, aerospace engineering, transportation science and technology, electrical and electronic engineering, veterinary sciences, nursing, and sociology. Other recognised strengths include: food and nutrition, linguistics and translation studies.

2. Strategy

Over the last REF period, our strategy sought to accelerate our ambition on scale of research intensity, its excellence, and the focus on impact. Strong impetus in our upward trajectory stemmed from the arrival of the new Vice-Chancellor in 2016, the launch of the Corporate Strategy in 2017, and the launch of the current Research and Innovation Strategy in mid 2019.

Our current Research and Innovation Strategy is supported by four pillars of investment in researchers, research infrastructure, PGRs and early-career researchers (ECRs) and their

training, and in enhancing our innovation ecosystem. These four pillars have delivered significant results as confirmed by our achievements over the REF period outlined below.

2.1.   Achievement of Strategic Goals and Future Strategy

Delivering Excellent Research

Our research has enjoyed marked success during the REF assessment period, with growth in all component metrics:

- Sustained improvement in the quality of our outputs is evident from the SciVal field-weighted citation impact, which has improved from 1.50 (average value over REF2014 period) to 1.64 (average over REF2021). The average proportion of our outputs in the top 10%, weighted by field, has improved from 16.4% to 18.6%.

- The average number of PGR student degrees awarded has remained constant at c.250 per annum over both REF periods, but the submission rate (i.e., the proportion of full-time doctoral students submitting within four years of registration) has improved from 77% to 91% (2009/10 and 2015/16) for cohorts substantially completing within the REF periods.

- Research grants and contracts income has increased from a per-annum average of £28m over the previous REF period to £41m in this period, and increased between periods on a per-FTE, per-annum basis from £45k to £67k. Average industry income has increased from £8.4m to £9.8m per annum. Research and Innovation income now totals c.£75m (2019/20) including: c.£44m in research grants and contracts; c.£22m of innovation-related income; and c.£9m in studentships and fees. Alongside our QR funding, this income represents around 30% of the overall university income.

- Recognising the importance of our people in sustaining excellence, over the period we have: established 13 Distinguished Professors; appointed 15 Vice-Chancellor's Fellows (0.2 FTE) to extend opportunities globally; appointed one Regius Professor; and been awarded: one Queen's Anniversary Prize; one Fellow of the Royal Society; five Clarivate Web of Science highly cited researchers in 2020 (increasing from one over the previous REF period); over 100 elected fellowships; and 14 major awards in recognition of the excellence of our researchers and their research.

The excellence delivered during the REF period is underpinned by investment in staff, seed funding and research infrastructure. We have supported staff to enhance the quality and impact of their research, e.g., changes to promotion and recruitment; annual peer-assessed output review (supported by the responsible use of metrics); and appointment of Department/School Impact Champions. We have invested in: strengthening strategic bids with interventions such as rigorous mock panel interviews; mentoring staff through first grants (for example, leading the national league table for EPSRC New Investigator Awards in 2019); developing a fellowships strategy (resulting in a doubling of fellowships awarded during the second half of the REF period, compared to the first half, with 16 fellowships received in 2019/20); and launching the Doctoral College (see Section 3), supporting the career development of researchers.

Our research excellence is focussed on research users, with 8.6% of outputs authored with corporate collaborators, significantly higher than the UK average of 5.5%, and underpinning the University's continuing success for proportion of publications co-authored with industry, placing us 6th in the UK according to the 2020 Leiden ranking.

Future Strategy

External circumstances around the pandemic, Brexit and the University sector nationally and internationally have led us to an overall strategy refresh to be launched in late 2021. A key plank

will be the closer integration and alignment of teaching and research to ensure optimum synergy and balance. Central to this will be a new resource allocation model that holistically drives teaching and research performance. Our goal for scale and excellence in research will be refined and focussed on greater concentration of existing and new critical masses, with strong emphasis on new interdisciplinary pan-University institutes, moving beyond Research Themes. Our emphasis on supporting PGRs and ECRs will retain its home-grown pipeline approach but be extended to all staff – with a renewed focus on training and developing our people, especially selectively identifying and supporting our best. Our focus on infrastructure will be more highly targeted – towards achieving national prominence for the excellence of computing and data access and management frameworks, and on our efficient one-stop shop approach to supporting researchers. Another ambitious goal is to build on our excellent innovation ecosystem and heritage by up-scaling to make innovation mainstream at Surrey – such that a majority of our researchers will point to impact and innovation as part of their core activities. We anticipate 'innovation as mainstream' to be a strong driver for our institution over the next REF period.

2.2.   Delivering Impact Connected to KE and Wider Societal Contributions

Our overall impact philosophy represents a commitment to engaged, applied research, which contributes to improving the world we live in through technological innovation, commercial and social enterprise, shaping policy and professional practice. Most notably, our contributions to impact centred on the United Nation's Sustainable Development Goals has led to success in the Times Higher Education Impact Rankings, placing Surrey at 100th in 2019 and 59th in 2020.

The social and economic value of our research, as evidenced through our Impact Case Study contributors, is enhanced by the strength of our relationships with corporate and other partners, including Airbus, BBC, Enterprise M3 Local Enterprise Partnership, Guildford Borough Council, Huawei, National Physical Laboratory (NPL), Pirbright Institute, Rolls Royce, Royal Surrey County Hospital, Kent Surrey Sussex Academic Health Science Network, SETsquared Partnership, Surrey County Council, University Global Partnership Network (UGPN), and Zoetis.

We have increased access to impact support for all during this REF period by better linking and integrating research, impact and innovation activities, recognising their interrelationship, and providing an extra 6 FTE in impact support. Impact is recognised in appraisals and supported by increased funding and training for impact activities, complemented by our Impact Acceleration Accounts (EPSRC, ESRC, MRC and STFC), Knowledge Transfer Partnerships, totalling over £5m during the REF period, and strategic use of HEIF (£25m), when involving knowledge exchange.

Our impact is enhanced by a rich innovation ecosystem that regularly sees our national performance in knowledge exchange, relative to size, feature in the top 20 universities. Our research activity has boosted the regional economy through its linkage to innovation, enterprise and support of over 500 businesses engaging with our ecosystem's talent, knowledge, skills development, facilities, and funding sources (University of Surrey Seed Fund, and Surrey 100 Angel Investors Network). Pivotal is our Surrey Research Park, the UK's second largest, founded in 1984 and occupying 28.5h on our campus supporting c.170 businesses and more than 4,000 jobs on site. A vital support role is played by the SETsquared Partnership (in collaboration with the universities of Bath, Bristol, Exeter and Southampton), in operation on the Park since 2002, which has been voted the world's leading University incubator three times in succession). In 2018, the University became an inaugural partner of SPRINT, involving five universities supporting SME engagement with the Space sector, in which Surrey has been nationally leading since the emergence of Surrey Satellite Technology Ltd. Economic impact of the University, measured through gross value added assessed by independent consultants, equated to 19,430 jobs and a contribution to the UK economy of £1,840m in 2018/19, having grown by 31% over the REF period, and incorporating an £800m contribution from commercialisation (£103m), innovation and enterprise (£574m), and knowledge transfer (£123m), representing the real-world value of our research.

2.3.   Open Research, Research Culture and Integrity

Our commitment to Open Research is long standing. In 2005 we were among the first in the UK to have an institutional Open Access mandate. Our recently published Open Research Position Statement reaffirms our public commitment to openness and sets the framework for our institutional requirements on Open Access outputs, Open Research practice and approach to research data. Opportunities for training and engagement in open practices have been in place since 2014, e.g., on copyright, research data management and bibliometrics. Our Open Research practices have been considerably strengthened over the REF period by: expanding the Library's Open Access team in 2015 to seven FTE; appointing an Academic Lead for Research Culture and Integrity in 2019, who has established a large and diverse Open Research Working Group to drive our institutional agenda; and other measures such as workshops, competitions, refreshed web pages, surveys and the development of one of the UK's first training resources.

Reproducibility, as a key aspect of transparency and rigour in research, forms a core focus of the Open Research Working Group. In 2019, the University became one of ten inaugural members of the UK Reproducibility Network, and founded a PGR student-led forum, 'ReproducibiliTea'. Researchers are supported via training to use measures engendering reproducibility (e.g., transparent reporting of the research process, pre-registration of analysis plans, publication of null findings, and use of central data repositories).

Guided by the UK Forum for Responsible Research Metrics, led by our Vice-Chancellor, the University has developed its own responsible metrics statement and implementation plan to extend the principles set out in San Francisco Declaration of Research Assessment and embed the prudent use of a broad range of indicators.

Our 'Code on Good Research Practice' is at the core of our strong support for research integrity. In 2018, the University embarked on a change programme to enhance its research culture and integrity and fully comply with the commitments set out in the *concordat to support research integrity* and other guidance. Our roadmap, including a rolling programme of policy reviews, has provided an improved framework of more efficient, transparent and facilitative processes to support researchers in conducting their research. An example is the overhaul of the University ethics processes and committee structure in 2019/20, to oversee all staff and student research projects through a new on-line application and risk-based ethical approval process. Our enhanced infrastructure includes a new senior Head of the Research Integrity and Governance team (which has grown from two to six FTE over the period), complemented by staff in our Clinical Research Centre, School of Veterinary Medicine, and Experimental Biology Unit, with an ambitious three-year plan to further strengthen our research integrity and governance activity.

2.4.   Interdisciplinary Research, Collaboration and Engagement

Interdisciplinary Research

Interdisciplinary research is championed at all levels in the organisation. An example is the uniting of all three faculties to deliver the £8.5m partnership with Zoetis and Enterprise M3 Local Enterprise Partnership, bringing together veterinarians, biomolecular scientists, 5GIC engineers, Surrey Business School researchers and healthcare researchers to create the Veterinary Health Innovation Engine (vHive) in 2016. Central to our facilitation and enhancement of interdisciplinary research has been the establishment of four pan-University Research Themes, which have been progressively established. Selected activities and accomplishments of these themes are described below.

Lifelong Health: Our strengths in nutrition, sleep and cancer care have continued to deliver excellent research and impact, with nutrition receiving the Queen's Anniversary Prize in 2017. The integrated dementia care activity (Technology Integrated Health Management) which uses

artificial intelligence and internet-enabled devices to improve support for people with dementia in their homes received the prestigious ehi Award for Best Mental Health Initiative in 2017.

Sustainability: Research in sustainable materials, processes, travel and tourism, and electric vehicles has resulted in real-world change including at the forefront of policy in sustainability with the Director of the Centre for Sustainable Prosperity presenting at the World Economic Forum in 2020. Hospitality and Tourism Management, with strong focus on sustainability, was ranked 5th in the ARWU in 2020.

Technology and Society: We launched the 5GIC and cemented its role in regional development of digital infrastructure. In 2020, we launched the Distributed Digital Economy (DECaDE) project, securing £4m from EPSRC and £6m from industrial partners, and fusing world-leading expertise in AI and Distributed Ledger Technologies, socio-economic modelling, digital business transformation and people-centric security and trusted systems. The latter is provided by the Surrey Centre for Cybersecurity which, in 2015, became one of 13 Academic Centres of Excellence in Cyber Security Research in the UK. Our expertise in language translation technologies resulted in the award of a £3.56m Expanding Excellence in England grant in 2019.

Urban Living: We have addressed the challenges of the LGBTQI+ community in social housing, and championed urban air quality improvement measures, launching the Global Centre for Clean Air Research. Our developing Living Lab approach provides a framework for interdisciplinary research, maps to our other Research Themes, and builds on our heritage of investing in campus demonstrators, the latest with SME, MyGlobalHome, to construct a series of state-of-the-art 'smart homes' on campus providing University accommodation living labs.

Research Collaboration

Our researchers have continued to grow international collaborations with 57% of our research outputs featuring an international author in this REF period, compared with 44% in the last. A main focus for international collaboration is the UGPN with the Universidade de São Paulo, North Carolina State University, and the University of Wollongong. Since inception in 2011, US$1.65m has been committed to 72 projects facilitating 400+ researchers to collaborate on more than 800 publications.

In 2015, the Universities of Surrey and Strathclyde entered into a strategic partnership with NPL and the Department for Business, Energy and Industrial Strategy, including the creation of the NPL Post Graduate Institute for Measurement Science (see Section 3). The partnership has resulted in 14 joint appointments and 15 visiting appointments and produced over 300 joint publications.

In 2019/20, we partnered in 36 regional projects with Surrey County Council and formed a new partnership with Visit Surrey.

Engaging the Community

We have increased public awareness and understanding of our research through a variety of activities, e.g., we host Bright Club, Pint of Science events, and public lectures from innovators and scientists (6,000 attendees in 2018/19). Our social impact report, Measuring Up, published annually since 2016, highlights over 100 community projects running at any one time, alongside our citizen science programmes and engaged research agenda.

Our academics contribute strongly to informing the public, e.g., through expert writing for The Conversation UK, with 111 authors publishing 293 articles in five categories read 5.5m times in The Conversation (2.1m) and its re-publishers around the world (3.4m) over the REF period.

3. People

3.1. Staffing Strategy and Staff Development

Our staffing strategy gives due consideration in appointing new staff to the balance of teaching, research and leadership requirements, as well as to meeting our equality and diversity goals. Successes of this strategy over the period include: increasing the proportion of female professors from 20% to 28% of academic FTE; and further reducing the academic gender pay gap to a mean and median of 15% and 11%, respectively. Our enduring commitment to staff development and wellbeing is evidenced by 111 internal promotions (9% of staff) in the last year (45% women). Our REF2021 submission profile (below, in FTE) includes 2% with declared disability, and 53% of academics aged under 45.

	Female	*Male*
Professor	50.5	130.5
Reader	22.8	55.2
Senior Lecturer/Lecturer	134.6	187.8
Independent Research Fellows	15.3	14.9
	36.5%	**63.5%**

Staff are supported in working flexibly and/or remotely. Policies and support are available to staff who have caring responsibilities, ill health or other equality-related circumstances. Fewer than 4% of our submitted staff are on fixed-term contracts. The fraction of research-active staff on part-time (less than 1 FTE) contracts in 2020 has increased to 20% of headcount (13% of FTE) compared to 10% (5%) in 2013. Our recruitment age profile over the period reflects our ambitions to nurture talent, with 67% of new staff being under 45.

We ensure that staff have realistic appraisal targets consistent with the teaching and research and innovation strategies. Time for carrying out research and achieving impact is protected through a centrally monitored workload allocation model, which includes time for research management. Our sabbatical leave policy, operated at the local level, enables staff to be awarded relief from normal duties. We estimate more than 134 staff have taken sabbatical leave over the REF period.

Career development is available to all staff. In 2018, an academic leadership development programme was launched to augment our suite of programmes, with 57 colleagues completing to date.

The Vice-Chancellor's Inclusion Career Investment (VICI) Awards were introduced for all staff including researchers on fixed-term contracts. These awards provide financial support to cover caring responsibilities whilst attending conferences etc. The scheme has been expanded to include the VICI Academic Returner Awards, which provide £5,000 to research-active staff returning from maternity leave, shared parental leave or career breaks to help them re-establish their research activities. The award is accompanied by a release from teaching and/or administration duties in the first year of returning: 19 travel and 8 returner VICI awards have been made to date.

3.2. Early Career Researchers

We pride ourselves on being an excellent place to take the first steps into academia, offering an inclusive approach, led by the Doctoral College, to supporting ECRs, including fixed-term researchers and probationary academics. The University's Researcher Development Programme was commended in the re-accreditation of the HR Excellence in Research Award on completion of the 8-year external review in 2020 and is a signatory to the *Concordat to Support the Career Development of Researchers*. We are committed to supporting ECRs with the transition stages of their career and have dedicated resource within an extensive Careers and Employability team experienced in delivering career support, coaching and employability skills training to ECRs and PGRs. The Employer Mentoring Scheme also pairs ECRs with employers from a variety of employment sectors. Training by the Researcher Development team in the Doctoral College (8 FTE supporting 945 researchers and 1,236 PGRs) is amplified by discipline-specific support within Faculties and by funding-related support from the Research Strategy team.

Formally, the Doctoral College connects with ECRs through the ECR Forum whose Chair, an ECR, is a member of the Doctoral College Board and the University Research and Innovation Committee.

3.3. Postgraduate Research Students

Over the REF period, we have seen doctoral graduations increase from 2.0 to 2.9 per FTE eligible academic for REF2014 and REF2021 periods, respectively. Our current PGR population is 1,236 students (49% women, 35% BAME, 16% part-time, 27% international, 17% funded by industry), an increase of c.18% over the last four years supporting our successful "scale and excellence" strategy.

All PGR students are members of the University's Doctoral College. The Doctoral College provides a framework for monitoring progress with formal assessment within the first 12 to 14 months, online reports after supervisor meetings, and annual and mid-year reviews. The Doctoral College co-ordinates many training modules, drop-in sessions and runs an annual flagship conference showcasing the University's PGR and ECR community. All academic departments consider PGRs as important members of their research community and offer training and support which complement the Doctoral College offerings. PGR representatives from each Department meet regularly in Postgraduate Engagement Forums which feed into Faculty Research Degrees Committees. The Doctoral College offers an Employer Mentoring Scheme that pairs PGRs with external mentors, as well as a placement scheme, and conducts training and development of all supervisors.

Since the creation of the Doctoral College in 2016, student experience has improved considerably. PGR Directors work alongside PGR student representatives to develop action plans based on the Postgraduate Research Experience Survey data. The benefits of this systematic approach are shown in our increased satisfaction scores (5% increase for supervision during the REF period and 9% for research culture) and overall ranking; in 2020, we ranked 7th in the UK for overall experience and 1st for Research Culture. Further evidence that these approaches succeed is our submission rate increasing from 77% to 91% (see Section 2.1).

We have a well-established Doctoral Training Partnership (DTP) funded by EPSRC and are contributing partner to DTPs hosted regionally: SeNSS (ESRC), Scenario (NERC), Techne (AHRC) and FoodBioSystems (BBSRC). We have a major Centre for Doctoral Training funded by Leverhulme (Quantum Biology) and have recently attracted studentships from NIHR (ARC-KSS) and the European Institute of Digital Technology. We are one of two universities involved in the 200+ student NPL Postgraduate Institute for Measurement Science (see Section 2.4).

3.4. Equality and Diversity (EDI)

The EDI Strategic Plan 2020-2025 describes the University's ambition, progress and action plans associated with our equality charters. Equality groups champion equality, gender, race, LGBTQI+, disability, and faith/belief. Informal networks support people within these communities and an EDI Forum, with members drawn from across the University, discusses issues and proposes actions to the EDI Executive, who guide prioritisation.

Evidence of our commitment to EDI is participation and success in national equality schemes. In 2017, we received an Institutional Bronze Athena Swan award, and eleven of our 22 Departments across all three Faculties hold Athena Swan awards. We have been members of the Race Equality Charter since 2016 and are submitting for Bronze in July 2021. We have been a Disability Confident Employer since 2018 and have improved our Stonewall Workplace Equality Index to 204 and aspire to be top 100.

One example of our EDI success over the period is the increase in the proportion of BAME academics from 14% to 22%. The FTE breakdown at census date is provided below.

	White	*Black*	*Chinese*	*Asian*	*Other / mixed*	*Unknown*
Professor	153.6	1.0	10.8	10.2	4.6	0.8
Reader	62.7	0.0	7.1	5.0	3.2	0.0
Senior Lecturer/Lecturer	225.7	4.0	32.7	26.0	17.0	17.0
Independent Research Fellows	17.6	0.0	2.8	2.8	3.0	3.0
	75%	**1%**	**9%**	**7%**	**5%**	**3%**

The EDI strategy aims to create a culture that values diversity and supports minorities, e.g., providing bespoke career and personal development for staff from BAME backgrounds and developing Race Equality training, which will be mandatory for all staff and PGR students from 2021. Unconscious Bias training is mandatory and those involved in recruitment, promotion or disciplinary panels must complete face-to-face training before undertaking these roles. We ensure gender-neutral language is used in our staff recruitment documentation and recruitment panels are representative of diverse staff groups. We have developed extensive awareness training to enable colleagues to support the University's LGBTQI+ community and to deepen their understanding and, since 2019, we have been delivering the Rainbow Allies Programme and are proud to have the first permanent Rainbow Crossing at a UK university.

In 2019, we launched our first Springboard leadership development programme for women, with 36 participants to date and a further 24 on the Aurora Women's Leadership Programme in 2018/19 and 2019/20. The University is proactive in respect of Faith, Belief and Non-Belief and our team of chaplains has grown to 23, including, amongst others, Humanist and Pagan. We regularly host and promote events that celebrate diversity. These have expanded in recent years, including Black History Month, International Women's Day, LGBT History Month, Trans Memorial Day, and Holocaust Memorial Day.

Under our REF Code of Practice, all members of Output Selection Panels received bespoke Unconscious Bias training addressing biases in research, be they of protected characteristics or research specialism. Lack of bias in the outputs submitted is evidenced by 23% of outputs

attributed to BAME staff, who represent 22% of all submitted staff, and 33% of outputs attributed to women, who represent 36.5% of the submission.

4. Income, Infrastructure and Facilities

Various elements of the above apply to this section; specifically, support for the reproducibility of research is described in Section 2.3.

4.1. Support for Research Income

Since 2014, we have recognised the need to grow our research income and now set clear annual targets for Departments and Research Centres, and for individuals at appraisal. Our income has grown to a per-year average of £41m over this REF period compared to £28m over the last. About 38% is attributed to Research Councils with the remainder split between EU and Industry funding, and more than 30 grants exceed £1m in value. The University has devoted extra resources to enhance philanthropic activity; with donations to research over the period exceeding £11m. Alongside growth, an aim during the REF period was to increase funding from Research Councils, which increased from an average per-annum value of £10.8m to £14.4m between REF periods. Surrey is an EPSRC Strategic Partner having been elevated to a Tier 1 partner during this REF cycle.

Researchers across the University receive support through a dual-track (professional and academic), multi-tiered approach involving Faculty Research Facilitation Officers, academic Research Directors, Impact Champions, Postgraduate Research Directors and Associate Deans (including Research and Innovation, Doctoral College and International), ensuring strong coordinated local, Faculty and central support for all levels of researchers.

Research support underwent a major restructure in 2018 to deliver the strategy built around scale and excellence, with new linked/integrated directorates of Research Strategy (10 FTE) and Innovation Strategy (20 FTE) designed to support external partners and large-scale research consortia, with a shared business partnerships team, and emphasising the interplay between research and innovation. Including the Doctoral College, Research and Innovation Services, Library and Surrey Research Park, the overall FTE in professional support for research and innovation exceeds 100.

4.2. Infrastructure and Facilities Support

Our research capabilities have been enhanced through £151m investment in capital equipment and facilities. An average of ~£22m per annum has been spent on research and innovation equipment and facilities over this REF period, representing a healthy 8% of overall University expenditure.

As well as the £129.5m investment in new distinctive facilities already described in Sections 1 and 2.4, other new capabilities developed during the cycle include: the multidisciplinary Innovation for Health building (£12.5m); high-performance and parallel research computing resources; testbeds for internet security and Blockchain technologies; Space robotics facilities; and the 'Global Home' demonstrator (£8m). We have continued to invest in upgrades over the period, including: £4m in the Advanced Technology Institute on nanofabrication and characterisation infrastructure, and £2.2m in the EPSRC UK National Ion Beam Centre. Our small animal Biomedical Research Facility has been upgraded (£7.5m), as has our Clinical Research Building supporting trials and sleep research to incorporate the Digital Health Technology Accelerator (£1.4m).

We regularly share facilities – major examples include our national Ion Beam Centre; vHive; and EnFlo, a NERC facility and part of the National Wind Tunnel Facility. Major external collaborators sharing facilities with us include: NPL, Pirbright Institute and Royal Holloway, University of London (MRI facility). Our use of national and international facilities include: AWE, CERN,

Diamond Light, and Royce, with an in-kind facility time value of £18.3m over the period. Major industry in-kind contributions to the 5GIC total £15.1m over the period.

4.3. Equality and Diversity in Research Funding and Infrastructure

Our research community, including all support services, undertake a broad range of EDI training. They are cognisant of the potential challenges in acquiring research funding and accessing scholarly or operational infrastructure. A number of positive actions have been taken during the period including: creating a Research and Innovation EDI Forum; partnering with AccessAble to improve access options for staff across all campus facilities; and providing individual support for bid writing where English is not the first language. We undertake equality impact assessments on all research policies to ensure no unintended bias is present or introduced in our research policies and processes.