

University of Sussex

School of Mathematics & Physical Sciences

Research Strategy

Better Research for a Better World

Disclaimer: This is a School Research Strategy that applies across both Departments. However, Departments, Research Centres and Research Groups are encouraged to create their own strategies complementing the School Research Strategy. As strategies need to live, this document will be continuously updated in the coming years.



Background

MPS which consists of the departments of Mathematics and Physics & Astronomy was formed in 2009 after a reorganisation of Sussex academic Schools. These two departments have thrived as a cohesive, multi-departmental unit since and enjoyed an intellectual footprint that goes back at least 3 decades. Together both departments pride themselves as a highly collegial and inclusive environment for exceptional research. The School nurtures our research staff, especially our early career staff. Our main strategic priority has been to enhance the impact of our research with substantial investment in academics, professional staff and infrastructure. MPS is home to 66 academics (64.7 FTE) who belong to nine research groups as seen in figure 1. We also have approx. 150 doctoral students within the two departments. Overall, the School has an excellent research reputation established by a unique group of creative and diverse scholars and enhanced by a dedicated Professional Services team. The School's research income as percentage of full economic costing is one of the highest in the University, see chart below. The School's Research Impact profile has improved from REF2014 and the School prides itself on excellent Outreach and good research communication.

The Mathematics department has four research groups (i.e. Analysis and Partial Differential Equations, Numerical Analysis and Scientific Computing, Mathematics Applied to Biology and Probability and Statistics) but also leads a new interdisciplinary research centre:

- The Dr Perry James (Jim) Browne Research Centre on Mathematics and its Applications.

There are however no sharp boundaries between the Mathematics Research Groups and centre with frequent collaborations between members of different groups and with many working at the interfaces of these disciplines.

The Physics and Astronomy department has five research groups (i.e. Astronomy Centre, Atomic Molecular and Optical Physics, Experimental Particle Physics, Materials Physics and Theoretical Particle Physics) but also leads four interdisciplinary research clusters, most researchers belonging to at least one of these:

- Data Intensive Science Centre (DISCUS)
- Particle Astrophysics and Cosmology Group (PAC)
- Sussex Centre for Quantum Technology (SCQT)
- Sussex Programme for Quantum Research (SPQR)

The Department of Physics and Astronomy has a distinctive profile specialising in particle physics, extragalactic astrophysics and cosmology, and novel quantum technologies. Both departments participate in the recently established Mathematical Physics group which is multi-departmental.

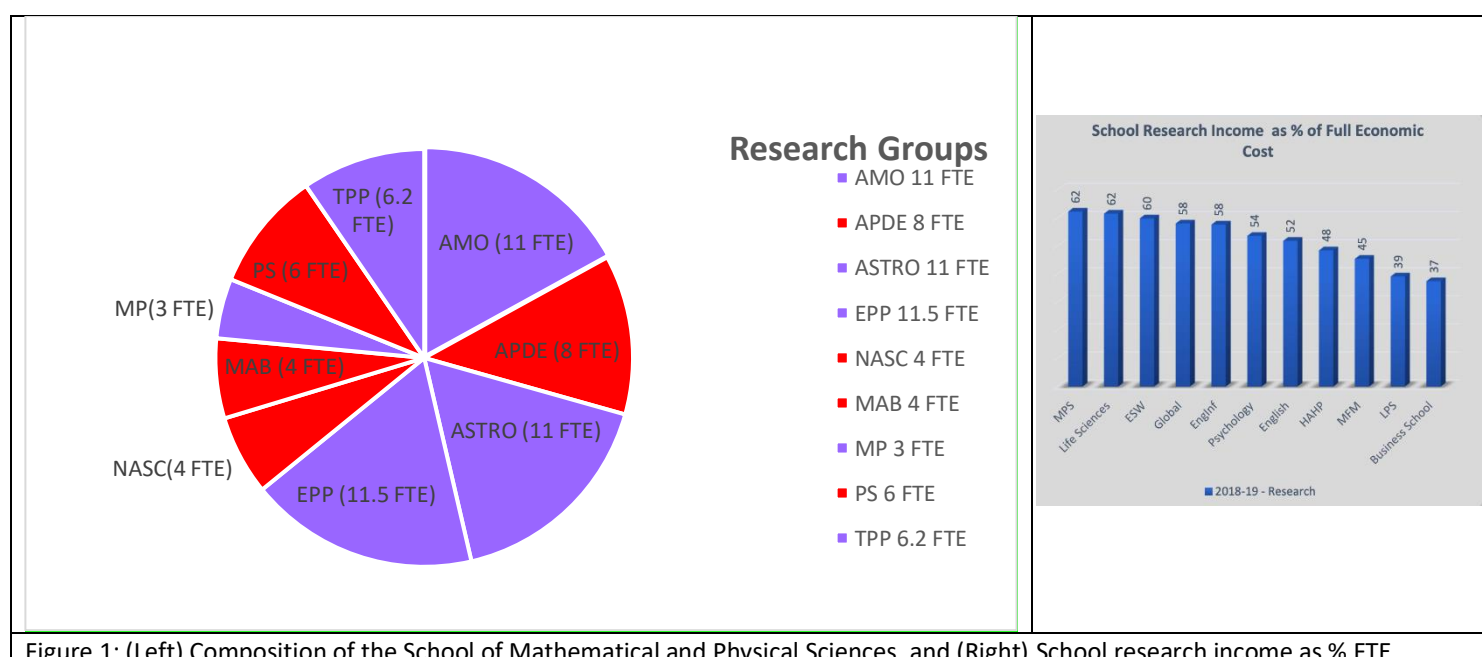


Figure 1: (Left) Composition of the School of Mathematical and Physical Sciences, and (Right) School research income as % FTE.

The Research Strategy is based on an internal SWOT analysis (see Appendix A) and several school workshops with feedback loops between DRaKE, HoS, HoDs, research group leads/coordinators and research support staff (see Appendix B).

RESEARCH VISION, UNDERSTANDING & OBJECTIVES

We are a research-intensive School aiming to be consistently recognised as truly world leading in key areas of our science. MPS is committed to the University's vision and strategy.

Research is a key priority and fundamental to the **identity** of both Departments. The School we will be **bold**, with the confidence to tackle research problems of globally recognised significance. We will be **imaginative**, harnessing the rich and varied talents within our School and the University and with strong partnerships outside. We will be **focussed**, achieving high academic and socio-economic impact. We will be **coherent and collegial**, recognising and making the best use the skills of all our staff.

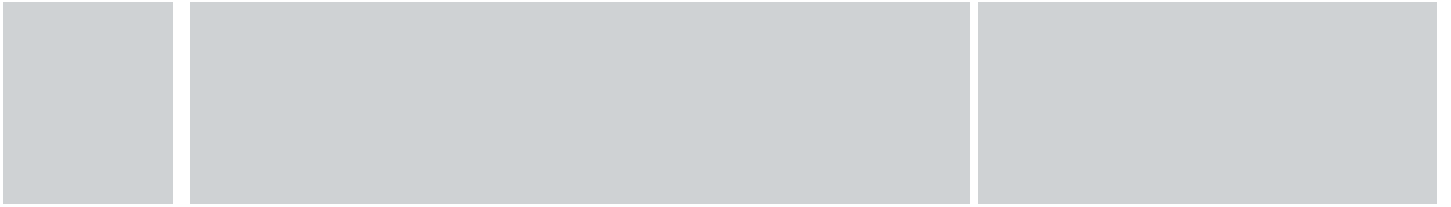
The University and our School has a long tradition of challenging conventional thinking and working at the interface of different research areas, be that intra- or interdisciplinary. We will build on this to create new synergies and partnerships across the HE-sector and external partners. This will facilitate and enhance the translation of our research in order to provide solutions to some of the grand challenges the world faces (see the School's current work on COVID19, Drought modelling in Africa)

The School will continue to show flexibility and agility in responding to new challenges and emerging areas and will aim to secure strategic support for larger top-down and smaller bottom-up initiative and thus promoting a healthy research eco-system.

Our research objectives are:

- Maintaining or enhancing a strong international reputation that makes a significant contribution to the University's position in international league tables
- Enhancing the quality of our research outputs, environment and impact such that we would be indistinguishable (within measurement errors) from all but the Top 5 in any UK REF exercise
- Obtaining sufficient financial resources (contribution income and FEC recovery) from diverse sources to ensure our research activities are sustainable
- Making a significant and growing impact on skills and economy of the region and nationally to address the 'Place' and KEF agenda
- Obtaining grant income per FTE that is high by UK standards to perform favourably in league tables (Top 20 UK position and rising)

	Description	Comments
A	Maintaining (or enhancing) field weighted citation	Research Metrics SciVal and Altmetrics.
B	<p>(i): number of accepted publications with ERA grade of 4* (10-12 on our 12 point scale) per year to aggregate to 0.22 (i.e. 1.5 (average number of papers per FTE)/(~ 7 Years till next REF)) 4* papers per FTE and per Year, leading to 60% of papers for the next REF submission being 4*</p> <p>(ii): To increase the number of 4* Impact Case Studies within each Department (2 out of 3 for UoA10 (Mathematics) and 3 out of 4 for UoA9 (Physics and Astronomy), and</p> <p>(iii): Enhance our environment so that it allows individuals and groups to excel in their research activities and careers (e.g. maintain at least one PhD per FTE at any time point, maintain/raise completion rates and placement after graduation)</p>	<p>Rolling forecasts, ERA scores.</p> <p>Annual data via Personal Research Plans, working closely with RQI, maintaining a live list of Impact Case Studies with their readiness status and projected scores.</p> <p>Research dashboard, rolling forecasts and continuous improvement of research culture based on appraisals and staff survey</p>
C		Rolling forecast and research dashboards
D	<p>(i): Maintain and improve contribution income, and</p> <p>(ii): Work towards FEC recovery rates >60%</p>	Rolling forecast and research dashboards.
E	<p>Enhance our outward facing work to contribute towards improving the University-level KEF results (e.g. improve success rate for Innovate UK applications, use HEIF money to initiate contact and carry out feasibility studies with local council, businesses and third party organisations to contribute to local growth and regeneration)</p>	Rolling forecast and research dashboards.
F	<p>Work towards aspirational total research income targets of £180k/FTE for Physics and Astronomy and £25k/FTE for Mathematics.</p> <p>Raising the profile of the Research in our School through public engagement, open lectures, teacher days, masterclasses etc in order to attract UG students. Rebuild momentum post-COVID19 and really advertise the Sussex brand up and above the science we present.</p>	We already have good systems in place to monitor outreach events, number of students reached etc.



Strategic Plan

Key to achieving our research targets is the creation of an open, supportive and diverse research culture that fosters excellence and facilitates impact in every part of the School. We are in a unique position to reach out and build bridges both in an intra and interdisciplinary way which allows us to leverage talent and funding in pursuit of solving fundamental science problems as well as carrying out impactful research by working on some of the grand challenges that world faces.

We focus on a multi-level strategy that follows the full life-cycle of research from problem definition (including stakeholder engagement), attracting research support/funds, carrying out the research, communicating research results, external engagement, knowledge exchange and impact for stakeholders. This approach will enable us to signal clearly our research strengths –which inform and enhance our taught portfolio and enable us to attract and retain high-calibre international scholars.

The vision and strategic plan at School-level will inform the development of Departmental research strategies while aiming to constantly adopt best practice and maximise our efficiency where activities can be coordinated and carried out at School level, in particular KEF, Business, Outreach and Research communication activities.

The Strategic plan is consistent with the strategic plan of the University of Sussex (Sussex 2025): to obtain excellence through support and development of its researchers. Through recognising external drivers and the strengths of individuals and groups, our strategy is developed and refined both top-down and bottom-up and it is built upon the following **7 pillars**.

1. **Establish a vibrant, exciting, collaborative research environment and culture.** Environment and culture are key for our plans.
2. **Recruit and retain the best researchers at all career stages.** This includes establishing a recruitment process aiming at research excellence; ongoing support and mentoring of all existing staff; a predictable and transparent promotion process; defining clear career pathways for researchers at all levels.

TASKS

- MPS is fully committed to implementing the **Concordat** to **support the career development** of Researchers and to provide a productive and supportive working environment for researchers. The School has recently appointed a Post-Doctoral Development Lead whose task is to support early career Research Staff in their career development, and to continue to represent their interests at School and University level.
- MPS and the University will continue to use the successful **Researcher Development Framework** to plan personal and career development for research students and researchers. This ensures the fulfilment of all requirements of the **Concordat** to Support the Career Development of Researchers, the **QAA code of practice** for research programs and the Roberts recommendations for postgraduate researchers and research staff.
- MPS will **enhance its research capacity** and facilitate on-going strength and succession planning through **expanded recruitment**, and subsequent development of, exceptional early career researchers (fellows and PhD). Research studentships have been a pillar supporting the research strategy of MPS as they enable the recruitment of high-potential young researchers
- **Continue the recruitment** of high-calibre research leaders who either are or have the potential to become **international leaders** in their research area and who demonstrate a clear fit with vision of the School and the strategic aims of the relevant departments/research groups.
- Provide **clear and reliable development pathways** for all career levels in line with promotion committee expectations. Faculty develops and updates yearly their own Personal Research Plans and these inform and are aligned with Departmental, School and Institutional-level strategies.
- Renew our strong commitment to **fair and equal career opportunities for all** in hiring and promotion practices, supporting all researchers in achieving their full potential.
- **Stimulate researchers** by providing opportunities to join new research teams, and **engage in networking** and intellectual exchange (research days, themed meetings, hackathons), with opportunities for interdisciplinary and agenda-setting research within MPS and across the University.
- **Facilitate targeted opportunities for collaboration** within critical mass-sized research groups and support all researchers in engaging with collaborators and internal and external stakeholders.
- **Ringfence 40% of research workload capacity** for research activities and monitor compliance based on academic time surveys. A transparent workload model that is regularly revised. Holders of research grants are given either partial or full relief from teaching depending on the nature of the grant.
- Allow **adequate time for researchers** to concentrate on research work (e.g. by allocating teaching in one term wherever possible and demanded) as well as advocate for the provision of high-quality resources (including technology and office space as well as Professional Services support).
- Provide the opportunity for **study leave / sabbaticals for research work**. Faculty can apply for six-month sabbatical leave every nine semesters.

- 3. Strengthen and support our research activities.** This includes providing exceptional service from research management staff, creating research incentives as well as cultivating a supportive and collaborative environment.

TASKS:

- Recruit staff with specific skills that are essential to our **research and impact strategy** and enhanced professional support. Skills gaps will be filled primarily through **professional business development** staff and targeted recruitment of Faculty with a unique public engagement profile.
- Provide **guidance, training, mentoring and support** as required to equip all researchers with the skills needed to undertake high-level research as well as to apply for research funds that enable the institution to grow (e.g. writing workshops for papers and research proposals; dedicated mentoring).
- Provision of **dedicated Professional Services staff** to continue to support research activities for managing REF processes, doctoral programmes, conference organisation, policy engagement, communications and impact work, bid development, etc.
- Provide the professional support and internal structures required to help realise the University's goal of '[putting] **collaboration at the heart of everything we do**' (Sussex 2025); building opportunities and incentives for collaboration and engagement into the design of our policies and practices. Institutional Collaboration with colleagues on the same campus is extremely valuable for generating new ideas and exploring innovative applications of research with rapid feedback. Building on the huge value of local and regional academic collaboration, MPS will continue to play an active role in the successful South-East Physics Network (SEPnet).
- Continue to use the services of **External Research Advisers** in the development of research and impact strategy.
- Most of our **world-leading research** can only be achieved through **world-leading facilities**, necessitating significant **international collaboration**. We actively engage in these collaborations and position ourselves to take leading roles in areas aligned with our specialist expertise. We actively enable those with leading roles to fulfil them to the full.
- Ensure that appropriate and effective incentives are available to researchers who are particularly successful in attracting research income and **producing world-leading research outcomes**.
- The School is committed to **act on feedback** from staff survey and aims to improve on scores from one survey to the next. Senior Management Team is responsible for digesting the results from staff survey and coming up with actions as and when needed.
- While all research groups will play an important role in supporting many of the activities below, the research centres (SPQR, SCQT, DISCUS, PAC and the PJB-RCMA) will provide an extra focus by themed-seminar organisation, hosting of conferences and visiting scholars, **mentoring and developing and nurturing collaborations**.
- Provide more **generous conference attendance funding and administrative support** than most competitors.
- Encourage **international research** activity by inviting leading scholars for centrally-financed visiting scholarships (as and when these become available), actively developing nascent partnerships and managing and maintaining existing ones
- Ringfence **workload and funding for impact case work for REF** via existing workload allocation models
- **Host major national and international conferences** by providing financial and human resources (see recent Colloquium by Fields medalist, Prof Alessio Figalli, organised by the Dr Perry James Browne Research Centre on Mathematics and its Applications)
- Formalise **cross-campus links with key synergy schools** (e.g. strong links developed via DISCUS with Engineering and Informatics, Global Studies IDS etc) to foster interdisciplinarity.
- **Enhance workload planning** to ensure staffing needs are met over the medium-long term; e.g. continual liaison between departments and RDOs to ensure current Research Assistants/Fellows and Professional Services posts are written into research grants.
- Continue an **active research seminar series** with regular participation and attendance by faculty at all levels.
- **Reduce clashes between teaching and research activities** (e.g. smarter timetabling and leaner processes).

4. Grow our external research funding.

TASKS:

- Provide enhanced **dedicated Professional Services support** for managing research bids both pre- and post-award
- Enhance further the quality of the **internal peer review process** of research funding applications and couple this with (i) a mentoring scheme using the experience of highly-successful faculty, and (ii) carry out a post outcome review to improve applications.
- **Engage and be more proactive** in gaining nominations to panels/reviews of major research funders.
- Continue to aggressively support major research bids, through **match funding**, strategically prioritising research which aligns with key synergy areas and areas of significant strength.
- **Diversify our external research funding** by creating and appropriately supporting opportunities for working on industry-sponsored projects, consultancy engagements, and other non-standard forms of research or knowledge exchange activity.
- SPQR, SCQT, DISCUS, PAC and the PJB-RCMA research centres will also **serve as a gateway for translation of research** and a mechanism of **diversifying our research income**
- Work to become a **“go to place”** for academic and non-academic partners in our strongest research areas.
- **Use cross-departmental, cross-school, national and international synergies for funding applications** to diversify research income streams and foster interdisciplinarity, exemplifying the University’s ambition to ‘reclaim our reputation as the university of choice for those committed to interdisciplinary research and engagement’ (Sussex 2025)
- **Position ourselves to capitalise on key strategic funding opportunities.** Build on our successes by further developing interdisciplinary and international collaborations that will lead to access to an even wider range of funding bodies, enabled by recent strategic recruitments.
- Ensure our **subject mobilisation groups are apprised of key opportunities** with support from the Research Development Office, are well informed, well resourced, and poised to react in good time (i.e. gaining and utilising research intelligence more readily.).
- Ensure **networks are actively developed and maintained**, and are appropriately utilised in marshalling collaborators to pursue key funding opportunities.
- SPQR, SCQT, DISCUS, PAC and the PJB-RCMA research centres will play an important role in **developing local, national and international collaborations**, be it in fundamental or interdisciplinary research.

5. Ensure transparent and reliable processes for the allocation of research resources following high standards of integrity.

TASKS:

- Establish **transparent processes** for the allocation of resources (match funding, impact funding, seedfunding) as well as ensuring fair and open access to research leadership positions.
- Regularly review processes and policies to ensure **full compliance with equality, diversity and inclusion** principles.
- Equality, Diversity and Inclusion (EDI) is fundamental to the school's culture and articulated in **our 7- point Guiding Principles**. Our EDI strategy builds on a strong University commitment establishment of an EDI unit and the introduction of a new institutional EDI Strategy.
- The School of Mathematical and Physical Sciences holds an Athena SWAN bronze award and EDI is overseen by the Director of Equality, Diversity and Inclusion. MPS has two Equality, Diversity and Wellbeing Champions.
- MPS also **operates flexible informal procedures**. For instance, any staff member can choose to work from home at any time if appropriate.
- MPS's strategy seeks to **recruit, support and retain the highest-quality researchers** irrespective of ethnicities, genders, sexualities, disabilities, ages and beliefs.
- MPS has Faculty from 20 countries with an excellent gender ratio.
- **Equality and Diversity training is mandatory** for everybody, Unconscious Bias and Recruitment and Selection training is mandatory for staff involved in recruitment have at least one female member **Inclusive, supportive and transparent culture**.

6. Communicate, promote and celebrate research internally and externally.

TASKS:

- Support **impact generation and external engagement and communicate successes** through web, media, social media and bespoke publications.
- Develop a **stronger web presence for research**, focused around core themes while also linking with the research profiles of Departments and Centres, to ensure academic colleagues, potential collaborators, new potential staff, students, funders and policy makers are fully aware of the School's strengths and expertise
- Create **research communication training programmes** to enable researchers to promote their personal research more effectively and engage widely, both internally and externally
- Organise an **annual research day** to celebrate the research successes of our School and share research interests and best practice
- Work to instil a **culture that recognises and rewards** research success by communicating accomplishments widely and awarding prizes
- Provide **regular and timely communication** about research topics through our monthly research activity report, as well as producing an annual research report showcasing success across the School
- Identify **central research themes** for the school and provide extra resources for their communication & promotion.
- Cultivate a **strong, coherent research identity** by actively promoting key synergy areas and high-performing research groups, consistently championing areas of core research strength

7. Create a flourishing doctoral student cohort and dynamic PhD programme.

TASKS:

- Provide a **comprehensive and attractive doctoral training programme** that produces excellent research scholars in the spirit of the School's research programmes and engenders the skills and experience required for today's hyper- competitive graduate market.
- **Grow the doctoral student cohort** by identifying innovative ways of funding studentships.
- **Integrate doctoral students from the start into research groups** and wider research community, allowing them a crucial role in contributing to the research culture of the School.
- Attract increasing numbers of **high-quality applications to the doctoral programme** by ensuring the programme's competitiveness against rival offerings.
- The University of Sussex has a set of approved **Principles to Govern Doctoral Studies**, which provide the university-level strategic framework for doctoral education. MPS is using these university-level principles to guide its post-graduate provision. Our doctoral research students are main contributors to our research environment. Doctoral study thus plays a central role in our research strategy, underpinned by substantial investment and strong support structures.

Next Steps

- Now follows a period of prioritisation and implementation of the measures set out in this Strategy. The School DRKE will liaise with Head of School, HODs, Directors of Research in both Departments, Research Group leads/coordinators and research support staff to determine priorities, establish appropriate timelines and assign tasks across the team
- Departments are encouraged to develop/update their own research strategies in light of the above. Support is available from the DRAKE as well as Research group leads.

Appendix A: SWOT analysis

Context

These are times of unprecedented change in the external research funding landscape:

- UKRI active from 1 Apr 2018, along with OfS and Res England
- Brexit: implications for research talent and access to EU capital & research funds
- Radical sector changes under consideration by Government
- National sectoral disquiet around pensions, Equality, Diversity & Inclusion, HE culture & practices

Coupled with substantial internal changes:

- Increased budgetary pressures imposed by Centre
- Development & subsequent implementation of Sussex 2025
- Institutional refocusing on teaching & learning, and away from research & KE
- Potentially radical reshaping of central Research & Enterprise division: review undertaken, restructure currently underway.

SWOT Analysis

Strengths

- Global reputation for research quality and impact
- Research excellence across a range of research areas
- World class academics: ability to attract and retain excellent staff
- Highly attractive T&R offering (esp. to international students)
- Relatively well-resourced to support research: dedicated res management team and annual res budget, department DRKEs and Impact Leads
- Great potential for inter-/cross-disciplinary working, within Sussex and externally
- Academic networks (SEPNET)
- Embedded employment officer and our employability rankings
- PGCert – quite a lot of faculty have this
- TEF Silver
- Teaching Labs are high grade.
- Quantum – internationally leading
- High profile Fellowships (enhances our international reputation)
- International summer school is internationally leading
- High quality student study spaces
- High-volume & high-profile outreach activity

Weaknesses

- Decreasing funding for postdoctoral researchers
- Limited awareness of & responsiveness to external factors & global competition
- Close to critical mass in some areas
- Under-investment in developing talent & skills pipeline at Masters, doctoral and ECR level
- Research Centres could be perceived as disjointed
- Marketing is not School-focused and is underperforming
- Too much negative information from centre
- Assessment and feedback – student perceived
- Quantum – outside view is disjointed
- Community feeling in the school needs improvement
- Deficit position and worsening with falling student applications and intake
- PS support in (and for) research and school: deficit school means we have less to spend on this
- Supporting faculty with development needs – comprehensive not overly targeted ie. don't single out. How to persuade faculty to do more training/development, esp. around teaching?
- Peer support with grant apps
- Students lack comparators and don't perceive quality of facilities
- Relatively small size of Departments :funding more difficult, lacking EPSRC studentships
- Faculty/student engagement: mixed performance from a few
- Maths Finance MSc fees were raised too high to be competitive

Opportunities

- Uniquely placed to exploit new funding streams – esp. ISCF & GCRF, additional funding for KTPs, DTCs
- Great potential for developing more/better links with industry & external partners to leverage res funding
- Chance to strengthen interdisciplinary ties as UK & EU funding policy shifts to mission-focused approach
- New Mathematics Research Centre
- Postgraduate teaching internationally
- TEF Gold
- Converting outreach into intake – in a more focused way, targeted, not scatter
- Amalgamating marketing efforts – esp. Quantum
- Closer links between Maths and Physics
- Closer links with other schools
- Maths Legacy – research centre
- Interdisciplinary links across schools – needs co-ordination and formalisation and a plan
- China – needs more support from organisation. 2 MOUs so far.
- TNE: China & elsewhere
- Alumni network – how can we make use of them?
- Expansion of summer school – note lab capacity
- Curriculum review – market intelligence to better link us to market place
- Research placement programme. Isn't this working for us as it used to?
- Leveraging academic networks
- Centralised support for business development officer: quantum, MP opportunities
- ODL: data sci, QT
- International office engaging anew
- Much better engagement with marketing
- Cross teaching: Maths, P&A, EngInf
- Research placement programme

Threats

- Brexit: May impact ability to attract/retain staff and students; potential loss of access to EU funding programmes
- Political & regulatory factors: structural changes in HE market may lead to increased competition, greater regulation, loss of ability to cross-subsidise research from teaching, etc.
- GCRF & ISCF: we will be left far behind competitors if not organised & mobilised to seize opportunities. We must compete to survive
- Loss of key staff – eg Financial Mathematics, Innovations Partnerships fellow
- Online teaching – scalability elsewhere, behind the curve
- Augar review and further developments here – especially re risk to foundation year
- Funding studentships – internally and grants
- COVID – threat to the sense of community
- Impact of NSS is dis-proportionate for STEM
- Funding per head for STFC science is reducing
- Loss of expertise in key areas eg Financial Mathematics
- **Accept or mitigate**
- Low student numbers
- Govt threat to foundation year
- Any staff loss would risk viability of research groups and teaching, and will affect our reputation and research income

Appendix B: Overview on Research Strategy development process

- Research Strategy skeleton drafted jointly by School DRAKE with input from Research Management Team (April 2021)
- Initial feedback on Research Strategy skeleton from leadership team and RDOs (June 2021)
- School-level research strategy presented to SMT during away day on the 7th of July 2021
- Publication of the School Research Strategy (end of July 2021)
- Directors of Research of both Departments are invited to use this to inform Departmental research strategies (1st of August 2021)