University of Cambridge
School of Technology

Academic Vision 2019

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28th October, 2019

Version 1.4
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1 Introduction: The School of Technology

The School of Technology (SoT) comprises four Departments, namely Chemical Engineering and Biotechnology (CEB), Computer Science and Technology (CST), Engineering (DoEng) and Cambridge Judge Business School (CJBS) together with one Institute, Cambridge Institute for Sustainability Leadership (CISL). Through its constituent departments, the School is fully involved in a number of Interdisciplinary Research Centres (e.g. Energy, Language Sciences) and Strategic Research Initiatives (e.g. Trustworthy Technologies, Global Challenges) fostering collaborative activities within the School and with other Schools. There are many prospects for new collaborative initiatives catalysed by the SoT.

Table 1: Composition of School (July, 2019)

<table>
<thead>
<tr>
<th>Staff</th>
<th>1510</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academics:</td>
<td>275 (16.8% of total University academic staff)</td>
</tr>
<tr>
<td>Professional services staff:</td>
<td>700 (12.5% of University professional services staff)</td>
</tr>
<tr>
<td>Researchers:</td>
<td>550 (13.6% of University’s research staff)</td>
</tr>
<tr>
<td>Undergraduates</td>
<td>1800</td>
</tr>
<tr>
<td>Postgraduates (Taught: MPhil, MBA etc.)</td>
<td>600 (F/T), 400 (P/T)</td>
</tr>
<tr>
<td>Postgraduates (Research: MPhil, MRes, PhD)</td>
<td>800</td>
</tr>
</tbody>
</table>

Table 1 shows the overall composition of the School in terms of people. It is noteworthy (i) that the ratio of academic staff to professional services staff is higher than other science Schools and (ii) that the comparable numbers of full-time postgraduates and undergraduates reflects the substantial level of teaching at the postgraduate level.

Figure 1 shows the breakdown of direct research income by sponsor, totalling £65M/y for 2017-18. An important feature is the £17M/y from industry, accounting for about 46% of the University’s income from industry. There are about 50 companies contributing to the SoT total, with the top six partners being Rolls Royce, Huawei, ARM, Toyota, Mitsubishi, Samsung and Shell.
Over the five years from 2013-14 to 2017-18, the School has delivered a Resource Allocation Model (RAM) surplus of £32M to the University, on top of charges for central costs. This relates to a Chest income of £350M and hence a net return to the University of 9%. The RAM position of all the Schools in shown in Figure 2, showing that just two Schools (SHSS and SoT) are making a RAM surplus.

The Departments in the School lead in research teaching and engagement with the private and public sectors. Using the THES metric, the School was the top School in the University in REF 2014. Two of the undergraduate courses in the School are in the top three in terms of applicants per place. There is continuing demand for places on MPhil courses, particularly so in those in Machine Learning and Machine Intelligence and in Advanced Computer Science.
The School itself helps to maintain the delicate balance in Departments between teaching a substantial flow of high-quality students (undertaking a range of undergraduate, postgraduate, online and executive education) and helping to ensure that the volume of internationally-competitive research continues an upwards trajectory. This is a result of a unique blend within the Departments in the School of (i) academically-gifted staff and innovative professionals, (ii) freedom to conduct significant, innovative research of interest to individuals, (iii) dedication to teaching fundamentals, (iv) guarding admissions and examination standards, (v) active engagement with practitioners in business and government to build on the expertise of the School and the wider University, and (vi) sheltering staff from burgeoning administrative requirements, as far as is possible. The School understands the need to maintain high flexibility in its interaction with industry. Thus, researchers do not just get funding from industry, they undertake research with industry and that is essential with much of the research undertaken. It is essential to preserve these basic values and to build on them in a thriving School assisting Departments, where appropriate, with their teaching, research and impact agendas.
The School will be able to play a strong part in the financial recovery of the University. Assuming that the University develops responsive business models allowing more of the MPhil fee income to be available to the School, then there is room for substantial expansion of masters-level offerings, *e.g.* in Machine Learning and Artificial Intelligence. Other initiatives are discussed later in this document.

### 2 Strategic Principles

#### 2.1 Principles

The School seeks to grow activity impact and income through education, research and wider engagement activities in its constituent Departments, whilst maintaining and enhancing excellence and commitment to core values. The overall approach is as follows.

**Research:** The School will encourage a well-balanced portfolio of research of the highest quality with a wide range of interests. By maintaining a reputation for world-class research, we expect to attract the best staff who will, in turn, enhance the international standing of the School and its Departments. With a clear focus on the advancement of technology, we aim to lead both in the creation of wealth and in improving the quality of life, by increasing the efficiency of existing technologies and by optimising the use of our natural resources and, at the same time, preserving our environment. Our research creatively explores interfaces with *e.g.* mathematics, chemistry, biology, physics, earth sciences, business, social sciences, law and medicine to solve challenges facing industry and society.

**Education:** The School’s Departments will provide education of outstanding quality at the undergraduate, postgraduate and professional-development levels to produce high-calibre graduates who will play leading roles in their chosen careers in industry, the professions, government and academia. We recognise that an individual might have several changes of career so that programmes must be durable and lifelong learning will become increasingly important.

**Engagement:** The School and its Departments will continue to develop innovative mechanisms to engage the public and private sector in its work – not only as a funder and commissioner of research and education, but as an explicit route to having real world impact through co-developing solutions to real-world commercial and societal problems.
We aspire for the School to be the first point of call for companies and organisations around the world that desire to address significant challenges that need technological, innovation, entrepreneurship, or management solutions.

**Impact:** The School and its Departments will focus on exploiting innovations from research and education through the transfer of technological or other advances to industry and third-sector organisations, by spinning-out companies or by other appropriate means.

**People:** Delivery of the foregoing requires that great consideration be given to the culture of the organisation in which we expect to attract, develop and retain the very best and productive people. Accordingly, the School upholds the University’s core values

1. to endorse the rights of the individual to freedom of thought and freedom of expression, so that views and opinions are respected,
2. to respect the freedom of academics to conduct their own research,
3. to respect the diversity of our students, academics, professional staff and visitors and value their different expertise and contributions to the life of the School,
4. to ensure students are selected on intellectual merit, regardless of protected characteristics,
5. to foster a collegial culture of well-being, cooperation, leadership and sharing of responsibilities, and
6. to commit to staff development to give fulfilling careers.

**2.2 Mission**

Following from the principles in Section 2.1, the **mission** is as follows:

The School of Technology and its constituent Departments will be internationally leading in education, research, engagement and innovation in technology in order to solve challenges facing business, society, the environment and healthcare. This will be achieved by the pursuit of excellence in: outstanding teaching and education, fundamental research of the highest quality, private and public sector engagement, encouraging individual enterprise and innovation, attracting and retaining talent and commitment to staff and student development.
2.3 The Relationship between the School and Departments

It is important that the SoT continues to add value to Departmental activities without seeking to dictate or constrain bottom-up and Departmental initiatives. In principle, the function of the School can be envisaged as illustrated in Figure 3.

Figure 3: Relationship between the School and the Departments

Here, the School provides its normal operational input to the processes common across the Departments to reach concerted positions, improve efficiency and spread best practice in areas such as HR, IT, teaching, financial control etc. However, it is clear that there is the potential for increasing activity in cross-School themes in research and education and engagement where, e.g. strategic research themes might be identified and encouraged (and linking with other Schools) to add value to existing research and to bring in further research income. It will also make the School more attractive to industrial funding by offering larger, strategic themes in areas of critical importance. Some areas (e.g. decarbonisation) cannot be School-specific because of their breadth. In these areas, the role of the School is to help...
make these large themes work across the University and beyond (to other Universities, industry, third sector organisations etc.). In education, the potential for the application of digital learning is huge.

Figure 3 attempts to depict the School adding value to Departmental activities but without attempting to dictate to constituent Departments or to reduce academic freedom to conduct individual research. This is underpinned by our accepted norms and values.

3 Research

The Departments in the School recruit outstanding researchers of the highest international calibre. Academics are encouraged and supported in initiating and developing innovative, curiosity-driven research. Generally, research is undertaken within broad strategic themes within Departments with the overall aim of delivering integrated solutions to major societal challenges. An important aspect, in collaboration with the School, is to ensure that critical mass is maintained in terms of researchers and funding in identified areas of challenge.

As seen in Figure 3 and noted in Section 2.3, an important strategic role for the School in research is to add value to existing research activities in its constituent Departments where help is needed to grow or connect themes into larger activities. Accordingly, the future overall objective of the School’s research strategy is to encourage researchers to draw together their interests into School-level themes, when appropriate, where this helps to create the impetus, capacity and profile necessary to connect more effectively with major challenges and the funding and resourcing thereof. Clearly, other mechanisms exist to grow critical mass in research and these might not involve the School at all: the important point is that the School is available for facilitation when this is needed.

As seen with the Singapore (CARES) activities and China (e.g. Nanjing, Shenzhen etc.), subjects in SoT are attractive to other countries. This invariably means that, in future, there will be an increasing need to evaluate new overseas’ opportunities in a more rapid and satisfactory manner than is currently the case. Often, the fine operational detail is overlooked at the time of inception, resulting in a substantial administrative burden to reach an operational outcome.
3.1 School-Level Research Themes

Based on initial consultations across the School, and more widely, and taking into account major themes of research already in place in the constituent Departments, seven strategic research themes have emerged for the School, labelled 1 to 7 in Fig. 4. The vision is that these themes will link with Departmental initiatives to add value to existing research, to bring in further research income, to ensure an international-level degree of critical mass and to offer a very attractive proposition for industrial involvement. These themes are currently under discussion with Departments, as part of the present strategy-setting exercise.

Fig. 4: School Strategic Research Themes (1 to 7) operating within an environment embracing sustainable policy and business processes and promoting innovation and entrepreneurship.
Figure 4 also attempts to depict the strength of the School in terms of its research themes, and indeed education, operating within an environment embracing sustainable policy and business processes and promoting innovation and entrepreneurship. Therefore, the School, with its wide mix of disciplines, could make unique offerings to industry and policy makers. A key element of the forward strategy will be to strengthen further the coupling between sustainability, modern business processes and entrepreneurship on the one hand and the main research themes on the other. The proposed Research Themes are as follows.

**Energy Transition and Civil Infrastructure.** This is concerned with creating sustainable, integrated solutions for the provision of energy, transport and infrastructure. It is anticipated that this theme will interface effectively both with the Maxwell centre strategy, Energy@Cambridge and with the Carbon Neutral Forum and will recognise that the energy transition will occur over a finite time, requiring the improvement and adaptation of existing technology as well as the development of radically-new technology. We envisage that an important aspect will be decarbonising air transport, led by the Whittle Laboratory.

**Sensors, Measurement, Metrology and Data.** The intention is to build on the substantial expertise in the School on major measurement techniques, *e.g.* magnetic resonance imaging, photonics, acoustics *etc.*, including the ability to interrogate and understand the vast amounts of data produced by sensing methods. There are particular opportunities to interface with, *e.g.* medicine, in the development and interpretation of sensing and imaging techniques and diagnostics.

**Molecular and Synthetic Biology.** The rational understanding of biological systems, and how they can be manipulated, to support innovation in drug discovery, other medical applications, new manufacturing processes and new products. It is expected that this will further strengthen links with the Schools of Clinical Medicine and Biological Sciences.

**Manufacturing, Design and Materials.** Research here is directed at understanding the whole process from fundamental molecular design, raw materials through the design of process and artefacts to manufacturing, including service and end-of-life considerations, within a context of sustainability.

**AI/ML, Human Interfaces, Language Processing and Security.** This recognises the huge fundamental contributions to the various fields from CST and DoEng and the very
wide applicability to all areas of science, engineering, healthcare, business and manufacturing. This area is potentially very fertile and requires strategic funding to set in train a coordinated “Digital Campus” embracing most areas of University research and teaching.

**Healthcare and Wellbeing.** This builds on the very strong links between Departments in the School of Technology and those in the Schools of Clinical Medicine and Biological Sciences and with clinicians. There are substantial initiatives in healthcare engineering (*e.g.* improvements to per-operative care), biomedical engineering (*e.g.* devices and sensors, cartilage imaging and characterisation, arthritis surgery), biological engineering (*e.g.* organ-on-chip and tissue regeneration, drug targeting), computer science (bioinformatics, mobile and wearable, machine learning and AI for healthcare data) and healthcare leadership (*e.g.* CJBS CUH Senior Leadership Programme).

**Organisational Response to New Technology and Systemic Global Challenges.** This recognises that technologies are applied only if organisations (including commercial, NGOs and government agencies) change in terms of their performance measures, their practices, and their risk stance (for example, when introducing new things).

It should be noted that Figure 4 represents one view of how major research activities spanning the School and beyond could be grouped: it does **not** imply that research necessarily has to fit within those themes. The School’s support would assist with encouraging new SRIs and assisting with their finance, CUDAR interaction, administration and general administrative support for the theme. The theme itself would not be managed by the School but by the separate academics working in the field. A particular need will be to design new organisational models for strategic research activities, tailored to particular themes, rather than forcing a fit with current University models for SRIs and IRCs.

By drawing researchers into these larger themes, which align with key research areas in the Departments, it is clear that there is vast potential for increasing activity in interdisciplinary research. As noted above, a future vision for the School is for there to be an increasing level of interaction of the research and professional leadership of CISL and CJBS (in sustainability and business) with the Research Themes to ensure clear, workable and focused solutions to technological, environmental and social problems being tackled.
in the Research Themes 1 – 7. The IfM already plays a very strong role in manufacturing leadership, but there is a clear opportunity for further integration, for example, with modern manufacturing in the chemicals and drugs sectors (e.g. with CEB) and, of course, very strong links with digital and AI.

The **vision** is to have the confidence to set the Technology research, business and impact agenda here in Cambridge, rather than it occurring elsewhere. Champions for the Research Themes will need to be identified and encouraged, possibly with seed-corn funding from the School to ensure strong coordination. In the longer term, one possibility is for the themes to be led by senior academics, appointed from the School, but this requires detailed discussion with the Departments. In all of this, and to reiterate, those wishing to pursue their own research will be as welcome to do that as always, since our individual research competences form the basis for innovation.

### 3.2 Research Support Strategy, 2019 - 2022

The School’s measurable research objectives for the period AY 2019 – AY 2022 are:

1.1 To establish a collaborative research strategy in which the Research Themes are recognised and in each of which there is at least one significant, integrated School-level activity. To identify and lead SRIs, SRNs etc. where appropriate. To assist Departments with initiating new research directions.

1.2 To promote recruitment and development of academics, PDRAs and PhD students of the highest quality by robust HR processes, expanding funding opportunities and disseminating best practice in research management and policy.

1.3 To work strategically with industry, government and other bodies to expand the School’s funding base further. To encourage delivery mechanisms most suited to collaborating party, in addition to normal academic publication, e.g. short courses, signposting, roadmapping, consultancy (and research fellowships) etc.

1.4 To work with Departments to determine the optimum strategy and submission for REF.

1.5 To communicate, effectively, appropriate new developments and impact arising in the School (e.g. research, innovation, teaching, fund-raising, recruitment), both internally and externally. To develop measures to gauge the effectiveness.
The high-level strategies in pursuit of the above are shown in Table A, at the end of this document. The particular points to note for priority action are as follows. To identify and set up four new SRIs, or similar, by 2022. Some ideas for SRIs well within the School remit might include leading “Industry 4.0” initiatives in the processing or biomanufacturing area, quantum communication, AI and applications, the future of decarbonised air transport etc. Of course, many others potentially exist. Such SRIs should evolve into IRCs with appropriate funding from industry and research funders. This is an area where the School could make a very large impact and, with appropriate care, add real value to Departmental initiatives. To facilitate this, the School will set up a Seed Fund to prime exploratory studies and, or, workshops on potential themes.

To conduct a review of existing SRIs and IRCs within the School to identify any operational problems (e.g. needs for management support) and to make recommendations to RPC.

With the uncertainty over Brexit, the School is aware of the potential challenges in research funding in the coming years and that funding will become more competitive. The School remains committed to encouraging further larger multi-disciplinary research, and will be considering how to provide better support for this important area through the School’s Research Committee, under the chairmanship of a newly-appointed Deputy Head of School.

Almost 50% of the University’s industrial funding comes via the School of Technology, but the bulk comes from only around ten companies. A priority is to work with the PVC (Enterprise and Business Relations) to develop further relationships with existing and new companies, particularly around the opportunities offered by the School in AI, chip design, aerospace, manufacturing, sustainable business processes, pharmaceutical production and process technology. In some areas (e.g. chip design), there are large numbers of companies willing to fund but too few academic staff in the right areas. An important option to consider (Table A, objective 1.3) is whether the need to offer a range of training and
engagement offerings for companies might best be served by means of a School-based company, operating in a similar manner to IfM ECS.

- The School has revamped its Research Committee and its Terms of Reference. An important factor in the practical implementation of the School’s strategy will be the appointment of a Deputy HoS (Research and Strategy) from October, 2019.

- The School will need to work with CUDAR to lay more emphasis on a focussed list of fund-raising priorities. Particular emphasis will be placed on opportunities for substitutional funding for academic posts, research studentships and research fellowships and associated start-up packages.

- CST has a timely strategy to grow AI/ML capabilities within the Department and across the University. The proposal is to establish a core group in CST, who can guide and mentor a group of research fellows with teaching responsibilities. These fellows will teach others, some in different disciplines, some of whom will become fellows in their own right, giving a multiplicative effect. The core group will be available for consultation with critical projects or particularly difficult problems. The core group will also be able to keep up to date with developments, to recommend the use of new techniques that become available, but also to guard against the adoption of fashionable but unsuitable methodology. As fan-out across the University proceeds, teaching materials can become more specialized for different disciplines. The School will be making this a very high priority and, at the time of writing, a meeting has been scheduled with the VC for early November, 2019.

- The last Research Excellence Framework (REF) outcome for the School was good, but not outstanding. Both our international competitors and our colleagues in the UK have been catching up with significant investments in their research and staff. For example, Oxford’s Computer Science Department has doubled in size and their Engineering Department plans to do so by the next REF. Therefore, the School needs to continue to invest in academic staff in the Departments so that they can attract even more income to the University.
3.3 Innovation and Impact

The School is well placed with its mix of skills in the constituent Departments to take a joined-up view of what is the appropriate way to promote the impact of its research and to link with the other Schools, and with Cambridge Assessment and CUP, where appropriate. Developing an Impact agenda featuring key successes could become a key role for the School, provided this is seen as desirable by Departments, and would be in line with developments at MIT, Imperial etc. This activity is closely associated with identifying the Research Themes, discussed above.

It is critical to maintain the School’s flair for innovation, since this underpins new research areas, success with grants, and spin-outs. It is also the key to maintaining Impact. Prime factors for innovation include (i) being able to try new ideas quickly, (ii) free, frequent and informal conversations with each other, particularly across disciplines, (iii) key innovative individuals, (iv) enthusiasm for research and teaching, and (v) the ability to engage with business and policy makers to address real world problems. Where required, the School will prioritise: (a) strong support for identifying funding to try new ideas in teaching and research, (c) streamlining and minimising administration where feasible, and (d) facilitating ways of talking informally, across research disciplines. It is essential to maintain recruitment of bright, young academics as UTOs, whilst also making senior appointments of established academics when appropriate.

4 Education and Training

The overall objective of the School’s research strategy is help Departments maintain, develop, create and fund internationally-leading courses in undergraduate, postgraduate and executive education taking into account trends in learning, teaching, delivery and necessary balance of subjects taught. This includes examining and encouraging benchmarks of quality across courses and assisting course-leaders to prepare for reviews by external funders (e.g. for EPSRC CDTs).

4.1 Overview

Undergraduate Education. The School would like to see a growth in undergraduate student numbers, particularly in DoEng and CEB, by a steady increase to the full capacity
of the two Triposes in the medium term. Applications from overseas students are generally of high quality and the School wishes to take advantage of the wider pool of excellent candidates. This would relieve pressure from subjects stretched beyond their teaching resources elsewhere, and provide high-quality students at little marginal cost to the University. CST’s position is that, given the huge demand for its undergraduate course, it would consider increasing undergraduate numbers, but would require more resource, including space. New interdisciplinary Triposes that may involve the School are in early stages of discussion and consultation, for example Technology, Policy and Economics (TPE).

The School recognises the importance of the balance of students across subjects and the balance of home and overseas students. It does not believe that the proposed growth would significantly affect the balance. There is evidence that high-quality overseas applicants apply but then opt to study in the US on financial grounds: Colleges need to realise this competitive situation and adjust the number of overseas offers accordingly.

The DoEng and CEB are reviewing their Triposes to improve their respective structures to facilitate a better student learning experience, provide more opportunities to develop creativity and ingenuity, and increase contextualization of learning using real-world examples. This should appeal to a broader range of applicants, as has already happened in the restructured Computer Science Tripos. The imposition of Chest savings is causing CEB to have problems in delivery of its Tripos because of deferrals in the filling of posts. This is exacerbated by two members of staff being on long-term sick leave, for which the Department bears the cost without any allocation of funding for substitute teaching. Good progress has been made in widening participation in many Departments (e.g. CST).

The forthcoming introduction of a Subject-Level Teaching Excellence Framework (TEF) by the Office for Students will be an important consideration for the School, although exact details of how the exercise will be conducted are not yet known.

**Taught Masters Courses.** The School wishes to build on the strenuous efforts of recent years to broaden and deliver a number of highly-specialised postgraduate courses aimed at educating graduates both to engage in future research and to maintain links with
strategically important industrial sectors. The Departments in the School have successfully established both new full-time MPhils (e.g. in Machine Learning and in Biotechnology), and new part-time courses (e.g. MSt in Social Innovation, Master of Accounting).

There is substantial opportunity and core capability in the School to develop new offerings, particularly aligned with the School’s strategic interests in sustainability, AI, robotics etc. However, the uncertainty with regard to timely financial return from the Chest to a course to defray set-up and running costs sufficiently is holding back developments. For example, CST recently considered setting up a potential course in Data Science. The Department did not pursue this partly because existing competitor courses had experienced declining numbers but mostly because the current cost model used by the University did not show clearly how much return there would be to CST to invest in the course. The investment was needed for new staff to teach the course and to supervise projects.

Discussions with CST have also highlighted that it is important to establish the objectives for teaching Masters’ courses. In the case of Advanced Computer Science, it is to provide research training suitable for those who wish to do a PhD, and it supplies CST with many of its PhD students. The students also carry out research, often leading to publication. Other taught masters models do not offer such benefits, so there have to be substantial other benefits to a department in pursuing them.

The number of part-time masters students within the SoT has more than doubled in the last three years - over 600 are now studying University degree courses (MSt, EMBA, MAcc). However, part-time Masters courses offer further challenges with regard to colleges. College provisions for these students remain an ongoing issue. Course directors are working to build relationships with a few individual Colleges to establish a common understanding of expectations of the provision for their courses. This would need to be addressed systematically if the School were to expand on MSt numbers. The 25% college fee also presents a disincentive.

**Digital Learning.** Digital learning is growing in importance in higher education and particularly so for part-time and professional courses. However, in some areas we are behind our competitors. Strategically, we need to emphasise the distinctiveness and high
quality of Cambridge teaching, with its strong focus on individual and small group activities, and find a way to do this for distance learning.

CJBS and CISL have developed substantial experience in delivering remote teaching for part-time students. For instance, CJBS has successfully designed four part-time, blended-learning degree programmes (EMBA, MSt Social Innovation, MSt Entrepreneurship, Master of Accounting) which contain high-quality online modules which are then backed by one-week residential in Cambridge. CJBS and CISL deliver remote content principally using customised Moodle environments, with use of interactive forums and feedback from peers.

CJBS has invested significantly in digital learning, both in terms of people and infrastructure. In particular, it has a studio for recording videos and webinars with assistance for academics provided by a dedicated digital learning support team. A priority for the School is therefore to help support this activity and to ensure that best practice and expertise is available to other Departments.

Remote learning has been used by CST and CJBS to teach pre-courses to enable students to acquire prerequisite competences needed before full-time students start at Cambridge – example competences are computer programming, statistics and business analytics.

For full-time students within Cambridge, the use of lecture capture in individual departments varies from routine (in DoEng) to rare. We await decisions on University funding for implementation of lecture capture in locations where it is not currently available. While some academics have reservations over the merit of lecture capture, it has proven to be helpful to students in certain situations (particularly those with specific learning difficulties, or those returning from illness).

There have been a range of technology-enhanced learning developments within the School. These include innovative use of visualisers in lecture theatre settings (in DoEng), audience voting via smartphones (in CJBS) and changes in course content and presentation (in CST). Technology is also being used to aid assessment of submitted work, for instance to test whether a computer program written by a student works or not (in CST), or to check that students answer some basic questions correctly before allowing students to proceed to
the main assessed task (in CEB). Experiments are being undertaken in new technologies that allow students to have a virtual presence in lectures they cannot physically attend (e.g. using video360, or using a telepresence robot).

The School of Technology will continue to invest and grow in the digital learning area and explore opportunities to integrate further new technologies into existing pedagogy (including face-to-face delivery) to enhance the student learning experience. It will be important for the School to share good practice in the areas of distance learning, technology-enhanced teaching and digital assessment. It will be a priority for the School to support provision of local expertise to help academics develop and deliver digital learning.

**Professional and Executive Education.** The School is well placed to provide executive and professional education and the activity will continue to grow for the foreseeable future.

Executive education is a very important activity of CJBS, which is not adequately described by the University’s phrase of “Trading”. Executive education adds to CJBS’s reputation as a place that produces applicable and relevant knowledge. Executive education is also a testbed of pedagogical experiments (such as simulations and online materials), and of pedagogical training for academics. Finally, and very importantly, CJBS is continuing to work to increase the ability of executive education to contribute to applied research by exposing theoretical ideas to practice. The many organizations that CJBS encounters in executive education are constantly experimenting with new challenges and methods. Close working with such organisations enables concepts, case studies and hypotheses to be developed. JBSEEL continues to be a source of reliable income and corporate research funding to CJBS. Executive education courses are delivered in many countries, including India, Malaysia, China and the Middle East. In addition, JBSEEL contributes to the quality and impact of CJBS research, by exposing JBS faculty to the complexity of management problems in organisations, thus helping to generate innovative research questions and creating opportunities for data collection, experiments and testing of research results. The executive education offered by CISL, drawing on a wide range of academic staff from across the University, offers similarly valuable insights and opportunities to contributing academics.
CJBS has now set firm foundations that will enable it to grow its postgraduate programmes and professional education offerings. Within the next 5 years, it expects to see an increase of 15% in its total postgraduate student numbers, bringing the total number to over 1000 students. CJBS is exploring the feasibility of introducing a new stream of the EMBA programme, to be delivered primarily in China. This programme will have an anticipated steady state annual intake of approximately 60-80 students. This is currently awaiting approval by the University and colleges.

Given the benefits of such deep engagements between academia and industry experienced by CJBS, there is scope for the School to explore with the Departments currently not so actively involved in the provision of professional education to see if similar benefits could be obtained for them. This is an area of professional expertise and will require the hiring of best talent in programme design and leadership, as well as business development and client engagement.

To grow executive and professional education, along with the associated income, impact and alumni, the University needs to enable the recruitment and development of world class professional staff within departments and to allow associated investment to underpin business growth. For instance, this is likely to need to include market pay supplements and other financial incentives as well as professional development opportunities, including the opportunity for senior professional staff to become college members.

**Doctoral Training.** The School is fortunate in attracting very talented research students from around the world: they are essential to delivering future research. However, the funding for research studentships is limited and our major source of un-hypothecated doctoral training funds from UKRI has been decreasing in real terms over the past few years. The School welcomes the University’s campaign for fundraising for research studentships and is keen to engage. As noted in Section 3.2, raising additional funds for studentships is a priority for CUDAR interaction with the School. Many talented overseas students are lost owing to the inability to make timely offers of studentships.
The recent applications for the EPSRC Centres of Doctoral Training (CDTs) yielded a relatively good outcome given the limited institutional funding the University and the School were able to provide.

EPSRC renewed CDTs in Future Infrastructure and Built Environment, Sensor Technologies, and Future Propulsion and Power, as well as starting three new CDTs based in SPS. The University is a collaborator in a further 4 CDTs from which students may undertake PhDs in Cambridge. This is a relatively good outcome given the limited institutional funding the University and School were able to provide. Both CST and DoEng (Information Engineering) have plans for CDTs funded exclusively by industry. The School is actively working to introduce cross-cohort training for CDT students based in departments within the SoT and SPS. For instance, SoT and SPS has arranged a workshop on responsible research and innovation (RRI) for cross-cohort CDT students this December.

The School collaborated with SPS on application for EPSRC DTP funding which was successful.

4.2 Education and Teaching Strategy, 2019 - 2022

The School’s measurable objectives for the period AY 2019 – AY 2022 are:

2.1 To work with the Centre, as appropriate (e.g. as a member of the GB’s Education Committee) to give informed oversight on postgraduate and undergraduate matters. To review and streamline timely dissemination through the School’s Undergraduate Education Committee and Postgraduate Education Committee to academics.

2.2 To grow undergraduate numbers appropriately, taking into account access and participation etc.

2.3 To work with the Centre to help ensure smooth introduction of electronic capture, online learning and testing and other new developments in pedagogical innovation. To coordinate/inform information on new teaching technology.

2.4 To have a clear-sighted, active, coordinated strategy for the management and development of graduate and professional education.
The high-level strategies in pursuit of the above are shown in Table B. The particular points to note for shorter-term action are as follows:

- Clarity on MPhil cost models is essential for future development.
- As noted in Section 3.2, the School will explore with CST the current strategy to develop AI/ML and associated courses from October, 2019.
- A substantial increase in constructive engagement both with Departments and with the Centre is expected, following the appointment of a Director of Education from October, 2019.
- The School expects to instigate some pilot projects in digital learning, as well as organise dissemination of best practice and expertise, in the next 12 months. This is an indispensable precursor to development of PGCert and MSt offerings.
- The School will examine in 2019-20 if a range of flexible offerings to industry and policy makers, e.g. short courses, professional education, consultancy, short-term studies etc. is best initiated by forming an operating company, akin to JBSEEL and IfM ECS. This has been highlighted in Section 3.2. The School will therefore clarify the driver of this objective (e.g. in terms of direct income, impact, indirect income via philanthropy from alumni) to help evaluate the efficacy of forming an operating company to cater for opportunities beyond those services already provided for, or could be provided for, through existing departments and companies.
- Managed growth in numbers is expected. On existing courses, more work is needed to determine variations and trends in numbers. There is a particular need to examine where high quality students (e.g. from very oversubscribed courses, or international students) are lost and to develop strategies to mitigate this.

In the longer term, the School has been considering trends in lifelong learning. The has been partly motivated by MBA alumni increasingly asking to come back for refresher courses, thereby indicating a desire for continuing engagement at various periods after graduation. Outside the University, there are numerous institutions offering courses to
alumni to update skills. It would appear that the following features of developments in this area would be:

- Mixtures of on-line learning combined with the ability to study at intervals in Cambridge could be a powerful offering.
- Intersections between expert areas could be important, e.g. sustainable finance.
- People prefer to develop their own skills – these are not necessarily aligned with the priorities of their current employer.
- Training over a period of time, without prescribed limits is favoured. However, the ability to accumulate credits for a higher degree is important.
- The objective of lifelong learning would have to be clarified. For example, over and above being part of the University’s mission, it could be for (i) better connections to alumni, or (ii) bringing company experts into a Department. University financial models would need adjustment for this market.
- With a clear and differentiated offering that leveraged the School’s strengths, there is opportunity for the University to win a much greater share of the corporate training market.

5 Capital Investment and Estate

5.1 Overview

The overall objective of the School’s estate strategy is to ensure that Departments are housed in buildings suitable for the pursuit of teaching, research and learning at the highest levels of international excellence. The last six years have seen the successful completion of significant building projects and the initiation of several new ones. CEB is now housed in a new building at West Cambridge. The Dyson Building and the Electrical Engineering Extension have been completed for DoEng. The new Civil Engineering Building was handed over on schedule, and within budget, in May, 2019. CJBS designed and commissioned the new Simon Sainsbury Centre in partnership with the Monument Trust and has won a number of awards for its architecture. The Sainsbury Centre is having a very positive impact on professional courses and executive education. The ongoing
refurbishment of the Royal Cambridge Hotel, when completed, will further improve the facilities for attendees of professional courses provided by JBSEEL.

Important future projects are as follows.

**Engineering.** The DoEng has agreed on, and the University has endorsed, a strategy to relocate the Department from the Trumpington Street site to West Cambridge to re-integrate the Department. As noted above, the new Civil Engineering building has recently been completed and the next project will be the redevelopment of the Whittle Laboratory. Thereafter the intention is to extend the IfM building, relocate Division F into the Roger Needham Buiding, which is currently occupied by UIS, and move the Engineering teaching and laboratories to a new building to be situated on the site of the current Cavendish Laboratory (Cavendish II). It goes without saying that a fully-integrated DoEng is essential.

The development of the Whittle Laboratory has been catalysed by grants of £15.5M from the Aerospace Technology Institute (ATI) and industry towards a new experimental facility and building. This will enable the development of aircraft propulsion systems designed to have a much reduced carbon emission compared to conventional aeroengines. In fact, the coupling between innovation at the Whittle laboratory and implementation by its collaborators in turbomachinery, is so close that the resulting reductions in carbon emissions from improvements made in efficiency are substantially larger than from any other mitigating action the University might take (except, perhaps, research in CST leading to a reduction in energy use by data centres globally). This project therefore has a strong part to play in the University’s Carbon Neutral Forum. Because of planning constraints relating to location, it is not possible to build a basic, functional building for this initiative. The future of the project, indeed the future of jet-engine research at Cambridge, is thus critically dependent on whether or not PRC decides to support the building.

**CISL.** The successful refurbishment of 1, Regent Street, to time and to budget, is essential for the planned expansion of CISL. This should enable CISL to extend its current activities to engage more deeply with the research community in the University and to provide space to run an accelerator programme to help SMEs and starts-ups operating in aspects of sustainability. Strategically, a flourishing CISL is important for the School, as noted earlier.
CST. Extension of the William Gates Building has been mooted but it will not even meet the short-term needs of the Department because there is insufficient space for expansion. Given the rapid growth in interest in the activities of CST, both in teaching and research, space is very limited in its present building and is preventing, in part, expansions in course numbers and research activity. After the Whittle redevelopment, solving the problem of sufficient space for the expansion of CST is one of the most urgent tasks for the School, because of the impact of its work across the University.

CEB. The move of CEB into its new building has allowed the Department to unify all aspects of its operations, enabling enhanced opportunities for collaboration whilst maintaining the strength of breadth and diversity of its research and teaching. However, the building has already reached capacity and there will be a need to build an extension in the medium term. In some areas of research there ought to be opportunities to share space and resources with an expansion of IfM (e.g. in modern pharmaceutical manufacturing and formulation) and even with Materials Science.

CJBS. As noted above, the new Simon Sainsbury Centre has been a welcome addition and has had very positive impact on professional courses and executive education. However, the actual net additional space created by this new extension is limited as it provided the ability to transfer existing activities from across Cambridge to the main site (i.e. using the Simon Sainsbury Centre instead of college facilities in the case of executive education and instead of Mill Lane lecture theatres in the case of degree programmes). As a result, CJBS has already outgrown its capacity and will need additional space. An Area Analysis Report conducted by Estates Management in November 2018 has identified that, in advance of the delivery of Phase 2 of the Old Addenbrooke’s Site Masterplan, CJBS urgently requires 1090 m². Ideally, due to their proximity, allocation of some of the Trumpington Street houses would be a good solution. Additionally, the Trumpington Street houses currently occupied by CJBS (10-14, Trumpington Street) require significant refurbishment to bring them to an acceptable standard.

Accordingly, all the Departments within the School are potentially in need of new accommodation to house their teaching and research, and to fulfil their ambitions for planned growth. It is therefore important that they are fully integrated into the current fund-
raising campaign. It is important that opportunities for sharing and rationalising resources are examined wherever possible, *e.g.* workshops, HR, lecture scheduling, courses *etc.*

### 5.1 Capital Investment and Estate Strategy, 2019 - 2022

The School’s generic objectives for the period AY 2019 – AY 2022 are listed in Table C, together with associated high-level strategies. The particular projects for shorter-term prioritisation are as follows:

- **Redevelopment of the Whittle Laboratory.** As noted above, this has high strategic importance as it affects the future of aeroengine research at Cambridge – and potentially in the UK – and has a huge part to play in decarbonising air transport. A failure to fund this project carries huge reputational risk in terms of Cambridge being able to engage with major, global themes.

- **Refurbishment of 1, Regent Street for CISL.** Completion will significantly enhance the Cambridge contribution to a more sustainable economy and the innovative thinking and research required to achieve net zero carbon emission. The project has a very high public profile amongst industry, policy-makers *etc.*

- **Refurbishment of the Royal Cambridge Hotel.** This supplies an important suite of accommodation for attendees of professional courses at CJBS.

- **Exploration of expansion options for CST.** A priority for 2019-20 will be to find a suitable site for expansion and to formulate a strategy with the Department, including the necessary fundraising.

- **Masterplan for DoEng.** As noted in Table C, the SoT will continue to be vigilant and will raise concerns where external developments in infrastructure (*e.g.* West Cambridge transport infrastructure or other buildings) impinge on the ability of a Department to expand or relocate. In particular, there will be an ongoing need to defend the space earmarked for the Engineering Master Plan.

- **To work closely with the University to develop West Cambridge as a technology campus and as an important hub for science, technology and innovation.**
6 Philanthropy

6.1 Overview

The overall objective is to facilitate donations and philanthropic giving to enable Departments to pursue their building, research, teaching etc. plans in a timely way. The School’s plan is reliant on effective professional fundraising support for the new buildings and other high priority projects identified above. The School has been fairly successful in converting donor interest into significant gifts when a broad range of senior academics have worked closely with CUDAR. However, there is more to be done in terms of prioritising projects of various magnitudes and designing effective strategies for engagement. One consideration for debate is whether or not the School should engage its own Development Director to lead concerted activities. For example, the re-integration of the Department of Engineering on the West Cambridge Site is essential. The intention is for the move to occur in discrete phases as money becomes available. Strategic coordination of this complex issue, involving close collaboration in fund-raising between CUDAR and the Department, is essential. The pressing concern with respect to redevelopment of the Whittle Laboratory has already been noted in the preceding section.

As noted earlier, the expansion plan for CST needs to be costed – and a fundraising strategy constructed – once a viable site for CST has been identified.

Fundraising and alumni relations is a crucial activity for CJBS to support financial sustainability and engagement with its stakeholders. The structure of fundraising activities in competing peer business schools gives them a significant competitive advantage over CJBS. Competing schools often have autonomous structures for raising funds reporting directly to the business school; they also have many more fundraisers. This has enabled peer schools to raise significant higher levels of funding annually. In spite of this challenge, strong relationships developed by faculty members have continued to yield significant philanthropic funding, such as the $10 M raised by the Centre for Endowment Asset Management for a ten-year research relationship with Invesco. CJBS is, however, keenly aware that it needs to continue to grow philanthropic funding apace, particularly to support (i) teaching and research posts and activities, (ii) research centres, and (iii) scholarships to students in need. This would bring CJBS closer in competitiveness with peer schools.

The School’s generic objectives for the period AY 2019 – AY 2022 are listed in Table D, together with associated high-level strategies. It will be seen that there is an emphasis on:

- Developing and maintaining a database of fundraising priorities for individual Departments, including specific strategies for raising funds and critical timescales. The main capital priorities are identified above, but these have to be supplemented with details of substitutional funding needs, fellowships, studentships etc.
- Monitoring the success of fundraising for specific projects and taking remedial action where these are not working effectively.
- Where a lead academic has worked with a donor, to ensure that the HoS and HoD engage with lead academic on a proposal before the proposal is sent to the donor, viz. that there is a well-documented process which has been widely disseminated to academics.

7 Finance

7.1 Overview

As summarised in Section 1, the School has striven to maintain sound finances, resulting in a strong financial position in recent years. However, in line with University policy, School reserves have been reduced to a minimal level and so the ability of the School to absorb any future cuts in Chest allocation is very limited.

According to the University’s RAM, the School has generated a surplus of £32M over the past five years to the University and has only received £2.1M in additional RAM allocation to the School. This is noticeably much less than the investments by our competitors as the next REF outcome is likely to show. It is important for the University to continue to invest in the School so that it can grow its surplus to cross-subsidise other parts of the University.

To address the adverse financial situation, the School would much prefer more financial flexibility from the University to grow activities and create new programmes to
generate additional income. A new financial model should be transparent, encourage accountability and should empower departments to take financial decisions in terms of investments, recruitment and courses.

As noted earlier, short-term possibilities include increasing the undergraduate intakes to the Engineering Tripos and the Chemical Engineering Tripos to full capacity (as the School has been arguing for in the past few years) and investments in various new full-time and part-time Masters courses, and, potentially, professional courses. On undergraduate numbers, the current Working Group on Size and Shape of the collegiate university, involving both college and university representatives, will hopefully generate improved mechanisms for joint planning of numbers desirable on courses. Additional income from these activities would enable the School to invest in more academic staff to enhance its REF performance.

In the School’s view, a key prerequisite for improved financial performance is a full understanding of costs and returns. In principle, given sufficiently detailed management accounting information, one could improve financial sustainability by balancing loss-making activities (e.g. expanding home undergraduate numbers) against those making a surplus (e.g. certain MPhil taught courses, or particular research activities) to arrive at a reasoned, balanced budget for the School. Improved management accounting information would also be powerful because it would enable Departments a much bigger insight into their profitable and non-profitable activities.

7.2 Financial Strategy, 2019 - 2022

The overall objective is to increase external income to enable flexibility of operations and approaches and to incentivise new initiatives. The detailed objectives are as follows, with basic strategies recorded in Table E.

5.1 To raise external research income by 50% over the 2019 income by the end of 2025.
5.2 Pro-actively engage with the University’s Strategic Research Initiatives and Networks and encourage large research bids at University level, using the breadth and depth of the School’s research areas.
5.3 To communicate with, and work with, central bodies on various opportunities for fund raising and income generation.

5.4 To manage smooth implementation of University financial models as they affect Departmental income, *e.g.* implementation of the Income Incentivisation Model.

The move of Engineering Division D into the Civil Engineering building and the planned move of the whole of Engineering in the longer term, to West Cambridge will consolidate most of the Technology Departments on one Site. This offers the School greater scope for benefiting from economy of scale in operations, and more opportunities for sharing of facilities and services within the School. West Cambridge offers real opportunities for sharing resources (*e.g.* workshops, technicians) across Departments where the sharing also gives improved career prospects and skills for those concerned. At the time of writing, CEB is engaged in a major exercise in this area.

The particular projects for shorter-term prioritisation are as follows:

- To grow research income. Priorities are for the School to catalyse bids for strategic research initiatives and large grants and to give as much assistance as possible in such undertakings. Almost 50% of the University’s industrial funding comes *via* the School of Technology, but the bulk comes from only around ten companies. As noted earlier, a priority is to work with the PVC (Enterprise and Business Relations) to develop a plan for further relationships with existing and new companies, particularly around the opportunities offered by the School in AI, aerospace, manufacturing, *etc.*

- A growth in various postgraduate teaching offerings is essential, assuming correct incentivisation from the Centre, as discussed earlier.

- From Section 3.2 (Objective 1.3), the School will consider as a matter of urgency, the best means of developing courses for industry and for tackling problems best approached *via* consultancy and strategic engagement, rather than long-term research. This offers one approach to offering flexible offerings to industry and others.

- Growth in undergraduate numbers, and overseas’ component, as discussed earlier.
- Operations. The School will continue to review its operations to ensure they are well-equipped to achieve its academic goals in the most efficient and effective manner. Some reviews in the past have led to efficiency savings while others have required greater investment to improve aspects of the administrative and technical support. Opportunities will exist to scale up efficiently through process improvement, as well as through the application of technical and digital solutions to support automation, ease and economy of work. The substantial reorganisation of CEB started this summer and is expected to be completed by the end of the calendar year. Documentation of this exercise and a careful study of the direct and indirect savings is a priority over the next 12 – 18 months.

- To propose an experiment to study the impact of a reduced taxation rate on the SoT on incentivising activities increasing income to both Chest and SoT. This needs to be underpinned by much-improved management accounting information, as noted in Section 7.1.

- To propose an experiment in which CJBS is given relative autonomy to operate, but with strict accountability to a School-level Committee and to the University. This experiment would decouple, in particular, market pay and incentivisation from current HR processes, in recognition of the special operating environment in which it finds itself. This is an existential matter for CJBS and will be put forward to the present Review Committee.

- To examine possibilities for sharing resources (e.g. technicians, equipment, workshops) for increased efficiency and for increased career incentives.

8 Human Resources

The overall objective of the School’s HR strategy is to promote best practice across the School in all aspects of staff development, reward, welfare and inclusivity to sustain its reputation for global leadership in scholarship, teaching and research. To set targets for staff expansion. The most recent version of the detailed objectives and strategy is contained in minute HR/18/55, presented to the School’s Needs Committee in MT 2018, and produced by Ms Tracy Brooks (HR Business Manager). The full details are not
reproduced here, but it is instructive to summarise the substantial list of objectives to be attained, thus.

**A. Recruiting and retaining talent**

8.1 Ensure that recruitment is managed strategically and is aligned to institutional succession plans. To manage the introduction of the University’s plan for Academic Career Progression (ACP) effectively. To establish desirable staff numbers for Departments by type, demographic etc.

8.2 Ensure that effective career progression opportunities are provided for all staff, and that excellence is recognised, rewarded and shared through the implementation of University reward and recognition schemes.

8.3 To ensure that all staff involved in recruitment and selection conduct fair and robust recruitment processes.

8.4 To ensure that senior leaders and managers are fully equipped to manage staff effectively to facilitate the retention of the best talent.

**B. Equality, diversity and inclusivity**

8.5 To continue to improve the gender balance of the workforce across academic staff in line with University policy.

8.6 To ensure best-practice, consistent HR is employed across all Departments including ensuring that management skills are actively developed to ensure staff wellbeing and optimal performance.

8.7 To tackle any reported bullying and similar infringements robustly (raising awareness of the University’s initiatives e.g. Breaking the Silence, Dignity@Work)

8.8 To increase completion of E&D online training and Unconscious Bias training.

**C. Organisational development and design**

8.9 To ensure that institutions have optimal organisational structures in place that will enable them to meet their current and long term objectives.
8.10 To raise skills and awareness of leading and managing change projects (i.e. reorganisations, TUPE, relocations) amongst senior leaders and managers.

8.11 To introduce a rational process for dealing with market pay, recruitment supplements etc., particularly at the Departmental level.

D. Increased translational research with industry and international assignments

8.12 To support institutions in collaborations and engagements with industry and wider society and in international initiatives (e.g. Nanjing).

This represents a huge activity, currently managed at the School level by one HR Business Manager and one HR Adviser. Currently, the School is working with central HR to introduce a second Adviser to relieve the very heavy workload, but funded from School reserves. It is noteworthy that the activities consuming large amounts of time are:

- A large caseload involving disciplinary matters, together with substantial issues raised by the restructuring occurring in two Departments.
- In a number of Departments, the level of departmental HR expertise is in need of an upgrade in terms of skills and training, so as to avoid problems being created at source and being passed on to the School team.
- Rewards and market pay considerations occupy huge amounts of time because a rational process does not exist. Introducing such a process – at least at the School level – is a priority, but the whole system, including REMCO and HR Committee needs an overhaul.
- Management training at all levels is essential to help reduce the caseload and to solve problems as they arise, rather than allowing them to be grow into much larger ones by inaction or inappropriate action.
- The HR aspects of putative international operations (e.g. Nanjing, Shenzhen) are substantial and time-consuming. The University needs to establish a rational process for dealing with foreign adventures.
- The devolution of initiatives from the Centre (e.g. the ACP process, Staff Survey) needs thought about the timescale with which they can be undertaken, given
existing resources. Indeed, if such initiatives have to be introduced quickly, the
centre needs to cost the extra resource required to ensure the desired speed.

- The School is of the opinion that pay, reward and grading need a substantial
overhaul to accommodate the particular needs of Departments.

The upshot of the above is that strategic aspects are not being addressed sufficiently,
thereby not catering for the future.

9 Conclusions

This document has set out the main elements of the strategy for the School of
Technology. It is expected that there will be substantial refinement as the School team
engages in discussion with Departments on the details. Although the current state of
University finances is giving cause for concern, we believe that the School of Technology
can play a substantial part in recovery and future growth. This does require, however, that
the University develops more responsive business models for new courses, adopts a
progressive approach to expanding student numbers and, most importantly, considers
reducing the taxation rate on School income as an experiment in order to incentivise new
initiatives, which could produce greater income than the tax foregone. In Section 7.2, two
“experiments” are suggested to increase income and to allow CJBS to grow substantially.

Overall, the School believes there are opportunities for business process
improvement (e.g. in HR, finance) and real opportunities for sharing resources (e.g.
workshops, technicians) where the sharing also gives improved career prospects and skills
for those concerned. Whether or not there should be academic posts in the gift of the
School, and designed to lead the major Research Themes, is for further debate within the
School.

Finally, the School is acutely aware of its close relationship with industry. We
believe there are real opportunities for expansion, but it requires a substantial level of
interaction with the University to produce a coordinated process for this complex problem.
### Table A: Research Strategy *(Green shading implies completed; yellow means in progress)*

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Strategies to Progress</th>
<th>Actions to achieve strategies</th>
<th>Responsibility</th>
<th>Target activity year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective 1</strong>: To encourage researchers to draw together their interests into School-level themes to create the impetus, capacity and profile necessary to connect more effectively with major challenges and the funding and resourcing thereof.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 To establish a coherent research strategy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Key actions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Establish an effective Research Committee (RC).</td>
<td>HoS, HoS, School Sec.</td>
<td>July 2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Recruit Deputy HoS (Research and Strategy) to include chairing RC.</td>
<td>DHoS, HoS, School Sec.</td>
<td>Sept. 2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Agree Research Themes and Leads by programme of visits to Departments, including workshops.</td>
<td>Needs</td>
<td>Aug – Dec 2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Establish School seed-funding to allow academics to explore feasibility of major new themes</td>
<td>Research Committee</td>
<td>Oct 2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Investigate specific funding opportunities:</td>
<td></td>
<td>May 2019 –</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Identify potential new SRIs to be led by SoT. To set up 4-5 new strategic research initiatives by 2022</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>o Work with ROO to obtain earlier notice of research calls</td>
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<td></td>
<td></td>
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<tr>
<td>o Identify researchers in other Schools to initiate specialist meetings</td>
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</tr>
<tr>
<td><strong>1.2 To promote recruitment and development of academics, PDRAs and PhD students of the highest quality.</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Key actions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• To engage with CUDAR to prioritise opportunities for (i) fellowships (e.g. Dowling) and (ii) studentships for PDRAs and PhD students of the highest calibre.</td>
<td>DHoS, HoS, HoDs, CUDAR</td>
<td>2019 –</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• To engage with CUDAR to prioritise needs for substitutional funding for chairs and other researchers, especially schemes including start-up funding.</td>
<td>DHoS, HoS, HoDs, CUDAR</td>
<td>2019 –</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**SCHOOL OF TECHNOLOGY**

- To raise research management standards by promoting training in management essentials, research ethics, open research, responsible innovation etc.
- To promote mechanisms for sharing experience with applications for research and fellowships, including mentoring, Masterclasses etc. Also to assist with internal peer review of important large applications, where requested by PIs.
- Develop reward systems for excellence (e.g. innovation fund to reward solution of significant challenges).
- Review recruitment regularly and remove bottlenecks where possible – HR Business Forum.

<table>
<thead>
<tr>
<th>Research Committee</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Committee</td>
<td>2018 -</td>
</tr>
<tr>
<td>HoS, HR Business Manager</td>
<td>Oct 2019</td>
</tr>
</tbody>
</table>

### 1.3 To work strategically with industry, government and other bodies to expand the School’s funding base further

**Key actions**

- To explore options for increased influence through other University initiatives, e.g. Maxwell Centre, Carbon Neutral Centre etc.
- By extending Masters’ and CPD offerings, to open dialogues with new companies on both training and research. In particular, to develop a large, AI-based MSt in Technology in conjunction with Centre.
- To develop an effective process, in conjunction with the Centre, for managing offshore activities, e.g. Nanjing, Shenzhen etc., and ensuring that they add value. To record lessons learnt.
- To promote participation in large grants and strategic bids.
- To disseminate best practice in various modes of delivery, e.g. by drawing on strengths in CISL and JBS. Consider developing a company similar to JBSEEL to deliver training, short-term studies etc.

| HoS, DHoS | 2019 – |
| HoS, DHoS, School Sec, PVC (S&P), PVC (B) | Oct 2019 – |
| DHoS, SPO, PVCs | 2019 – |
| DHoS, HoS, PVC (R) | 2019 – |
| DHoS, HoS, School Sec., PVCs etc. | MT 2019 |

### 1.4 To work with Departments to determine the optimum strategy and submission for REF.

**Key actions**

- To coordinate activities through the School REF Committee

| School UoA Committee | Aug 2019 |
### SCHOOL OF TECHNOLOGY

- To set up a special School Committee for UoA 12 to determine optimum approach, ways of working, support, code of practice, the identification of, and support for, impact cases etc.

| HoS, School Sec., REF Office | Mar 2019 |

**1.5 To communicate, effectively, appropriate new developments and impact arising in the School.**

**Key actions**

- Formalise a communications team including external advisers. Formalise methods of communication through revamped web site which is regularly updated.
- Link communications managers across the School to ensure coherent approach. Define interaction with University’s Comms. Office. Communications Committee needed? – RC to consider.

| Research Committee | Oct 2019 – |
| Research Committee | Oct 2019 - |
### Table B: Teaching Strategy

**Objective 2:** To help Departments maintain, develop, create and fund internationally-leading courses in undergraduate and postgraduate education taking into account trends in learning, teaching, delivery and necessary balance of subjects taught. This includes examining and encouraging benchmarks of quality across courses and assisting course-leaders to prepare for reviews by external funders (*e.g.* for EPSRC CDTs).

2.1 To work with the Centre, as appropriate (*e.g.* as a member of the GB’s Education Committee) to give informed oversight on postgraduate and undergraduate matters.

**Key actions**
- To recruit an effective Director of Education (DE) for the School who will liaise and inform effectively.
- To disseminate developments by means of presentations in Departments and via revamped SoT website.

<table>
<thead>
<tr>
<th>HoS, School Sec.</th>
<th>As required</th>
</tr>
</thead>
</table>

2.2 To grow undergraduate numbers appropriately, taking into account access and participation *etc.*

**Key actions**
- SoT to enter into early discussions with Departments about aspirations for changes in undergraduate numbers. To coordinate aspirations with consultations with, *e.g.* colleges Senior Tutors’ Committee to gauge practicable increases.
- To determine variations and trends in numbers. To examine where high quality students (*e.g.* from very oversubscribed courses, or international students) are lost and strategies to mitigate this.
- To review new technology developments to streamline courses and optimise use of staff resources.

<table>
<thead>
<tr>
<th>SoT Education Committee, DHoS (Teaching), Senior PVC</th>
<th>Oct 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Office, School Education Committee</td>
<td>Oct 2019</td>
</tr>
</tbody>
</table>

2.3 To work with the Centre to help ensure smooth introduction of electronic capture, on-line learning and testing and other new developments in pedagogical innovation. To coordinate/inform information on new teaching technology.

**Key actions**
### Key actions

<table>
<thead>
<tr>
<th>Action</th>
<th>Leader(s)</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>To set up a Steering Committee as part of ITSC to guide School</td>
<td>IT Strategy Committee, DHoS (Teaching),</td>
<td>2019</td>
</tr>
<tr>
<td>developments and activities and signpost resources and expertise.</td>
<td>Education Committee</td>
<td></td>
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<tr>
<td>To encourage dissemination across the School and sharing of best</td>
<td></td>
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<tr>
<td>practice (“teaching master classes”, workshops etc.).</td>
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<tr>
<td>To identify and implement a set of pilot projects.</td>
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<tr>
<td>To understand resourcing required to introduce new techniques.</td>
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<tr>
<td>2.4 To have a clear-sighted, active, coordinated strategy for the</td>
<td></td>
<td></td>
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<tr>
<td>management and development of graduate and professional education.</td>
<td></td>
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<tr>
<td><strong>Key actions</strong></td>
<td></td>
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</tr>
<tr>
<td>To revise and refresh SoT Education Committee’s ToRs.</td>
<td>DE, Ed. Committee</td>
<td>MT 2019</td>
</tr>
<tr>
<td>To benchmark taught masters’ courses and feedback within School</td>
<td>Education Committee</td>
<td>MT 2019 –</td>
</tr>
<tr>
<td>and externally. To suggest action where unsatisfactory trends appear.</td>
<td></td>
<td>LT 2020</td>
</tr>
<tr>
<td>To communicate responsibilities and activities in PhD student-</td>
<td>DE, HoDs</td>
<td>LT 2019</td>
</tr>
<tr>
<td>supervisor-adviser arrangements. In particular, to emphasise</td>
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<tr>
<td>appropriate research productivity and guidance, including writing.</td>
<td></td>
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<tr>
<td>To form a CDT Management Committee to ensure consistent practices</td>
<td>DE, HoDs</td>
<td></td>
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<tr>
<td>and coherence across programmes.</td>
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<tr>
<td>To encourage the generation of new offerings: short courses,</td>
<td>DE</td>
<td>LT 2019</td>
</tr>
<tr>
<td>professional development, MSts etc.</td>
<td>DE, Fin. Officer, Ed. Committee, PVCs</td>
<td>Oct 2019</td>
</tr>
<tr>
<td>To work with the Centre to determine the actual costs of running</td>
<td>DE, Fin. Officer, Ed. Committee, PVCs</td>
<td>Oct 2019</td>
</tr>
<tr>
<td>programmes so that costs are explicit and known.</td>
<td></td>
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</tr>
<tr>
<td>To coordinate aspirations on increases in student numbers with</td>
<td>DE, Ed. Committee</td>
<td>Aug 2019</td>
</tr>
<tr>
<td>consultations with, e.g. colleges Senior Tutors’ Committee, PVCs to</td>
<td></td>
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<tr>
<td>gauge practicable increases. To discontinue loss-making courses.</td>
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<tr>
<td>To oversee how DTPs are meeting EPSRC expectations, e.g open access,</td>
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<tr>
<td>responsible innovation. To ensure such expectations are disseminated</td>
<td></td>
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<tr>
<td>to holders and supervisors of DTPs.</td>
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</tr>
</tbody>
</table>
Table C: Capital and Infrastructure Strategy

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Strategies to Progress</th>
<th>Actions to achieve strategies</th>
<th>Responsibility</th>
<th>Target activity year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective 3:</strong> To ensure that Departments are housed in buildings suitable for the pursuit of teaching, research and learning at the highest levels of international excellence.</td>
<td></td>
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<tr>
<td><strong>3.1 To build cases for capital expenditure to be made to PRC.</strong></td>
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<tr>
<td><strong>Key actions</strong></td>
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</tr>
<tr>
<td>• To take early advice with PVCs about cases prior to submission and to ensure that obvious risks are carefully discussed together with strategies for mitigation.</td>
<td>HoS, DHoS</td>
<td>2019 –</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• School office to assist with case details, as required, and also with reading and feedback prior to submission.</td>
<td>School Sec., Finance Manager</td>
<td>2019-</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3.2 To monitor progress of buildings projects, plans for relocation, refurbishment etc. via Project Boards to ensure that projects are delivered in a timely way and within budget. To monitor deviations from the plan and to minimise effects by altering strategies accordingly.</strong></td>
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<tr>
<td><strong>Key actions</strong></td>
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</tr>
<tr>
<td>• To ensure active participation in Project Boards and to identify strategies for dealing with issues at as early a stage as possible.</td>
<td>HoS, HoDs, PRAO</td>
<td>2019 –</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• On large projects, e.g. Move West, to refresh plans regularly to ensure that latest needs are being catered for and to ensure that fundraising is in line with building strategy.</td>
<td>HoS, HoD</td>
<td>2019 –</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• To examine the possibilities of more than one Department sharing a building where there are, in fact, common interests.</td>
<td>HoS, HoDs</td>
<td>2020 -</td>
<td></td>
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</tr>
<tr>
<td><strong>3.3 To ensure that reasonable goals are set for fundraising and to set priorities for fundraising with, e.g. CUDAR.</strong></td>
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</tr>
<tr>
<td><strong>Key actions</strong></td>
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</tr>
</tbody>
</table>
3.4 To raise concerns where external developments in infrastructure (e.g. transport or other buildings) impinge on the ability of a Department to expand or relocate. In particular to defend the space earmarked for the Engineering Master Plan.

<table>
<thead>
<tr>
<th>Key actions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Raise issues at appropriate Project Boards. Ensure that minutes and other documents reflect the concerns</td>
<td>HoS, HoDs</td>
</tr>
</tbody>
</table>
# Table D: Philanthropy and Fundraising Strategy

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Strategies to Progress</th>
<th>Actions to achieve strategies</th>
<th>Responsibility</th>
<th>Target activity year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective 4: To facilitate donations and grants to enable Departments to pursue their building, research, teaching etc. plans in a timely way.</td>
<td></td>
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<tr>
<td>4.1 To maintain a database of fundraising priorities for individual Departments, including specific strategies for raising funds and critical timescales.</td>
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<tr>
<td><strong>Key actions</strong></td>
<td></td>
<td></td>
<td></td>
<td>2019</td>
</tr>
<tr>
<td>• Work with CUDAR to establish priorities for fund raising and strategy for doing so, including where School or Departmental input is required. Ensure that plans and timescales are realistic for projects.</td>
<td>HoS, CUDAR, HoDs</td>
<td></td>
<td>2019</td>
<td></td>
</tr>
<tr>
<td>• Work with the SPO/PVC to develop industrial contacts and action plan. Ensure careful liaison with key academics.</td>
<td>HoS</td>
<td></td>
<td>2019</td>
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<tr>
<td>4.2 To monitor success of fundraising for specific projects.</td>
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<tr>
<td><strong>Key actions</strong></td>
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<td></td>
<td></td>
<td>2019</td>
</tr>
<tr>
<td>• Ensure that CUDAR priorities are reviewed regularly and fundraising success on projects is, too. To alter plans to suit failing targets.</td>
<td>HoS, Project Boards</td>
<td></td>
<td>2019</td>
<td></td>
</tr>
<tr>
<td>• Communicate problems (and successes) to Centre to manage expectations e.g. for PRC.</td>
<td>HoS</td>
<td></td>
<td>2019</td>
<td></td>
</tr>
<tr>
<td>4.3 For donations and gifts, to ensure HoS and HoD engage with lead academic on a proposal before the proposal is sent to the donor. To ensure CUDAR obtain CBELA permission for the process to proceed.</td>
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<tr>
<td><strong>Key actions</strong></td>
<td></td>
<td></td>
<td></td>
<td>2019</td>
</tr>
<tr>
<td>• Establish a simple policy of communication on such projects, including procedure for School sign-off.</td>
<td>School Sec.</td>
<td></td>
<td>2019</td>
<td></td>
</tr>
</tbody>
</table>
### Table E: Financial Strategy

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Strategies to Progress</th>
<th>Actions to achieve strategies</th>
<th>Responsibility</th>
<th>Target activity year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective 5:</strong> To increase external income to enable flexibility of operations and approaches and to incentivise new initiatives.</td>
<td></td>
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</tr>
<tr>
<td>5.1 To raise external research income in School by 50% by the end of 2025.</td>
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<tr>
<td><strong>Key actions</strong></td>
<td></td>
<td></td>
<td>Research Committee, DHoS (R&amp;S)</td>
<td>2019 –</td>
</tr>
<tr>
<td>Research Committee to encourage large, cross-Departmental initiatives</td>
<td></td>
<td></td>
<td>School Office, ROO rep.</td>
<td>MT 2019 –</td>
</tr>
<tr>
<td>Establish PhD fund (e.g. DTPs) to involve PhDs between Departments with supervisors/advisers from respective Departments.</td>
<td></td>
<td></td>
<td>Research Committee, PIs</td>
<td>2019 –</td>
</tr>
<tr>
<td>To make call information available in a timely way and to identify researchers to whom it might be of especial interest. Identify research “portals” in Departments.</td>
<td></td>
<td></td>
<td>HoS, DHoS</td>
<td>MT 2019 –</td>
</tr>
<tr>
<td>To establish/encourage special workshops in key areas and work to encourage industry attendance.</td>
<td></td>
<td></td>
<td>HoS, DHoS</td>
<td>2019 -</td>
</tr>
<tr>
<td>Interact with Maxwell Steering Committee, Carbon Neutral etc.</td>
<td></td>
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<tr>
<td>5.2 Pro-actively engage with the University’s Strategic Research Initiatives and Networks and encourage large research bids at University level, using the breadth and depth of the School’s research areas.</td>
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</tr>
<tr>
<td><strong>Key actions</strong></td>
<td></td>
<td></td>
<td>Research Committee</td>
<td>MT 2019 –</td>
</tr>
<tr>
<td>Identify internal research champions who will interact with SRIs and networks</td>
<td></td>
<td></td>
<td>Research Committee</td>
<td>2019 –</td>
</tr>
<tr>
<td>Feedback and action through informal research meetings and workshops facilitated through School.</td>
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</tbody>
</table>
### SCHOOL OF TECHNOLOGY

- Foster PhD studentships bridging two Departments to help initiate new thinking at interfaces by having co-supervision. Perhaps via the DTP funds.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsible Party</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.3 To communicate with, and work with, the Centre on various opportunities for fund raising and income generation.</td>
<td>Research Committee</td>
<td>MT 2019 -</td>
</tr>
<tr>
<td>• Develop effective business cases for fundraising projects in Departments</td>
<td>HoS, HoDs, School Sec.</td>
<td>2019 –</td>
</tr>
<tr>
<td>• Establish schemes to incentivise Departments by relaxing taxation at Centre/increasing independence of operation. This to be considered once review of CJBS has taken place to establish devolution principles.</td>
<td>HoS, ProVC (S&amp;P)</td>
<td>2020</td>
</tr>
<tr>
<td>• To contribute to Centre debate about reducing costs and raising income by careful analysis of Centre proposals and implications for School. HoS to articulate concerns.</td>
<td>HoS, Needs Committee, School Sec.</td>
<td>2019 -</td>
</tr>
<tr>
<td>5.4 To manage smooth implementation of University financial models as they affect Departmental income, e.g. implementation of the Income Incentivisation Model.</td>
<td>Needs Committee, School Finance Manager, HoS</td>
<td>2019 –</td>
</tr>
<tr>
<td>• Scenario planning undertaken in School office to be shared with HoDs (e.g. at Needs Committee) to understand implications and agree optimum methods of implementation.</td>
<td>Needs Committee, School Finance Manager, HoS</td>
<td>2019 –</td>
</tr>
<tr>
<td>• Communicate problems to Centre as soon as they are spotted – take early action.</td>
<td>Needs Committee, School Finance Manager, HoS</td>
<td>2019 -</td>
</tr>
</tbody>
</table>