Institution: Imperial College London
Unit of Assessment: 19 (Business and management studies)

a. Context

From its outset, Imperial College's Mission Statement has been not merely the discovery of science but its effective impact on the economy and society. Research in the Business School has had substantial impact on corporate behaviour and performance, on government policy, and on wellbeing. Our principal focus has been on innovation, entrepreneurship, government policy (including the roles of science research, innovation policy, and tax incentives more generally), and healthcare. Principal beneficiaries and forms of impact include:

Companies: Our research has enhanced efficiency via more effective innovation processes and corporate reorganisation [Case Studies 'Reorganising IBM staff and capabilities', 'Transforming the project-based firm']. Companies partnering in research, and changing behaviour in consequence, are detailed in subsequent sections.

UK Government: Working closely with BIS, the Treasury, and the Patent Office, our research changed the Government's assessment of the benefits of science research ['Defending Government investment'], its modelling of how tax incentives affect saving and retirement ['Using tax incentives'], and how it can promote telecare to mitigate the tension between increasing healthcare demands and the tighter government budgets ['Promoting remote care'].

Other governments: By developing a theory of entrepreneurship promotion, and an international GEDI index to make this operational, we changed the way in which the EU is going to allocate its Structural Funds, and the policies of many national governments wishing to remove impediments to entrepreneurship ['Identifying and eliminating bottlenecks'].

Professional practice: Research by our Centre for Management Buyout Research became a benchmark for the British Venture Capital Association. Research-led training provided by Design London trained 580 SMEs in techniques to enhance their competitiveness through better design. Our research on actuarial finance allowed us to develop a bespoke Masters in Actuarial Finance that the Institute of Actuaries has adopted as the elite pathway by which new actuaries in the UK receive their training.

Wellbeing: In addition to the contribution of our telecare research ['Promoting remote care'], we have also influenced policy towards effective public health delivery in a number of countries, including Turkey, Russia, and the Gulf states.

b. Approach to impact

Serious impact is slow to accomplish, and rarely achieved by individuals acting alone. We nurture teams of researchers – internal and external to Imperial – building deep relationships with partners in business and government, allowing our influence to develop. In many cases, these are supported by large grants. Our greatest impacts result from years of collaboration. From the outset, we seek research relationships with such opportunities.

Staff are supported by (a) a culture making this strategy explicit (b) the existence of grants and relationships into which to embed new staff (c) recruitment, appraisal, and promotion policies that emphasise success in these dimensions (d) working with Imperial faculties of Engineering & Medicine to harness their corporate and policy relationships and build more effective inter-disciplinary teams (e) working with Imperial College's Corporate Partnerships to strengthen external relationships yet further.

Innovation The flywheel for this research and impact was the EPSRC £8.5m funding over ten years (£3.1m 2003-08; £5.4m 2008-12) for an Innovation Studies Centre, led by Professor David Gann. Corporate partners included Arup, Atkins, Balfour Beatty, Buro Happold, Crossrail, Heathrow T5, IBM, Proctor & Gamble, and Laing O'Rourke. Much of the research spanned construction, engineering design, and project management. Lessons were transferred from one

project to another, within the limits of commercial confidentiality. Corporate partners helped in the initial formulation of research questions and original EPSRC grant proposal. The Case studies ['Reorganising IBM staff and capabilities', 'Transforming the project-based firm'] discuss how organisational structures at IBM and Laing O'Rourke were transformed by applying lessons from this research.

Our work on engineering design was cited in the *Cox Review of UK Design & Competitiveness.* As a result, the Business School, Imperial's Faculty of Engineering & the Royal College of Art (RCA) founded Design London, with £5.8m support from HEFCE & NESTA. Design London provided design training for 580 SMEs and launched 10 spinout businesses, the best now valued at £3m. To sustain Design London's impact, the Chair of its advisory board, Sir James Dyson, donated £5m to the RCA – on condition it kept working with Imperial's Faculty of Engineering and the Business School. Design London led to a number of successful spin out companies. Four currently have products in the market including: The Mu or Folding Plug from Made in Mind, Brit Designer of the Year Award 2010; and Plumis, a fire suppression system that won the Dyson Award 2009. Design London maintained a 5%-20% stake in these companies, now valued at around £10m. Initiatives have won the UK Dyson Award, the RCUK Business Plan Competition, and a Grand Challenges Explorations Award, funded by the Bill and Melinda Gates Foundation. Almost 600 companies – mainly SMEs - participated in design training workshops and seminars at Design London.

Similarly, we had major impact on how construction mega-projects are managed and delivered. We conducted extensive research on the Terminal 5 construction project, working with its programme director Andrew Wolstenholme, who is now CEO of Crossrail, Europe's largest construction project. On our impact website, Andrew attests how our long partnership with him, and lessons learned along the way, was critical to his innovation strategy at Crossrail.

We worked with IBM to develop a bid to EPSRC for a new Digital Economy Lab (DEL) to explore how data captured in one use can be reused elsewhere to drive efficiency gains and even new business models. Larry Hirst, ex-chairman IBM Europe, not only chairs the DEL advisory board, he accompanied two Imperial professors (Business School, Engineering) to Swindon to pitch and win the £2m grant. The project now includes the Met Office, Cisco, & Intel. It is too early to document impact outcomes but this illustrates our general approach to impact.

We also second staff to companies or government. Since 2009, Dr Keith Smith has been seconded to BIS to head thought leadership on innovation policy. His advice to ministers led to the *UK Innovation and Research Strategy for Growth* (drawing on research of Imperial colleagues including Professors Gann, Haskel and Salter) and has led to invitations to advise the governments of Sweden and Norway.

Healthcare Professor James Barlow led a four-university bid (HaCIRIC) for research on healthcare innovation (£7.2m, EPSRC, 2006-11, renewed for £3.9m for 2011-13). Again, the bid design intimately engaged prospective users and long-time collaborators: Partnerships for Health, Community Health Partnerships, NHS trusts, and the industry supply chain, including IBM and Laing O'Rourke. HaCIRIC became the largest programme in the world analysing the interplay of technology, infrastructure, and services in healthcare. The UK Whole System Demonstrator programme - the largest trial of telecare yet conducted - was then developed by the Department of Health, in collaboration with HaCIRIC researchers and based on our work. Its findings shaped the government's next-generation telecare programme, to deploy the technology to 3 million people over the next 5 years, with an estimated net saving to the NHS of £450m. This is further detailed in our impact case study on 'Promoting remote care'.

HaCIRIC illustrates the porous nature of intellectual boundaries in the Business School. Before joining our healthcare group, Professor Barlow was Deputy Director of the Innovation group. Ideas about innovation and efficiency flowed easily between innovation and healthcare research; corporate partners in one programme (e.g. IBM, LOR) became engaged in the other, seeing new opportunities for impact, and then became engaged in our more recent research on the digital economy. Capturing data on patients and their location leads to insights about better transport patterns, industrial relocation, and energy use. As we work with Cisco, Intel et al to create appropriate platforms, benefits and impact will flow back to users in healthcare, energy, environment, construction, and even retail.

Energy Energy is another strategic priority of Imperial College. Participating in this research lets the Business School use - and contribute to - Imperial's long-term partners, such as BP, which funded the Urban Energy Systems project to forecast the future evolution of our cities and their needs. Similarly, Imperial's Energy Futures Lab works closely with companies such as Centrica, National Grid and Rolls Royce, a conduit for us to learn about their challenges and contribute to their solutions. We are involved in two EPSRC Grand Challenge Consortia on energy networks and on energy storage. Their Advisory Boards include members from the Department of Energy and Climate Change and the energy regulator, Ofgem. We recently participated in a major study of integrated transmission planning and regulation for Ofgem: our research is feeding into regulatory policy in this area. We provided evidence to the House of Commons Energy and Climate Change Committee, correcting misleading claims about the cost and emissions savings from wind energy.

Finance In 2006, Brevan Howard funded a Centre for Hedge Fund Research in the Business School. Brevan Howard staff directly interacted with our Finance group, both at Imperial and in their offices, embedding our research in their operating practices. Robert Kosowski contributed to the report 'Impact of the proposed AIFM Directive across Europe', prepared for the FSA, a major input into the FSA (and thus UK) response to the European Commission's Regulation on Alternative Investment Fund Managers (http://www.fsa.gov.uk/pubs/other/Impact_of_AIFM_Directive.pdf). Kosowski then became Special Advisor to the UK House of Lords inquiry into the AIFM Directive, then to the House of Lords' inquiry into OTC derivatives regulation. After 6 years building a relationship with Brevan Howard, in 2012 Brevan Howard donated £20m to the Business School to establish a Finance Centre of world repute, with a brief to conduct research of significance and disseminate these findings effectively, materially to influence public policy and public understanding of financial issues.

Our research on insurance and climate change led to a KTP partnering a consortium of Lloyds Syndicates to model large commercial risks, creating an anonymised dataset of losses and exposures for public release to the industry and the academic community by end 2013, allowing the insurance industry better to quantify the uncertainty surrounding a class of perils traditionally called "non-modelled risks". In another KTP with FINEX, a division of Willis covering Financial and Executive Risks, the School is developing a risk appetite index to allow underwriters better to address the needs of financial clients.

Entrepreneurship We develop impact of our entrepreneurship research by building relationships with entrepreneurs - and their firms, advisors, & finance providers – and policymakers. The Centre for Management Buy-Out Research (CMBOR) transferred to Imperial in 2011. CMBOR has developed deep relations with iEquistone Partners Europe (formerly Barclays Private Equity), Ernst & Young, and the British Venture Capital Association. CMBOR has had multiple impacts over the REF period, including: development of sponsors' private equity market strategies throughout Europe; the Bank of England report on private equity in 2013; British Venture Capital Association reports on the role of private equity in growth (acknowledged by Business Secretary Vince Cable as *"relevant in terms of the work of this department in promoting non-bank finances"* at an event for the Academy of Social Science on 18 June 2012); and reports for the ICAEW explaining the workings and effects of private equity to policymakers and practitioners.

Research by our academic entrepreneurship group led to two subsequent INTERREG projects (2008-20011; 2012-2015), financed by the European Commission (EC), translating our research results to a consortium of tech transfer organisations throughout Europe to develop best practices for stimulating academic entrepreneurship. Our research has also led to an on-line entrepreneurship training tool, and set of best practices, currently used by universities throughout Europe (Vlerick Leuven Gent Management School, Imperial College, DTU, Denmark, RSM and Lithuania's Sunrise Valley project). Our approach has been shown to increase the metacognitive knowledge of students and raise their entrepreneurial capability.

The group's reputation and impact in entrepreneurial finance and institutional influences on entrepreneurship were influential in gaining funding for Imperial's part of the £2.9m newly created Entrepreneurship Research Centre (ERC) from ESRC, BIS, TSB and British Bankers' Association (BBA). An early impact has been to influence policy thinking on the development of the Business Bank.

Consequences of these relationships This set of partnerships let us (a) validate the culture of research and impact in the School (b) generate over £20m of resources within the REF period, some of which has been used to lighten teaching loads of staff and allow their greater focus both on conducting research and then working with organisations to convert knowledge into behavioural change (c) develop a reputation for effectiveness that encourages companies and government to seek our advice.

c. Strategy and plans

This strategy, which we continue to pursue, integrates research & impact. The prospect of impact excites researchers & attracts funders. Participation of prospective users keeps research relevant, sharpens its questions, and enables access to data and people that would otherwise be unlikely. Discoveries are then embraced, and impact achieved. This drives the next round of research. Impact is not tacked on at the end of a project; the route to impact is embedded from the outset.

Several structures help deliver this strategy:

(a) Imperial Corporate Partnerships is a team dedicated to building relationships with leading companies and assembling within Imperial, including the Business School, the team of researchers needed to engage effectively;
(b) Each of our principal activities has a dedicated Advisory Board of corporate and government members, who broker relationships and stress the need to aim for impact as well as academic success;
(c) The Imperial Business Partners Programme tackles shared strategic issues through thought-provoking dialogue between our academics and Imperial's core industrial partners;
(d) Direct secondment – Dr Keith Smith to head Innovation research at BIS, Professor David Gann to be Group Innovation Executive at Laing O'Rourke, and Professor James Sefton to be Managing Director for Risk at UBS.

d. Relationship to case studies

As described in section b. above, our fundamental strategy was developed in the Innovation Studies Centre, which then gave rise to innovation impacts in case studies ['Reorganising IBM staff and capabilities', ['Transforming the project-based firm']. This led to:

- The recruitment of Professor Haskel from QMUL, whose work on previously unmeasured benefits of the knowledge economy then influenced the Treasury to spare the science budget in the austerity cuts ['Defending Government investment'];
- Our proven success of innovation research and translation allowed us to partner EPSRC and QinetiQ in a programme on tech transfer in physical sciences, recruiting Professor Autio, whose work on innovation and entrepreneurship then led to the Global Innovation Development Index ['Identifying and eliminating bottlenecks'];
- Professor Richard Baldwin - Chair of Partnerships for Health and Chair of the Advisory Board of our Innovation Studies Centre - then worked with us to facilitate HACIRIC funding from EPSRC, and to transfer results to healthcare practice ['Promoting remote care'], drawing on relationships with IBM and LOR;
- Our core focus on large groups does not preclude the talented lone scholar from making a material difference. Professor James Sefton, an economics professor who has served several periods on secondment as Managing Director of risk at UBS, developed a simulation model of the effects of tax and benefit changes on saving, retirement and labour supply decisions. This has now become a core tool at HM Treasury as it evaluates prospective policy changes ['Using tax incentives'];
- Similarly, Professor Tommaso Valletti's work on competition and regulation in the telecoms industry did not arise out of one of our grant-funded centres, but through Professor Valletti's individual research endeavours and influence with regulators ['Regulating the telecommunications market'].