Experience from 16 years of support to Knowledge and Technology Transfer and Exchange projects by **The Gatsby Charitable Foundation**

The Gatsby Charitable Foundation

Experience from 16 years of support to Knowledge and Technology Transfer and Exchange projects by the Gatsby Charitable Foundation

October 2010

Foreword[1]

This document marks the conclusion of The Gatsby Charitable Foundation's involvement in Knowledge and Technology Transfer and Exchange (KTT), and looks back at the range of initiatives and research it has supported.

It also serves a purpose in looking forward. By sharing the lessons learned from 16 years of support to KTT, it will hopefully inform those practitioners and policy makers who continue the important work of building effective links between the research community and industry.

When Gatsby first became involved in KTT 16 years ago, the landscape was unrecognisable. Most crucially perhaps, there was little to no support for KTT from government.

That has now changed, no doubt helped in part by the pioneering initiatives that Gatsby has supported. Hence Gatsby's decision to draw its involvement to a close since its aim of supporting the establishment of a KTT sector has been fulfilled.

The range of Gatsby's support is exemplified by its first and final grants.

In 1994 Gatsby joined with the John Innes Centre at Norwich to establish a company which would help commercialise the internationally excellent research undertaken there and at the Sainsbury Laboratory – Norwich. Plant Bioscience Limited still provides services to those two institutes, but now its reputation has developed to an extent that it attracts business in its specialised domain from groups across the UK and, indeed, from many other countries.

Gatsby's latest grant, just coming to an end, has focused on the Further Education (FE) sector and supported the New Engineering Foundation to develop and test a framework for KTT in FE colleges. It is still too soon to judge the impact that this work will have, though central government and regional agencies are already adopting some of the lessons from the pilot schemes funded at a selection of colleges. Improving links between firms and FE colleges should help firms directly through project assignments and indirectly by ensuring that the workforce they require benefits from teaching informed by industry's needs and enlivened by practical engagement.

Not all the grants have led to unqualified success, but most of the projects have performed strongly, which suggests that there is a latent enthusiasm among both researchers and firms for closer links. However, to release the latent potential has required hard work by dedicated professionals, and Gatsby has been fortunate in many of the individuals who have driven forward the work we have helped to fund. Many of them have given generously of their time in informing this review.

[1] The review was undertaken by Bill Wicksteed who was a co-author of a review of Gatsby-supported Technology Transfer (TT) projects in 2000 – *Six Case Studies in Technology Transfer* – and of a report on Gatsby support to the Institute for Manufacturing in 2007.

Contents

1: Introduction

1.1 This report looks back over a period of almost 20 years during which time the interest in, commitment to, and resources available for Knowledge and Technology Transfer and Exchange (KTT) have been transformed. It is quite probable that initiatives pioneered by The Gatsby Charitable Foundation played a part in raising general awareness of the importance of KTT for wealth creation. They were certainly important in galvanising energy within the institutions which were supported.

1.2 The report does not present an evaluation of the various grants in terms of the additional outputs they generated. Rather, it seeks to describe the operating experience of some of the more interesting initiatives to draw out lessons that may be helpful to the future development of policies, programmes and organisational structures which aim to enhance further the contribution which KTT makes to wealth generation, research and teaching.

1.3 Gatsby's involvement with KTT was in part an outcome of a concern, dating back to 1983, to improve the relevance of engineering education to industry's needs. Support was given to a variety of initiatives to address these concerns, including:

- the Engineering Education Continuum (subsequently renamed BEST) to encourage "the most able students studying maths and science to aspire to a leadership role in manufacturing industry and assist them by providing early leadership and entrepreneurial opportunities". The programme elements spanned schools, undergraduate education, and postgraduate education – through the Sainsbury Management Fellowships which "provides a bursary to talented young engineers with leadership potential to study for a Masters degree in Business Administration (MBA) at internationally renowned business schools"; and

- support for two courses at Cambridge University, the Advanced Course in Design, Manufacture and Management and the Manufacturing Leaders Programme.

1.4 Grants were given to seed a number of KTT initiatives to enable university ideas, invention and know-how to be available to industry and local communities. Initially the grants resulted from the Trustees taking a positive stance towards interesting ideas that came to their notice, partly as a result of educational connections with universities. The grants are one of the two foci of this report, with the main initiatives documented and reviewed in Chapter Three. The other focus is on research projects which sought to increase the understanding of KTT processes and challenges. These are examined in Chapter Four.

1.5 In addition to these direct involvements with KTT, Gatsby has given sustained and substantial grant funding to scientific research, notably in plant science and neuroscience. Grantees are typically encouraged to carefully consider and identify the intellectual property (IP) arising from their work, and the best way of harnessing this for social and economic well-being. This report does not seek to cover such grants, nor those designed to improve the quality of entrepreneurship education. It also does not consider the funding Gatsby and the Wellcome Trust gave the Government's University Challenge programme to provide universities with seed funding to exploit their IP.

1.6 The emphasis given to individual projects varies somewhat, depending on:

- the evidence/analysis already available in the public domain;

- the likely interest of the project for policy makers and practitioners; and

- the time which has elapsed since the grant was given, bearing in mind the extent to which the policy context has changed over the past 15 years or so.

1.7 A number of individuals, most of whom have heavy workloads, have given generously of their time to provide information and engage in discussion – either directly for this report or indirectly in connection with earlier reviews that feed into this one. Some individuals have been involved more than once and to them especial thanks are due!

2: Overview

2.1 A previous review of six Gatsby-supported pilot technology transfer initiatives was published in 2000.[2] At that time government was starting to develop funding support for university outreach through two programmes:

• Higher Education Reach Out to Business and the Community, launched in 1998, sought bids competitively from universities for up to £1 million. Over a three-year period it allocated £66 million to 137 projects; and

• University Challenge Fund, launched in 1999, also operated through a competition and allocated £40 million to 15 seed funds. Both Gatsby and the Wellcome Trust made significant contributions to the £40 million and universities were required to add a further one-third to funds they were awarded (i.e. 25% of the total).

2.2 In the 10 years following, the policy emphasis given to KTT has strengthened markedly and led to the establishment of a third funding stream (alongside teaching and research) for knowledge transfer and dissemination. This has been paralleled by an increasing recognition of the importance of translational research to take inventions closer to the point at which their development can attract commercial funding.

Earliest grants

2.3 This policy framework was not in place when Gatsby's first grants for KTT activities were made. It is likely that the experience gained from those grants helped to demonstrate what could be achieved in the KTT sphere, in ways supportive of, rather than threatening to, teaching and research, and the potential contribution to regional development and national wealth creation. Interestingly, the earliest grants, all before 2000, covered a variety of approaches:

• the establishment of seed funds (at Southampton University and St John's Innovation Centre);

• the establishment of a freestanding company – Plant Bioscience Limited – to help commercialise Research Institute breakthroughs (at Norwich);

• the establishment of an Industrial Links Unit specific to one division of an engineering department (Cambridge University's Institute for Manufacturing (IfM));

• the dissemination and transfer of knowledge and expertise on a particular scientific topic to companies, especially small and medium enterprises (Nottingham University's School of Chemistry); and

• freeing up academic time for development of research with commercial potential i.e. essentially funding for proof of concept work (at Loughborough University).

2.4 In parallel with these practical activities, grants for research projects also helped to raise the profile of KTT. Funding was given for missions to leading US research universities under the aegis of the Committee of Vice Chancellors and Principals (now Universities UK). The CVCP report highlighted how a number of US universities had approached the establishment of policy frameworks and implementation teams for KTT and what they had achieved. A report on the Cambridge Phenomenon provided an illustration of the role that research can play in building a knowledge-rich cluster. A series of reports on funding technology highlighted the case for a policy focus on the availability of early stage finance.

Subsequent grants

2.5 Subsequent grants provided follow-on funding for activities at Cambridge, Loughborough and Nottingham. Again these were pilot projects exploring new approaches:

• building a team of third party associates at Cambridge's IfM to help overcome the constraint of scarce academic time;

• the employment of postdoctoral students at Nottingham for internal proof of concept work and project work for firms – using practical work to increase their understanding of research commercialisation; and

• seeking to build an internationally renowned cluster of sports companies at Loughborough.

2.6 The largest single grant was in support of the Cambridge-MIT Institute, established to encourage collaboration between the University of Cambridge and the Massachusetts Institute of Technology. A highly-regarded outcome from this complicated, government-inspired initiative was a not-for-profit organisation called Praxis set up to

[2] Bill Wicksteed and Walter Herriot, *Six Case Studies in Technology Transfer*.

provide training for university TT staff. Serendipitously this met the need identified in the earlier review of Gatsby projects, which suggested that the single most important issue for TT was the shortage of *"people with the right level and length of expertise and the necessary attitudes and sympathies to form the effective bridges between academic and business life"*.

2.7 Other initiatives supported were:

• a Proof of Principle programme at the University of Manchester which helped give positive impetus to the successful restructuring of KTT responsibilities following the merger with the University of Manchester Institute of Science and Technology; and

• path-breaking work to encourage KTT in Further Education through the New Engineering Foundation.

2.8 Further grants for research sought to provide an evidence base for a more balanced understanding of topics such as the choice of commercialisation route and the role of spin-outs; the availability of finance; the appropriateness of universities' patenting strategies and patent portfolios; and the nature and scale of benefits from publicly funded research. In addition to these specific research grants, a Fellowship was established at the University of Sussex which helped to draw together and disseminate experience from a range of projects and initiatives, including those supported by Gatsby.

Some common experience

2.9 Nearly all the initiatives Gatsby supported were, in their time, innovative. Some were genuinely pioneering. While this review does not pretend to the rigour of an evaluation, it seems likely that in most cases Gatsby's support enabled projects and research for which it would have been either impossible or else very difficult to find other sources of funding (i.e. there was a good deal of additionality).

2.10 Moreover Gatsby was seen by many recipients as providing support beyond the (vital!) provision of funds, for example by:

• raising the internal profile of the initiative and in some instances helping to leverage further funds;

• emphasising the need for an independent advisory board to appraise project applications with membership including a representative of the university leadership (to ensure institutional support) and practitioners with hands-on experience of commercialisation (bringing a streetwise "nose" to judge likely market acceptability);

• being positively willing to accept changes of focus in response to changed circumstances; and

• bringing independent perspectives and expertise from Gatsby's staff and advisers.

2.11 Most, but not all, projects achieved success in one form or another. The fact that not everything worked at a detailed project level is not a particular surprise given the experimental nature of several initiatives. The one clear-cut failure - a company called Calyx Plantech operating across six universities to increase the impact of plant science research - was a complicated and ambitious collaborative project which suffered from an inappropriate initial staff appointment.

2.12 The other side of the same coin is that much of the success achieved in the projects can be attributed to the enthusiasm and abilities of key individuals. Gatsby has tended to place considerable weight on the individuals applying for a grant and this review suggests it is a good emphasis. When developing new approaches, open-mindedness to recognise quickly when things are not quite working and an ability to make timely and flexible responses are important qualities.

2.13 A general disappointment relates to work with SMEs where the conclusion, in particular from the IfM, is that a self-financing model for such activities is unattainable: some form of ongoing support from public or charitable sectors is required.

Looking forward

2.14 Over the next few years both universities and firms will be operating in severely straitened financial circumstances. It will be vital to secure a strong contribution to wealth creation from the research base and there will be increasing pressures to demonstrate success. There may be areas where slimming down is possible now that the importance of the commercialisation agenda has been spread across the full range of universities. In particular some merger and acquisition activity (or the formation of collaborative networks) may be justified in order to achieve the scale necessary for an effective commercialisation office.

2.15 However, there should be no expectation that significant surpluses from commercialisation activities are likely to accrue in any but a small handful of universities at best. Moreover, it is extremely difficult to predict which those will be: the US experience is that there has been a very small number of transformative "big-hits" in terms of revenue and that some of the top research universities have never achieved one.

2.16 The case for continuing to invest in research commercialisation and wider KTT activities rests on the wealth and well-being created in the wider economy, not the income that will accrue to universities. It needs to be recognised that in many research areas, not just the bio-sciences, the gestation period for economic impact is often a lengthy one.

3: Grants to assist KTT activities

The initiatives considered in this chapter are summarised in the table below, listed (approximately) chronologically in terms of the year of the Gatsby grant award. The first six initiatives were reviewed in 2000 and relevant extracts from the 2000 report are given in this report's annexes.

Table 1: a summary of grants for KTT activities

Institution	Name of initiative	Nature of initiative	Year	Amount of grant
1. John Innes Centre and Sainsbury Laboratory	Plant Bioscience Ltd	A company to act as a Technology Interaction Office for the JIC and SL	1994	Equity investment
2. Universities of Birmingham, Glasgow, Leeds, Manchester, Warwick and York	Calyx Plantech Ltd	A company operating across the six universities, aiming to increase the impact of their plant science research through collaboration	1995	£300,000
3. University of Southampton	Support for Southampton Innovations Ltd	A stand-alone company aiming to make money from the most promising University IP	1995/6	£275,000
4. University of Nottingham Chemistry Department	Technology Transfer Scientist	Postdoctoral researcher employed to disseminate research and undertake projects for firms	1996	£60,000
5. University of Cambridge	Institute for Manufacturing Instrumentation Group	Problem-solving technical support for a group of companies	1995	£405,000
6. University of Cambridge[3]	Institute for Manufacturing Industrial Links Unit	A company to facilitate two-way interaction with industry and generate funds through products, services and delivery support	1996	£830,000 spread over eight years
7. St John's Innovation Centre, Cambridge	Technology Transfer £ for £ Funding	Small grants to SMEs for technology development using expertise from the University of Cambridge	1997	£300,000
8. Loughborough University	Innovation Fellowships	Funding to "buy" an academic time to develop inventions with commercial potential	1999	£605,000
9. University of Cambridge	Cambridge-MIT Institute	Encourage collaboration between the two institutions including IP commercialisation and entrepreneurship promotion	2000	£5 million spread over seven years
10. University of Nottingham Chemistry Department	Postdoctoral Business Science Fellowship	To contribute toward the costs of postdoctoral students to work in the Department's Business Partnership unit	2003	£243,000
11. University of Manchester Intellectual Property	Proof of Principle Programme	Grants to further develop IP showing commercial promise	2004	£375,000
12. Loughborough University	Innovation Awards for Sports Technology SME	Develop a cluster of SMEs drawing on the University's excellence in sports S&T	2007	£200,000
13. New Engineering Foundation	KTT for Further Education	Development of an overall framework for KTT in further education and grant funding for selected mini-projects as pilots	2007/8	£331,000

3.2 A commentary on each of these initiatives follows. The coverage is uneven and there are three reasons for this:

- first, for some of the initiatives there is rather little to say in addition to what has already been covered in previous reports (which are available for download on the Gatsby website);
- second, for others there is little information in the public domain and a fuller treatment is, therefore, appropriate; and
- third, for two universities, Loughborough and Nottingham, the Gatsby-supported initiative is considered within the broader context of their other KTT activities; which has the advantage of providing a sense of how the policy context for KTT has changed since Gatsby's first grants in the mid-1990s.

[3] A comprehensive review of Gatsby support for Cambridge University's Institute for Manufacturing was published on the Foundation's website early in 2007.

Plant Bioscience Limited[4]

Nature of the initiative

• A company to act as a Technology Interaction Office for the John Innes Centre (JIC) and the Sainsbury Laboratory (SL) at Norwich.[5]

Background

3.3 Gatsby and JIC each invested £250,000 in the equity capital of Plant Bioscience Limited (PBL) in 1994 (Gatsby's shares have recently been transferred to SL). For both JIC and SL, PBL manages and pays for IP protection; funds early stage development; undertakes technology marketing and licensing; and, where it is the appropriate commercialisation route, catalyses spin-outs. Since 1997 it has also provided services to other organisations active in similar scientific areas. Its success in doing so has been helped by the reputations of JIC and SL.

3.4 This extension of PBL's services to other public research organisations was partly motivated by an opportunity to meet the needs of such organisations for specialist technology transfer services, but also partly by a concern that JIC and SL alone might not "supply" a sufficient flow of innovations to sustain PBL's self-funding business model. This strategy of outreach raises potential sensitivities and PBL has been conscious of the need to avoid diluting its service to JIC and SL. In the event, IP from external organisations has, in a number of instances, added value to IP from JIC and SL in complementary technology bundles.

3.5 In 2004 the Biotechnology and Biological Sciences Research Council (BBSRC) provided an extra £2 million in equity capital, acquiring one-third of the company (on the basis of an independent £4 million valuation). BBSRC has been keen for PBL to help some of its other institutes in developing their approaches to commercialisation. As a result, PBL now has a staff member based at Rothamsted Research, a close relationship with the Institute of Food Research (Norwich), and a memorandum of understanding with the Babraham Institute.

3.6 The company's aims and operating principles were set out in agreed Working Guidelines, which are also appended to PBL's agreements with scientists. The five key points are:

• the mission of PBL (the Company) is to bring the results of research in plant and microbial sciences at JIC/SL into public use for public benefit through commercial exploitation;

• the Company will operate as an independent, fully commercial entity, providing such services to the management and scientists of JIC/SL as are required to fulfil its mission;

• the Company's services will be provided only to those researchers who freely elect to use them. The Company shall not be obliged to accept commissions from researchers where, in the judgement of the Company's management, to do so would not serve the Company's mission or its commercial objectives;

• in order to achieve its aims, the Company will actively identify, protect, market and license intellectual and other properties and services arising from the activities of JIC/SL and the institutes' scientists; and

• the Company's activities will be conducted so as to achieve its mission without compromising (a) the long-term sustainability of its activities and viability of the company, (b) the stated missions of JIC/SL which it serves, and (c) the interests of the scientists working at JIC/SL.

3.7 These aims and principles (as stated in the 2000 Gatsby review) remain valid 10 years later, despite the fact that the establishment of PBL took JIC into what was then new territory for a government-financed research institute. A number of general points are worth noting in this respect:

• the relationships with JIC and SL remain positive. The late director of JIC, Professor Chris Lamb CBE FRS, gave particularly strong and valuable support;

• PBL has remained independent of JIC and SL in operational terms, is selective and non-bureaucratic in approach and has an independent Board with strong business and scientific expertise;

• the (two-way) voluntary basis for working with scientists still holds and, in practice, has never proved to be an issue;

• PBL's staff has remained small (seven strong in 2010) with two plant science technology managers, two pharmaceutical/biotech technology managers, a qualified patent attorney (based at Rothamsted) and two administrative staff; and

[4] The section of the 2000 report dealing with PBL (*Six Case Studies in Technology Transfer,* pp13-17) is given in full at Annex B.

[5] The John Innes Centre and the Sainsbury Laboratory are internationally renowned research centres of plant and microbial science.

• the current (second) managing director has remained in post since January 1997.

Broad indications of performance and current standing

3.8 In 15 years PBL has generated licensing revenue of nearly £10 million, approximately half of which has come from the top 10 protected technologies. PBL has invested over £4 million in patent costs. Overall:

• 17% of projects taken on by PBL earn revenue; and

• 40% of all patented technologies earn revenue.

3.9 PBL has also nurtured a number of spin-outs including:

• **Novacta** (2001) – which has developed a proprietary technology platform from JIC for the exploitation of Lantibiotics, naturally derived products with potent anti-infective properties. The Wellcome Trust has provided substantial translational funding both for the platform technology and for a specific programme to treat infections caused by Clostridium difficile. In 2009 the company raised £13.1million from investors;

• **Chameleon Biosurfaces** (2003) – a company based on JIC technology that is currently dormant but has real IP assets and may attract a trade sale;

• **IDNA Genetics** (2004) – a small but profitable company providing plant genetic diagnostic services to the international seed industry and related sectors;

• **Procarta** (2006) – which is targeting the major healthcare problem of antibiotic drug resistance by deploying its proprietary transcription factor decoys against the resistance mechanisms of superbugs, such as MRSA. The company has attracted seed funding and has the potential to be a winner; and

• **Norfolk Plant Sciences** (2007) – a company aiming to develop GM crops with consumer benefits. Despite substantial efforts this venture has yet to succeed in raising investment and its future is uncertain.

3.10 As at the beginning of 2010, PBL had a small but respectable number of technologies which seemed to have the potential to achieve major commercial success:

• enhanced (anti-cancer) broccoli – JIC and the Institute of Food Research (IFR) science. Due to reach market in 2011;

• Short RNA technology for inducing and detecting gene silencing – SL science (Baulcombe and Hamilton). Major patent granted April 2010;

• flavodoxin, derived from blue/green algae, which protects plants from stress – University of Rosario (Argentina) science. Licensed for major crops in 2008 with product development in progress;

• Model Gut, a dynamic gastric model which is a breakthrough in the accurate simulation of the human gastric compartment. *"It is the first true 'dynamic' in vitro system that full replicates both the complex biochemical conditions and the array of gastric forces crucial for the prediction of the bioperformance of Active Pharmaceutical Ingredients and dosage form"* – IFR science. Generating six figure revenue streams; and

• Jasmonate treatment which primes seeds to resist insects from germination and in the early stages of crop establishment – University of Lancaster science. Licensed in 2009 and launched in 2010 as a commercial product.

3.11 In addition, PBL has provided expertise to JIC/SL on attracting and setting up industry-funded research contracts (and ensuring that their IP is properly recognised, managed and rewarded); assistance in formulating bids for government and Research Council funds for research (both basic and applied); and training for staff on IP and KT.

Financial performance data[6]

3.12 Over the period from 1994 to March 2008, business transactions relating to JIC and SL (combined) were as follows:

• number of technologies 'coded' by PBL	285
• patent applications filed	91
• technologies/patent families still active	31
• patent costs invested by PBL	£2,477,000
• development funding direct from PBL	£459,000
• industrial research funding via PBL	£3,114,000[7]

[6] These data are derived from a presentation made to the Sainsbury Laboratory on 24th March 2009.
[7] Does not include Dupont and Zeneca wheat research funding (estimated at £2.5 million plus).

- income generated by PBL from licensing/technology £3,946,000
- rewards paid out to inventors £412,000
- revenue share paid to JIC/SL £664,000

3.13 These numbers are impressive, but they need to be considered in the context of an uneven profit and loss performance as, despite fluctuations in income, PBL has continued to invest in technologies (and maintain its small but expert team), even in lean years. Profits were made in 1999, 2000 and 2002, averaging around £175,000 per annum. Losses were made in 2001 (about £150,000) and in each year from 2003 to 2008. The biggest annual loss was in 2004 (some £450,000) though this improved in each year from then to 2008 (a loss of £150,000). Overall the net loss for the period was in the region of £1.3 million, which can be compared with the total payment to inventors and JIC/SL of £1.1 million.

3.14 Moreover, the losses were incurred despite a number of other positive factors:

- JIC/SL agreed to forego a proportion of the share of gross income to which they were entitled under the original founding agreements when the company was set up (it was realised early on that the intended 50% payout level would be unsustainable); and

- PBL did well in competitively securing public sector grants which gave the opportunity to invest in the development of what PBL identified as promising technologies.[8] The biggest challenge for PBL has been that technology emerging from the academic research at SL and JIC usually lacks proof-of-concept and the inventors are often not oriented towards taking their innovations forward to application. PBL's use since 2005/6 of public grant funds to commission directed "technology development" has made a very significant difference to the success of transferring these early stage technologies.

Points for further reflection

3.15 Had it not been for PBL's success in obtaining government grants and, crucially, the injection of equity capital by the BBSRC, PBL would not have been able to maintain even a modest patent portfolio and would have been unable to begin and maintain its successful investments in the targeted development of selected technologies. It would also likely have been forced to drop a number of key patents, cut staff and run a limited patent portfolio on a care and maintenance basis. In part, the uneven income streams could be attributed to a relative lack of industry interest in much (though not all) of the research undertaken at JIC/SL; a constraint exacerbated by stagnation across the whole technology economy during certain periods since the mid-1990s.

3.16 However, even with a more favourable climate for innovation uptake, PBL may still have struggled to perform within the financial structures that were envisaged in 1994. **The length of time needed to achieve significant financial returns to JIC/SL and the depth of purse needed to commercialise the outputs from major centres of scientific excellence were, arguably, both underestimated.** As a consequence, the automatic revenue sharing requirement was certainly over-ambitious given the level of initial equity investment.

3.17 Thanks to the positive actions of the company's Board and management – and the endorsement of these by the shareholders reflecting their support for the efforts of the executive team – PBL now looks to have reached a position of considerable, albeit still uncertain, promise. This has been achieved without any further financial investment by JIC and SL since the original financing in 1994. It is a credit to PBL that the company has not only survived and established a highly promising IP portfolio, but also achieved wide recognition as an expert and respected technology transfer organisation in both the UK and overseas. This is reflected by the range of international public sector institutions which have entrusted their technologies to PBL (including, for example, INRA, the 22 institute-strong French agricultural research body). Positive links have been built with institutions in the UK, mainland Europe, North America, South America and, more recently, in India and China. As well as being sources for new IP for PBL to manage, some of these public sector partners have considerable applied research resources which offer the scope for co-development opportunities for PBL IP to bring basic academic discoveries nearer to market before transferring to industry.

3.18 A further stream of opportunities may arise from grants of just over £1 million (1996-1999) that

[8] Public sector research establishments have been able to compete for funding to support commercialisation. They do not, however, enjoy the stability and predictability that the Higher Education Innovation Fund now provides to universities.

Gatsby has made to Two Blades, a US-based charitable organisation that supports programmes of research and development on durable disease resistance. In July 2009 Two Blades announced an applied research collaboration with the SL aimed at rapidly translating groundbreaking discoveries by the SL into practical solutions to assist farmers worldwide.

Calyx Plantech[9]

Nature of the initiative

3.19 A company operating across six universities and aiming to increase the impact of their plant sciences research through collaboration.

Background

3.20 In 1995 six UK universities (Birmingham, Glasgow, Leeds, Manchester, Warwick and York) established a jointly owned company called Calyx Plantech Ltd, for the purpose of the "promotion and exploitation of plant science". All six of the parent universities are of a substantial size and each has a strong research base, but following an independent review they had concluded that, in the field of plant biotechnology, there were advantages in operating collaboratively. It was believed that the company could bring added value to the partners through its role in helping transfer individual projects and IP and possibly also establishing multi-campus, large-scale projects targeted on specific themes beyond the capability of any single university.

3.21 The resources allocated for operation over a four-year period totalled £570,000. Gatsby provided matching funds to an equal university financial commitment. The principal activities that this budget funded were:

- support for individual scientists in the commercialisation of their research;
- a small Internal Initiatives fund to provide start-up grants for research with industrial potential (also used to establish an Arabidopsis library);
- promotion of cross-campus strengths to potential industrial partners with a focus on four themes/technology platforms:
  - transgenic technology and molecular genetics;
  - defence mechanisms;
  - signalling; and
  - novel plant products.

3.22 While industry welcomed the initiative in general terms, recognising the advantages of central contract negotiation and project management, this did not translate into contracts. Companies appeared more comfortable with considering individual products and technologies rather than strategic packages delivered across a number of campuses (perhaps a prudent wariness). In consequence, the level of commercial income was below that projected in the Calyx business plan – which envisaged self-financing by the end of the four-year period. The Calyx Board identified several factors behind this:

- the universities would not allow Calyx to own any IP, nor undertake any contracts for research: all had to remain within each of the separate universities. As a consequence, Calyx had no product of its own to sell and was often regarded to be in competition for facilitating deals with the Tech Transfer offices of the universities;
- a poor initial appointment to the Business Development Manager post;
- a failure to achieve full commitment of the Directors, whose principal loyalty had to remain with their universities. In addition, no incentivisation was allowed and no-one stood to gain or lose financially from Calyx's performance;
- the lack of an incentive for academics to market their research through Calyx; and
- the difficulty in arranging cross-campus activities, partly because the universities placed considerable emphasis on securing equal shares of the Business Manager's time rather than agreeing to select a limited number of potential winners and allocating resources to secure their early completion.

3.23 As a consequence of these experiences it was resolved during 2001 to wind the company up.

Points for further reflection

3.24 There were three unfavourable factors outside the company's control:

- adverse publicity about genetically modified organisms, which may have led to a more general wariness about plant biotechnology and a generally difficult climate at that time for new research collaboration with industry;

[9] This section has been based on two sources – the 2000 report (the relevant section is reproduced at Annex C) and the final (internal) report to Gatsby Trustees for their meeting on 25th January 2001. No further research has been undertaken for this report.

• the expansion of the industrial liaison offices in the individual universities, some of which had plant science central to their portfolios; and

• the insistence of the individual universities to "plough their own furrow" rather than commit to opportunities for development through Calyx.

3.25 Nonetheless, with a greater degree of trust and commitment from the partner universities, a number of the problems which Calyx faced could have been addressed. PBL faced many of the same contextual issues with a similar level of resource. However, in its early years PBL only had two client institutes and their support was not tempered by the ambitions of internal commercialisation officers.

3.26 While it would be fanciful to overplay the lessons from comparing the two initiatives, a few conclusions can be hazarded as hypotheses:

• appointing appropriate individuals is vital for a small organisation. This suggests the need both to pay competitive salaries and to take swift action if a mistake has been made in hiring;

• support from the top of the institutions involved is essential. This may be less obvious in the rare event of all going swimmingly, but is of crucial importance when problems are faced. The initial financial assumptions behind both Calyx and PBL were over-optimistic, but with PBL its owners showed a willingness to persevere, modify their own involvements and take the necessary steps to help the firm succeed;

• there are advantages in starting with a limited focus and broadening ambitions when initial progress can be demonstrated. For Calyx to seek to work across six universities from the outset was highly ambitious. Some form of "softer" start may have had a greater chance of success; and

• above all, the achievement of a solid financial performance from KTT is, at best, likely to be a long term outcome, and in many cases may simply prove elusive.

Southampton Innovations Limited (now Research and Innovation Services)[10]

Nature of the initiative

3.27 A stand-alone company aiming to make money from the most promising University of Southampton IP.

Background

3.28 In 1995 the University decided that there was scope to boost its ability to exploit innovation through focusing technology transfer expertise on fast-tracking a number of projects with high potential. The aim was to produce a significant income stream for the University to be re-invested in the research base.

3.29 A number of UK university structures were reviewed to try to identify the best model. It was concluded that the best approach was to set up Southampton Innovations Limited (SIL) as a separate company sitting alongside the Office of Innovation and Research Support (OIRS). SIL's remit was to adopt a proactive approach to university departments and industry in order to optimise exploitation. The expectation was that after three years "the company will provide a substantial return to the University".

3.30 This expectation of quick financial returns was not met and the position was exacerbated by the failure of Southampton's early bids into Government funds for enterprise and research commercialisation (which were awarded through competitions). In consequence, Sir John Fairclough was asked to review the position and recommended a new structure that brought SIL and OIRS together into Research and Innovation Services. The individuals previously responsible moved on (one of them to a successful career at the science park) and Dr Tony Raven was appointed in September 2000.

3.31 The University's early experience with spin-outs had been mixed. Kymatra and Southampton Photonics had both been successful in taking technology to the market but were hit by the adverse sentiment created by the dot-com bubble. Although each was acquired by a major global company – Alcatel and Trumpf respectively – the University's stake was diluted to such a degree that the returns were small.

3.32 Money from the Gatsby grant was still available to help sustain a small professional team at the end of 2000. This allowed momentum to be maintained in straitened circumstances. A fund of £5 million for seed investment was raised from IP Group PLC and the original SIL policy of selectivity was maintained, with investments being substantial (in the region of £500K) and restricted to companies with the potential to achieve substantial scale (say a turnover of £100 million), thus offering the prospect of realistic exits.

[10] This section draws on the 2000 report (see Annex D) and telephone conversations with Dr Tony Raven.

3.33 This policy has proved successful with:

- investments in 12 spin-outs. The IP Group currently lists 11 in the Partnership Portfolio - Activotec Ltd, Capsant Neurotechnologies Ltd, Ilika Technologies Ltd, iQur Ltd, Karus Therapeutics Ltd, Nanotecture Ltd, Offshore Hydrocarbon Mapping plc, Perpetuum Ltd, Plexus Planning Ltd, Stratophase Ltd and Synairgen plc;
- four market listings;
- £5 million to the University from realisations; and
- a portfolio value of some £20 million.

3.34 Since 2000, the University has been successful in its bids for government funding, which may be attributed, at least in part, to the underpinning resource which the Gatsby grant provided at a critical phase. The University has now achieved general recognition for its performance in commercialisation, ranking third for spin-out activity in the 2008 Library House report and achieving similarly strong rankings on other measures of KTT and entrepreneurial activity.

Points for further reflection

3.35 The original structure for commercialisation which Gatsby supported proved unsustainable. The commercial potential of Southampton's research strengths did not begin to generate resources until there was a change in structure, along with a change of personnel. Nonetheless, the original expectation of a substantial return to the University after three years was arguably unrealistic. Perhaps it was typical of a more general misconception at the time that KTT would generate substantial income to help finance universities (an unhelpful myth which runs contrary to the evidence from both the UK and US, yet shows remarkable resilience).

3.36 Subsequent success in accessing government funds has been important for the turnaround in Southampton's performance in KTT, as have the changes in key staff, underlining the more general Gatsby experience that backing the right individuals is often key.

3.37 Gatsby Trustees' willingness to adopt a flexible and non-bureaucratic response to Southampton's change of approach made a real difference. The continued availability of Gatsby funds at a critical juncture was greatly appreciated and Dr Raven sees Southampton as "one of the great unknown successes of Gatsby funding".

University of Nottingham School of Chemistry: Technology Transfer Scientist and Postdoctoral Business Science Fellowship[11]

Nature of the initiative

3.38 Postdoctoral researcher employed to disseminate research and undertake projects for firms.

Technology Transfer Scientist

3.39 In 1996 the School of Chemistry decided to take a novel approach to establish links between its 25-strong supercritical fluids research team and potential industrial partners. They designated a single member of the team, already qualified with a PhD, as a Technology Transfer Scientist (TTS), tasked with building up industrial contacts and taking on sponsored project work while remaining integrated with the team in its research activities.

3.40 At the time of the 2000 report, the TTS was already considered a success, having achieved self-funding and made positive contributions to the team's research as well as its outreach objectives. This success was thanks to:

- the individual appointed to the post and support from others in the team;
- an excellent research group working in an area with live industry interest; and
- positive support from both the School and University.

3.41 However, there were some concerns:

- the unevenness of cash flow, which has required a working capital buffer;
- the administrative burden of multiple small contracts; and
- the sustainability of an approach depending on a single individual.

3.42 In the event, Dr Paul Hamley continued in the post for 12 years, generating and supporting more than 200 interactions with industry. Towards the end of the period, tensions were developing on both financial and personal fronts. Financially, as Dr Hamley's salary increased with length of experience, it became increasingly difficult to cover costs. Personally, the role offered no obvious path for career development. There was, however, a satisfactory resolution as

[11] This section draws on the 2000 report, a meeting with Dr Trevor Farren and Dr Paul Hamley and a short report that they kindly prepared for this review; see Annex E.

Dr Hamley was appointed as a Research Business Development Executive in the University centre in 2008; so the experience he gained as a TTS is being put to good use.

Postdoctoral Business Science Fellowship

3.43 The TTS was focused on an individual research group within the School of Chemistry. Partly owing to the success of the initiative, it was decided to address the promotion and management of industrial relationships at the level of the School overall. A Business Development post was established with funding from the Higher Education Reach-out to Business and the Community Fund for three years. Dr Trevor Farren, a polymer chemist with extensive industrial experience, was appointed and he established a School of Chemistry Business Partnership Unit (BPU).

3.44 Using some of the funding derived from the TTS work, in 2003 the BPU piloted the Business Science Fellowship (BSF) aiming to:

- employ qualified doctoral graduates for up to one year to work within the School of Chemistry's BPU on the commercialisation of a specific research area;
- provide training in business skills to the appointed Fellows to supplement their chemistry background;
- enhance the versatility and employability of the appointed Fellows; and
- take a specific research project nearer to market and enhance the School's Technology Transfer Portfolio.

3.45 Gatsby then made a grant to put the BSF on a more permanent footing. Since that grant ended, Fellowships have been funded from several sources, including the Higher Education Innovation Fund and even directly from industry. In practice, Fellowships have lasted for rather longer than a year, and around 18 months is seen as desirable as the first six months involve a good deal of learning before the Fellow becomes fully productive.

Activities

3.46 During the 18 months, a Fellow might expect to be involved with 15 or so internal (proof of concept) projects and four or five external projects. The initiative was not envisaged to be self-funding, though in practice the external projects can cover up to 40% of the BSF's cost. Typically there will be two Fellows in post at any time and the value of the training seems to be reflected in their subsequent employability (see Annex E for details).

3.47 The BPU seeks positively to identify advanced science that has possible commercial applications and has a surprising degree of autonomy in the management of IP. As Manager, Dr Farren is authorised to sign contracts and takes the IP lead (while adhering to University policy and in dialogue with the centre). One-third of the costs of the patent portfolio are borne by the School of Chemistry and two-thirds by the University centre.

Outcomes

3.48 In addition to numerous collaborative projects with industry and several licence deals, IP from the School has generated six spin-out companies (three of them had a BSF involvement) one of which is at an embryonic stage:

- **Critical Pharmaceuticals** – produces drug delivery systems by impregnation of polymers with therapeutic agents using supercritical fluids;
- **Regentec** – produces a porous matrix suitable for use as a tissue scaffold in regenerative medicine;
- **Promethean Particles** – manufactures metal and metal oxide nanoparticle dispersions using proprietary reactor technology;
- **Cell Aura** – produces fluorescent G-protein coupled receptor ligands for use in drug discovery, molecular pharmacology and imaging at the single cell level; and
- **QGenta** – a joint venture with the University of Colorado developing specific lead compounds as potential therapeutics for solid tumours.

3.49 The approaches developed at Nottingham have attracted considerable interest from other universities and led to networks being developed in the region and across UK schools of Chemistry and Chemical Engineering (see Annex E).

A point for further reflection

3.50 Both the TTS and the BSF initiatives appear to have been highly successful, but it may be wise to exercise some caution before supposing that they can be replicated across the board. The nature and quality of the science being undertaken and, crucially, the enthusiasms and personalities of the leading scientists and managers are important variables determining what approach to KTT will work best. Experience shows that a suite of KTT mechanisms is required

to optimise the effectiveness of KTT across the range of situations normally encountered within a university. The University of Nottingham, which has given consistent support for the School of Chemistry's initiatives, has put in place several different models for KTT, not all of which are based upon those developed in Chemistry.

University of Cambridge: Institute for Manufacturing Instrumentation Group and Industrial Links Unit[12]

Institute for Manufacturing Instrumentation Group

Nature of the initiative

3.51 Problem-solving technical support for a group of companies.

Background

3.52 With the globalisation of manufacturing, medium-size companies need to assimilate, develop and apply new techniques and technologies swiftly and reliably if they are to remain competitive. This motivated the Institute for Manufacturing (IfM) to create a sector/cluster initiative to support these companies in the instrumentation sector.

3.53 The instrumentation sector was chosen as it met the criteria of high-technology and was experiencing growing international competition. It was also sufficiently typical that lessons learned could be transferred to other sectors. Furthermore, supply-side considerations were also relevant as Professor Baker, then the Gatsby Technical Director, had a particular interest in the sector and intended to secure collaboration with Cranfield University (though Cranfield later dropped out of the reckoning due to financial expectations which the initiative could not realise at the time).

3.54 Unfortunately, it took more than a year to recruit the full-time project manager. However, in the interim others initiated preliminary work and a number of companies expressed interest in obtaining support from the initiative to address particular problems in industry. In some instances, this support could be provided through student projects or short consultancy inputs from the project managers. However, others required more substantial assistance. Gatsby was approached for a grant to fund two bright young graduates who would be available to work on industrial problems under guidance. It was expected that this guidance would come from the project manager and from academics with expertise pertaining to the particular problem.

Outcomes

3.55 Initial results were encouraging. When an interim review was undertaken in 2000 there were 27 member companies (half from the Cambridge area) and work was underway to develop a Motor Sport Manufacturing Group. The instrumentation group itself was forecasting a membership of 90 by mid-2002, which prompted a comment in the generally positive report from the interim review that *"to achieve its future membership (and hence budgetary) targets, however, it would seem that considerably more effort will need to be put into marketing"*. Partly as a result of staffing problems, these ambitions were not achieved. Efforts to promote the group ran out of steam and the formal group membership scheme was merged into the IfM's overall membership, within which there are affinity groups for both instrumentation companies and for companies interested in manufacturing, planning and control.

3.56 However, work with the companies has continued thanks to the interest and efforts of Professor Baker (now full-time with IfM) who has been involved with five major projects concerning instrumentation manufacture (one of which continues); has active links with several other instrumentation companies; and also arranges – with colleagues in the IfM's Education and Consultancy Services team – two or three one-day workshops each year which typically attract 10-15 participants from industry. Several other instrumentation companies maintain active links with the IfM (i.e. through a 'Skills' project).

3.57 Perhaps most encouragingly, Professor Baker became aware of remarks by a chief executive of an inkjet company which sparked off the idea for the Next Generation Inkjet Technology project. This involved the group at Cambridge leading a team, including researchers from four other universities, on a five-year project looking into: the fundamental behaviour of inkjets and droplets and their use in various printing techniques; the effects of the ink constituents; and the behaviour of the deposited droplets on the print surface. The project had a £3 million

[12] In 2007 a wide-ranging review of the Foundation's grants to the Institute for Manufacturing was undertaken for the Trustees and its report published on the Gatsby website. This section is based largely on extracts from that report.

budget with a £2 million grant from the Engineering and Physical Sciences Research Council (EPSRC) and £1 million in contributions from the eight member companies, five of which are based in the Cambridge area.

3.58 This work has in turn led to a £5 million grant from EPSRC which, with additional funding from industry, is supporting a five-year programme of research to study the formulation, jetting and deposition of specialist printing fluids, and develop an overall process model. This work will improve the robustness of industrial inkjet printing and help companies develop new applications for the technology such as flat-panel displays, printed electronics and photovoltaic cells for power generation. The IfM-led consortium comprises collaborators from two other Cambridge departments, the Universities of Durham and Leeds, and a group of nine companies which includes the major UK players in the inkjet sector.

Points for further reflection

3.59 Initial expectations were over-optimistic. Without a detailed evaluation it is not possible to judge the impact of the young graduates' work with individual companies funded under the second Gatsby grant, but they would appear not to have been sufficiently viable to cover costs in the way that was originally hoped. A more in-depth appraisal of the market may have been appropriate.

3.60 It may have been easier to sustain the momentum of the instrumentation network membership if there had been a substantial research group working on instrumentation-related issues at the time. This would have produced new research and insights to reinvigorate the seminars and other activities, and such content could have been generated, at least in part, from academic research projects using public research funds (the intended link with Cranfield would have helped in this respect).

3.61 In terms of both market conditions in the selected industry and the research base within IfM, the context for the instrumentation work was less favourable than that facing the School of Chemistry at Nottingham University, whose positive experience was mentioned in support of the second project application. Moreover, whereas the individuals appointed and involved at Nottingham had very positive relationships with one another, the experience at IfM was more mixed.

3.62 Nonetheless, the sustained commitment of an individual academic has paid off – both in terms of the continued relationships between IfM and instrumentation companies mentioned above (and some very positive feedback from them) and in terms of the major inkjet projects. There are two general lessons from this experience:

- first, the need for an established enthusiastic academic with appropriate expertise, interpersonal skills, capacity and commitment to remain substantially involved in the project delivery; and

- second, that new initiatives should plan for a positive exit strategy so as to avoid wasting potential further opportunities by effecting an over-sudden closure. There should be plans, with allocated budget reserves, to allow an 'after-care' activity (government programmes have an unfortunate tendency to go for a 'clean break' with the past).

Industry Links Unit (now IfM Education and Consultancy Services)

Nature of the initiative

3.63 A company to facilitate two-way interaction with industry and generate funds though products, services and delivery support.

Background

3.64 When Gatsby approved the grant for the Industry Links Unit (ILU), the Trustees encouraged the Unit to achieve:

- industrial outreach through a proactive approach from the centre;

- collaboration with all regional bodies such as Training and Enterprise Councils, Industrial Liaison Offices, science parks, as well as other departments in the University including the Judge Institute;

- a sound financial basis to balance long-term viability with realistic overhead recovery;

- close links between education, research, technology transfer and practice; and

- appropriate arrangements to attract and keep high quality academic and professional staff to work across academic/industry boundaries.

3.65 IfM faculty and research staff had raised some issues about the ILU's structure and operations. All bar one have been addressed through a recent review. The partial exception relates to the second objective (collaboration with all regional

bodies). There has been good engagement with the East of England Development Agency and the Greater Cambridge Partnership, as well as St John's Innovation Centre, but consultees specifically raised collaboration with other departments in the University and other divisions of engineering as an issue. However, this is a more general issue for the IfM as a whole and it is perhaps unreasonable to expect the ILU to be out of step.

3.66 The report from the interim review in 2000 was strongly positive but highlighted the difficulty in recruiting a director who requires a set of skills and experience that are scarce. That difficulty persisted for a time, both with the director post and others. Two directors have left since 2000, but the present incumbent has remained in post over the past six years (and one of the two 'leavers' remains in close touch on a freelance basis). There has also been mixed success in the recruitment and retention of staff to work with firms. It has, by contrast, been relatively easy to recruit and retain good people for events organisation, marketing and promotion.

3.67 At Gatsby's request (to ensure transparency) the University agreed, after a good deal of soul searching, to set up a separate company, Cambridge Manufacturing Industry Links Limited (CMIL), which is wholly University-owned. This too had some teething problems, as it was difficult to recruit a good financial administrator – University accounting systems are somewhat arcane and CMIL has 20-plus cost centres. However, CMIL now operates effectively and the company structure is a significant asset for the IfM which enables centres and individuals to be rewarded tax-efficiently for their work with industry. The administrative resource that the ILU provides through CMIL is widely appreciated by IfM colleagues.

3.68 In order to increase the capacity to undertake work for industry beyond that which the academic staff can provide, the ILU has developed a structured approach to the use of Third Party Associates (TPAs). The need for this has been recognised for some time. The 2000 interim review reported (paragraph 7.10):

"In due course, the ILU may also face the problem of balancing the interests of industrial outreach against the requirements of teaching, research and scholarship. The need is to increase the level of industry-related activity without diverting too much energy from IfM's central educational mission. Already there has been some call made on freelance resources to help deliver events using material and approaches pioneered by IfM's research centres. The ILU is alert to the need for this approach to be extended so that the scarce academic resource can be devoted to the creation and pioneering of new products and services."

3.69 For projects that will bear commercial charge rates, typically with large firms or groups that will pay rates of £1,000 per day and upwards, the ILU draws on a group of TPAs who have held senior posts in industry or, less frequently, consultancy. Several have been on IfM courses. They work for the ILU at their own risk on projects for industry in which IfM's analytical tools or other research-derived knowledge can be applied.

3.70 The TPAs are charged with keeping abreast of developments in IfM expertise, focusing on a particular centre or research group, and with feeding back the experience that they gain from the industry projects. A set formula shares fees between the individual TPA, the ILU (to cover overheads) and the research centre whose expertise is applied. In cases where a specific research tool or technique is applied, a surcharge is added to the day rate (25% for a mature product or 10% for one under development). While most projects are for large firms, there have been two cases in which small and medium enterprises (SMEs) have been willing to pay full commercial rates. Both involved solving a pressing technical problem.

3.71 The contributions from outreach activities can be substantial. In the case of 'road mapping', the technique has been used with a diversity of organisations such as large firms, groups of SMEs (typically from the same sector), central government, Faraday Institutes and a Regional Technology Centre. Delivery is through one or two-day public training courses and in-company courses in the UK and internationally, where coverage has extended to Hong Kong, Japan, Singapore, South Africa, Spain, Thailand and the US. Since 2003, the revenue from this work has supported a senior research associate and a research associate. Road mapping is also featured in IfM's undergraduate and graduate courses and has been the topic for a PhD and two Master-level theses.

Points for further reflection

3.72 Apart from its intrinsic strengths, one reason why road mapping has been able to evolve is that the researcher who was active in its initial

development, and continues to develop the technique further, is also happy to have a very active engagement with its delivery, thus ensuring that the two-way feedback works. There are other tools/techniques where the academic with the core expertise does not have time (or perhaps the aptitude) for a substantive involvement in delivery. In such cases, there is much greater reliance on a TPA resource and a danger that further development work proceeds too slowly to maintain its freshness.

3.73 The ILU seems now to have reached the point at which it should be able to generate a reasonable level of surplus to reinvest in the IfM's research activities. It should also be able to share the risk of holding events such as training workshops or short executive education programmes. By using TPAs, it has widened the competencies that the IfM can offer industry and increased its capacity to deliver substantially beyond that which could be achieved by academic staff alone.

3.74 Academic staff members are concerned to ensure that the outreach work is firmly based on IfM expertise and that experience from working with firms is fed back to the research centres and groups. To ensure this, an appropriate balance needs to be struck between the time provided by research centre staff and the time provided by TPAs in undertaking project work with firms.

3.75 Equally, the question of financial rewards will always be a sensitive one and research leaders need to win both hearts and minds to:

- build a consensus about the fair division of rewards;
- obtain buy-in to a transparent system of information; and
- ensure that an individual who develops the initial core expertise which is deployed receives a fair 'rent' (even if the IP cannot be protected).

3.76 These are not easy objectives to achieve, but this does not vitiate the value of the model. Rather it points to the need for watchful management and good communication to provide early warning of any emerging problems. A connected issue - and this relates most strongly to the work with SMEs - is recruitment both of the risk-sharing TPAs and of staff employed by the ILU. When the economy was booming it was not always easy to recruit and retain staff of the right calibre.

3.77 It would be unacceptable if the ILU were to develop a range of activities and an associated overhead that motivated it to recruit less than wholly satisfactory staff in order to sustain activity levels (it would be dangerously easy to 'get away' with less than excellent performance, at least in the short-term, because of the strength of the Cambridge brand). This is a matter of internal governance for the IfM which needs to be given continuing vigilance. The issue is of redoubled importance because the IfM is often taking the initiative in approaching firms, rather than responding passively to requests.

3.78 This leads on to the question of 'marketing' and 'selling'. There is a view in some of the research centres that the ILU could do more to sell their consultancy time or their expertise to run executive education programmes. This enthusiasm for others to do the selling is understandable given the competing pressures on academic time, which can be extreme at certain periods, and the need for duties such as teaching and examining to take absolute precedence over other activities. However, it is probably somewhat unrealistic.

3.79 It has proved especially difficult to engage with SMEs. Identifying firms that will benefit from IfM help is not easy and, even after identifying them, clinching a 'sale' depends on making contact at a time when they are open to taking stock of their business (and not subsumed into short-term fire fighting). One approach could be to follow up the suggestion of identifying SMEs in the supply chains of large companies with which the IfM already has established relationships.

3.80 Another approach is to work with companies in 'affinity groups' and the experience of work with instrumentation companies has been positive. It is, however, difficult to sustain the momentum of such groups over the extended period of time required to justify the initial investment in establishing them. One answer is to obtain a public sector subsidy. However, even this may well be insufficient unless there is also an established research group - either within the IfM or with which there are close collaborative links - whose research work can provide a continuing stimulus. Sharing knowledge between firms is a valuable outcome from affinity groups, but it tends to produce diminishing returns over time.

3.81 For the IfM, a precondition for involvement should be a research group that is committed to dialogue with a particular sector/cluster and has the relevant expertise and the time resources required. It is the two-way flow of learning benefits, accruing to both teaching and research,

which justifies engagement of a top university in such activities.

St. John's Innovation Centre, Cambridge: Technology Transfer £ for £ Funding[13]

Nature of the initiative

3.82 Small grants to SMEs for technology development using expertise from the University of Cambridge.

Background

3.83 This initiative, established in 1997, provided matched funding through which SMEs could access expertise from the University of Cambridge. It also helped them to identify appropriate teams or individuals within the University. Gatsby provided up to 50% of the money; the firm itself had to provide or obtain the other half. In most cases, the requirement for matched industry funding was fully applied, but some exceptions were made to allow contributions of resources in kind.

3.84 Initially the fund had a slow start, due to the difficult balance between raising awareness of its availability to serious candidates and guarding against an avalanche of inappropriate applications that would make heavy and needless demands on management time.

3.85 Requests for funding were appraised initially by Walter Herriot, an IfM technical expert, and Tim Minshall, who brought the views together and then prepared a submission for Gatsby approval. The dialogue between the management team and final decision-maker in Gatsby seems to have been constructive and effective – contributing to well-considered decisions in a non-bureaucratic manner. For the applicant, the lack of cumbersome requirements and the speed of decision have been welcome.

3.86 A student dissertation reviewed the grants in 2009, but only obtained responses from 10 of the 33 projects. One reason for this low response rate is that contact had not been consistently maintained with recipients so they could not be traced. Another probable factor, often a characteristic of SME surveys, is that overstretched individuals simply don't find the time to respond and there is always the question as to whether a lack of success correlates with low propensity to respond.

3.87 Short case studies on the 10 firms (eight of which survive today) are given in Annex F and they are characterised in Table 2 overleaf. It is interesting to note that five of them had origins related to the University. Whilst the intention had been to focus on SMEs in the cluster in and around Cambridge, it transpired that there was something of a mismatch in 'sophistication' between some of the potentially interested firms and University researchers with relevant expertise. The alignment was markedly better for firms that had originated from the research base.

Points for further reflection

3.88 The overall conclusion drawn from interviews with these companies can be summarised as follows (the report refers to grants as "vouchers"):

"It was found that added value had been produced in varying ways as a result of the use of the voucher, including: IP generated; additional funding secured; evidence of on-going collaboration with research institutions; and increased technical know-how."

3.89 Other interesting findings from the dissertation were that:

- although not probed through a specific question, almost all the interviewees commended the ease of access and simplicity of the application (this was possible because there had been initial vetting for likely suitability before an application was submitted);
- *"seven out of the ten cases commented on the importance of the short time in which they received the voucher, shows how valuable it was to the companies at the most sensitive stages of their development"*;
- *"three of the ten companies received additional funding as a result of the work done using the St John's Innovation Voucher. In total … received £30 thousand from the St John's scheme, with the help of which they later secured a total of £1.32 million in additional funding"*;
- *"of the ten companies investigated, four have developed patents which were in some way linked to the St John's voucher. However, only the IP generated from one of the firms can be definitively said to have been a direct result of work done using the voucher"*;

[13] In 2009 a student dissertation reviewed the progress of the grant recipients and this section draws heavily on it. Extracts from *The long-term effects of innovation vouchers on high tech star-ups* by Ebrahim Rostin Haj Seyed Javadi of Wolfson College are given in Annex F.

Table 2: Firms responding to the 2009 survey

Founded	Grant date	Employment	University spin-out	Activity	Project supported	Additional funding
2006	May 2006	10	No	IP intelligence	Database development	Privately funded
2004	October 2004	-	Yes	Identify infectious diseases	Feasibility studies	£150,000
2002	March 2002	1	No	Super-conducting products	Market analysis	Yes, but not as a result of grant
2005	February 2006	3	Yes	Ventilation in houses and flats	Market analysis	Yes, but not as a result of grant
2002	March 2003	1	No	Water and waste-water treatment	Proof of concept/ prototype	£50,000 SMART
2003	September 2003	7	Yes	Solar micro inverters	Proof of concept/ prototype	£125,000 SMART
2004	August 2004	3	Yes	Value from waste solutions	Completion of prototype	£260,000 (£60,000 University Challenge)
2001	September 2004	13	No	Proximity marketing solutions	Completion of prototype	£1 million investment
1999	July 2000	-	Yes	Computer projector array	Proof of concept	-
1999	May 2002	1	No	Reduce vibration in hand held tools	Proof of concept/ prototype	£60,000 (NESTA)

Source: derived from student dissertation

Note 1: SMART was the DTI's Small Firms Merit Award for Research and Technology

Note 2: NESTA is the National Endowment for Science, Technology and the Arts – an independent body with a mission to make the UK more innovative

• *"five of the ten companies interviewed believed that they were operating in new fields and that the voucher had increased their technological knowledge"*; and

• *"of the ten companies that were interviewed, seven have maintained links with the university in one way or another. Three of these companies were companies that were founded by individuals with no affiliation to the University; the St John's voucher was therefore clearly successful in creating long-lasting ties between these companies and Cambridge University"*.

3.90 The general tenor of the comments by individual firms as reported in Annex F points to the grants achieving a high degree of additionality. There were also positive references to the individuals involved in the management of the scheme.

Loughborough University Innovation Fellowships plus Innovation Awards for Sports Technology SMEs[14]

Background to the commercialisation of research at Loughborough

3.91 The briefing report prepared by the University to assist this review (see Annex G) demonstrates clearly that Loughborough has taken active and successful steps towards implementing the goal, set out in its strategic plan of developing

"a culture in which Enterprise, encompassing knowledge transfer and research exploitation, is established as a core activity, accorded the same status as Research and Teaching"

3.92 Headlines confirming this include:

• establishing the post of Pro Vice Chancellor Enterprise;

• formally making enterprise activities a criteria for promotion[15];

• enterprise teaching across all three faculties and an innovation management module in the MBA;

[14] The section referring to Loughborough University in the 2009 report is reproduced in Annex H together with a report prepared by the University which describes that changing context for research commercialisation.

[15] Guidelines for Senior Lecturer promotion submissions 2009/10, Faculty of Engineering *"Clear evidence of achievement and potential for growth in one or more of research, scholarship or enterprise areas…"*

• a commitment to seek closer dialogue with industry at an early stage in research design so as to help achieve more exploitable outcomes;

• an exceptional proportion of collaborative research (83%);

• establishment of an incubator on the campus's science and enterprise park which can provide accommodation for up to 40 high-tech and start-up companies;

• investment in new initiatives which will contribute to enterprise (i.e. the major new Design Centre and the Sports Technology Institute); and

• housing the Energy Technologies Institute on behalf of the Midlands Energy Consortium.

3.93 Drawing on a variety of funding sources, the Enterprise Office now has a staff of just over 40. Loughborough has performed strongly in competition to win funds such as those in support of Collaborative Training Accounts. Commercialisation also benefits from good links with the East Midlands Development Agency (EMDA) which funded the Sports Technology Institute and is an investor in the Lachesis Fund which is:

"seeking to fill the seed-corn funding gap that exists for very early technologies in the higher education sector" and whose "investments range in size from £25K to £250K".

3.94 Many of the funding streams that can be tapped for the promotion of enterprise and commercialisation of research, including those from the Development Agency and the EPSRC are designed to implement their own strategies and their rules and regulations sometimes make it difficult to employ them (with others) to best advantage. HEIF funds (and those from Gatsby) are crucially important in that they can be deployed to achieve the University's own strategy. Without them it would be difficult to achieve coherence across the faculties. Even with the underpinning from HEIF funds it can be difficult to find resources to engage in 'social' rather than 'commercial' outreach (i.e. work with the police on mediation).

Innovation Fellowships

Nature of the initiative

3.95 Funding to buy an academic time to develop inventions with commercial potential.

Background

3.96 The IF initiative was launched early in 1999 following an internal market research study to identify the barriers to research commercialisation. Informed by an analysis of this study's findings, it was decided to find a means to relieve staff from university duties for a full or part time sabbatical period while allowing them to continue development work in a well-equipped and supportive environment. This was at a time before national schemes were available for such purposes.

3.97 The selected approach was to establish a number of IFs, funded through a combination of University and external sources. The funding was to pay for:

"the proportion of time for which innovation leave is granted. This cost has to be reimbursed to the relevant department to buy in replacement staff to cover normal duties and other direct costs, for example consumables and materials, technician time and the provision of specialist advisors, in market assessment etc. It was assumed that the costs of access to facilities, infrastructure and other overheads would be met by the University as part of its funding of the initiative."

3.98 At the time of the 2000 report, it was too early to comment meaningfully on outcomes from the Fellowship awards, although the processes to generate and review applications were commended, as was the decision that the two external members of the review committee, who took the lead in assessment of applications, would be assigned as mentors to the Fellows for the duration of their projects. However, concerns were noted as to:

• whether sufficient numbers of assessors and mentors would be available as the initiative developed; and

• the means available to take projects to the next stage of commercialisation after the end of the Fellowship period. Attention was drawn to the difficulty of obtaining seed funding and the desirability of establishing a local group of Business Angels or a local seed fund.

3.99 Since 1999, in addition to establishing the on-campus incubator, Loughborough has collaborated with the Universities of Nottingham and Leicester on a bid to the Government's "Reach Out" fund to establish an analogous IF

scheme to fund smaller projects and especially those with a regional focus.

3.100 When a bid was made to Gatsby at the end of 2001 for a second grant to extend the scheme, a number of changes were put forward in response to experience with the IFs and the changing national context for commercialisation. It was proposed to:

- introduce increased flexibility regarding the start date and duration of IFs;
- broaden funding from just full IFs to also include projects such as feasibility studies;
- act as a "feeder mechanism" to position projects to apply for support from the University Challenge Fund;
- use some of the grant, along with University finance, to provide a small seedcorn fund; and
- provide small grants (i.e. up to £5000) for staff to work with tenants of the Innovation Centre on early stage projects.

3.101 The table below gives the most up to date picture of the current standing of the IF grants, based on information available to the IP office. It is worth noting that these projects have received funding in excess of £5 million since the Gatsby intervention.

Table 3: Innovation Fellowship grants

Date	Recipient	Project	Amount	Outcome	Comments at April 2010
August 1999	Professor P Smith & Dr M Hayes, Electrical & Electronic Engineering	Development of an innovative piece of medical equipment as part of a joint-venture - 'e-pedal	£45,000	Spin-out company	Current position not known. Prof Smith died in a road accident
June 2000	Professor S Austin & Dr J Steele, Civil & Building Engineering	Establishment of a spin-out company providing services to users of innovative project management software ADePT	£42,000	Spin-out company Adept Management Ltd.	Company is growing and has just opened a US office
January 2001	Dr (now Professor) J R Tyrer Wolfson, School of Manufacturing & Mechanical Engineering	Evolution of a new laser-technology related product from its academic roots to become part of the product of an established spin-out company Laser Optical Engineering	£45,000	Spin-out company strengthened by new technology	The company is a small enterprise and commercial-isation of the technology is going well. A subsidiary company, Vehicle Occupancy Ltd, has been formed to exploit one aspect of the technology
February 2001	Professor D. Loveday & Dr H. Salt, Civil & Building Engineering	Development of a laboratory-based systems to license an innovative air conditioning system	£18,232	Licensing opportunity developed and being actively marketed	This is an active project known as "Cooled Ceilings". The technology came second in an international competition in 2009 and it is hoped a new joint venture company will be formed in Q3 2010
September 2001	Professor J. Huntley Wolfson, School of Manufacturing & Mechanical Engineering	Development of an innovative prototype system for optical shape measurement – Phase Vision	£47,000	Spin-out company Phase Vision Ltd.	The technology has developed well. The company has received investment of over £2 million and has grown to around 20 employees
August 2001	Dr D. Lockyer & Prof Y. Vardaxaglou, Electrical & Electronic Engineering	Design and manufacture of plasma antennae for third generation mobiles	£42,707	Spin-out company Antrum Ltd.	Currently a small company but it is seeking opportun-ities to grow and expand
March 2002	Professor R. M. Smith & Dr J Bone, Chemistry	Widen the applications of a flame ionisation detector to develop a broad portfolio of demonstrated applications that will assist in taking the product to market	£11,890	Spin-out company Detkt Ltd. (later wound up)	Exploitation through a spin-out company did not work. A licence for the technology has been signed with CSI Ltd who continue to develop the technology to release onto the market
August 2002	Professor C. Anumba, Civil & Building Engineering	Refinement and commercial-isation of software tool, Fanest, that has been created to enable organisations in any sector to better address their knowledge management problems	£45,000	Spin-out company (later wound up)	Project terminated when the academic left LU for the US. There was no possibility of exploiting the technology

Table 3 continued: Innovation Fellowship grants

Date	Recipient	Project	Amount	Outcome	Comments at April 2010
October 2002	Dr R Holdich, Chemical Engineering	To support production of a prototype micropore filter media rig, plus various activities associated with taking the product to market	£44,708	Spin-out company Micropore Ltd.	Company continues to develop its markets and is due to move from the LU Innovation Centre to its own premises in Q2 2010
October 2002	Professor P. Smith & Dr V. Crabtree, Electrical & Electronic Engineering	Development of a patient physiology recorder to create create a marketable prototype	£43,489	Spin-out company Dialog Devices Ltd.	Company received approx. £2.4 million venture capital investment and it continues to develop medical devices and instrumentation
November 2002	Professor R. Jones Wolfson, School of Manufacturing & Mechanical Engineering	System to measure ball spin	£44,500	Spin-out company QuinSpin Ltd.	The company still exists but is not actively trading. The initial technology was not as robust as desired, limiting the commercial success. A cheaper, software only package is being looked into
April 2003	Dr Michael Kong, Electrical & Electronic Engineering	Low temperature atmospheric plasma sterilisation technology	£43,595	Follow-on research and application research is taking place	The core technology is currently being used to develop further ideas. The commercialisation of one of these ideas (the treatment of soft fruit) is being developed in partnership with Nottingham University
January 2003	Dr E Norman & Dr O. Pedgley, Design & Technology	Cool Acoustics - Polymer Guitar	£44,924	Spin-out company Cool Acoustics Ltd. (later wound up)	The technology proved to be commercially unattractive and it was not possible to develop the spin-out company or to commercially license the software. The IPR will be made available to the academic inventors to allow them to individually use the ideas and concepts
January 2003	Professor P. Chung, Computer Science	Automated process hazard analysis tool	£9,000	Spin-out company Hazid Technologies Ltd.	The company survives and has received investment from both the Lachesis Fund and other investors. The company is poised to make significant sales in 2010 bringing it into profitability
June 2003	Mr M. Reading, Institute of Polymer Technology & Material Engineering	Development of a software package for understanding the effect of topography on scanning probe microspy measurements	£44,000	Academic moved away but LU retain an interest in the IP	No further action
June 2003	Dr J Mottram, Loughborough School of Art & Design	Aluminium stretcher support system	£10,445	Licensing explored – project now abandoned as academic moved away	No further action
August 2003	Dr A West, Wolfson School of Manufacturing & Mechanical Engineering	System to improve tablet manufacture (match funding for a DTI SMART Award)	£15,000	Project abandoned	No further action
November 2003	Professor R Parkin, Wolfson School of Manufacturing & Mechanical Engineering	Intelligent condition monitoring for optimal machine availability (match funding for a DTI SMART Award)	£15,000	Spin-out company Iensys Ltd.	No commercial progress was made. The IP and the company were transferred to the academic inventors
July 2004	Dr S Rice, Prof I Reid & Dr D Graham, Geography	Innovative measurement technology for granular modules	£29,224	Multiple licences sold and still being actively marketed through LUEL	The product is known as the "Digital Gravelometer" and there are several sales made through consultancy each year

Table 3 continued: Innovation Fellowship grants

Date	Recipient	Project	Amount	Outcome	Comments at April 2010
September 2004	Dr N Beacham, Computing Science	Commercialisation for a first line screening tool for dyscalculia	£43,430	The software was developed and a licence was signed	The academic left LU and no further work could be undertaken. To permit market penetration a licensing deal with a commercial software provider was signed
May 2005	Dr D. Mulvaney, Mr V. Chouliaris & Mr A. Kumaraswamy, Electrical & Electronic Engineering	Specification capture and electronic design tool Kreatur	£25,000	Spin-out company Axilica Ltd.	The company received investment from IPSO Ventures Ltd and is an active company in the Innovation Centre. It has made the first sales of its product

3.102 The University has summed up the importance of Gatsby's grants for the IF initiative as follows:

"The Gatsby Innovation Fellowship Scheme has been fundamental in enabling these changes and producing this success story. It has both helped to found the Enterprise Office and to engage with the academic community in a useful and meaningful way. The activity has grown significantly and will continue to develop as a major part of the University's overall strategic development plan.

"Support from the Gatsby Foundation has enabled us to accelerate and become a leader in technology transfer amongst British universities, and we will continue to build on this success."

Innovation Awards for Sports Technology SMEs

Nature of the initiative

3.103 Develop a cluster of SMEs drawing on the University's excellence in sports science and technology.

Background

3.104 Loughborough University leads the world in sport and its underpinning academic disciplines, with an outstanding track record in sports performance, sports science and engineering. The University explains the efforts to develop a sports cluster on campus as follows:

"The University's increasing impact and exploitation of its work through partnering sports organisations is reflected in its Sports Technology Institute, a £15 million initiative to enhance research, innovation and enterprise in the sports sector that opened on the Park in 2009. This was further reinforced by the opening in 2010 of SportPark, a national hub for sports governing bodies. Both initiatives are supported by emda, the East Midlands Development Agency, in acknowledgement of the significant wealth potential that sport brings to the region.

"The co-location of the Sports Technology Institute and SportPark, and their proximity to the School of Sport, Exercise and Health Sciences, the Sports Development Centre and many of the UK's leading athletes that train at Loughborough, makes the Science and Enterprise Park the ideal location for the sports industry and related organisations.

"As a preferred partner to UK Sport, the Sports Technology Institute is contributing to a range of cutting-edge research projects to support athletes in preparation for the London 2012 Olympic and Paralympic Games. The Institute is an important part of Loughborough University's offering to the British Olympic Association as the Official Preparation Camp Headquarters for Team GB for the London 2012 Olympic and Paralympic Games. The University's world-class reputation for sport has been recognised by an agreement with the Japanese Olympic Committee that will see Japan's Olympic teams basing themselves at the University prior to the Olympic Games and other international events, and the start of a legacy of stronger research and industry links with Japan."

3.105 It is within this ambitious context that the Gatsby Innovation awards have been deployed since 2008. Two rounds of competition for the awards have been completed. The final allocation was awarded in April 2010. A mid-project report was submitted to Gatsby in January 2010, by which time awards had been given to 12 micro companies. The University reported that:

"Successes include partnerships and licences with global brands, new product launches, increased workforce, doubled turnover within a year and worldwide brand recognition."

3.106 The award to David Cleaver of Inspired Bicycles **(www.inspiredbicycles.com)** was documented in a case study which instances the range of positive outcomes:

Figure 1: Inspired Bicycles

The Award enabled 27-year old Dave to move the trials bike business he had just launched from his living room to a warehouse in rural Leicestershire. Two years on, Dave has built up a loyal supply chain with Taiwan's leading bike component manufacturers who are keen to accept minimum orders because Dave's designs challenge them to innovate. He has also impressed Hope, the UK's biggest high-end bike component company, which has made Inspired Bicycles its exclusive supplier of trials bike wheel rims.

Another high profile supporter is Danny MacAskill, arguably the most famous name in trials biking and a team rider for Inspired Bicycles since its launch. In April 2009, a film of Danny riding an Inspired Fourplay bicycle around Edinburgh earned cult status by becoming the most watched YouTube sports video of all time, with over 16 million views to date. The film has been instrumental in raising the global profile of both Danny and Inspired Bicycles, with the YouTube site driving a surge of fan mail and custom to both their websites. The partnership remains strong, which in Dave's own words is "both fantastic and humbling" when you consider that Danny has since been featured in adverts for Volkswagen and praised by Tour de France legend Lance Armstrong.

The appointment last summer of a PhD graduate to manage marketing, branding and logistics, has enabled Dave to focus on product innovation and manufacture. As a result, complete bikes featuring his unique design have been on sale since December 2009. He moves into larger premises in Leicestershire later this year and will have at least four models of bikes by October 2010. These will arrive to the UK warehouse semi assembled by 2011 to keep pace with the burgeoning demand. Turnover has almost doubled in the last year despite the economic downturn. This is partly due to a 25% increase in exports and sales are regularly made to over 20 countries, including Europe, America, Canada, Australia and Japan.

Ensuring a pipeline of innovative products is crucial to the continued success of Inspired Bicycles and Sports Technology Institute Director Professor Mike Caine was impressed by Dave's Gatsby Award proposal to design and manufacture a further novel bike frame. "I've admired Dave's drive and ambition since his time as a student at Loughborough and was delighted to support his new business," says Mike. "I'm really pleased that Dave has been able to benefit from the expertise within the Institute and look forward to continuing to assist Inspired Bicycles as the company grows and prospers."

"The Gatsby Award has given me the impetus both to innovate and to diversify into street mountain bikes," says Dave, who is preparing a further funding proposal with the University. He has every reason to be proud of what he has achieved in three years and dreams of the day Inspired Bicycles bear the 'British made' stamp. Given the unprecedented success of the last year, and the potential of advanced manufacturing in Britain, it's a dream that could one day become reality.

3.107 It is, as yet, too early to reach independent judgements on outcomes and impacts but the mid-project report paints a broadly positive picture.

Points for further reflection

3.108 The individuals responsible for managing initiatives such as the two described above are typically responding to multiple imperatives. They need to:

- identify good projects – here Loughborough has consistently sought to ensure that a strong assessment panel is in place;
- work actively to recruit effective mentors and pair them with the most appropriate firms;
- help quickly to troubleshoot any difficulties that arise in project implementation;
- counsel and assist inventors with regard to IP protection and exploitation;
- ensure that grants are spent on approved activities; and
- celebrate and publicise successes for the benefit of the recipients and the University.

3.109 In the most part such roles need to be exercised energetically in the here and now. This leaves little time for longer term monitoring and standing back to learn from the larger picture. The information provided in Table 3 was specifically drawn together to inform this report. In future it may be worth pondering an approach through which a small amount of basic data can be maintained on a regular basis even for recipients of relatively small grants. To set up a monitoring system which required intrusive levels of information to be provided would be unreasonable and unworkable. There would, however, be considerable merit if a simple system, orientated towards learning rather than ex post judgment, could be developed for use across a range of KTT initiatives (including, for instance the St John's Innovation Centre £ for £ scheme).

3.110 There has been a good deal of debate among policy makers and economic development practitioners as to whether or not interventions can bring an internationally competitive cluster into being by design rather than serendipity. Loughborough's experience in releasing the latent potential it undoubtedly possesses in sports science and technology in order to stimulate wealth creation for the region will be of considerable interest to this debate. If possible, a local academic should be encouraged to undertake a longitudinal study into what is being achieved and how.

Cambridge-MIT Institute

Nature of the initiative

3.111 Encourage collaboration between the University of Cambridge and the Massachusetts Institute of Technology (MIT) on issues including IP commercialisation and entrepreneurship promotion.

Background

3.112 The Cambridge-MIT Institute (CMI) was established in 2000 to promote collaboration between the University of Cambridge and MIT on the initiative of the then Chancellor of Exchequer (who had favoured a link with the University of Edinburgh). From the UK side negotiations were orchestrated by the Treasury which subsequently passed responsibility on to the then Department for Trade & Industry (DTI).

3.113 This disjuncture alone may have complicated the start-up phase. However, it was further compounded by expectations that CMI's activities would quickly generate wealth, which placed a heightened importance on arrangements for IP ownership and exploitation. The ensuing discussions between lawyers and administrators representing both institutions meant tangible engagement started slowly, and may have deflected attention from more important considerations, as noted in a report by the National Audit Office.

3.114 Gatsby's £5 million grant to CMI was not formally ring-fenced for specific activities, though Gatsby indicated particular interests in knowledge transfer, developing entrepreneurship and broadening the Institute to involve other UK universities in these topics. Therefore these aspects of CMI are considered below.[16]

3.115 They need to be set within a broad context of:

- an initiative that struggled somewhat in its early years;
- a general sense that collaboration in teaching of both undergraduates and graduates yielded a range of positive benefits;
- mixed views about the outcomes of research collaboration. The Technopolis report, though generally positive, did not pay close attention to additionality; and
- widespread appreciation of the benefits that have arisen and persisted from collaboration between the two research commercialisation offices.

Research commercialisation

3.116 The director of MIT's Technology Licensing Office (TLO) was involved quite early in the discussions to set up CMI. At one stage it was suggested that her office should take responsibility for commercialising CMI's IP. This she declined, instead suggesting MIT's Office could transfer the technology of technology transfer itself.

3.117 MIT has a clear policy framework for IP commercialisation, transacts a high level of business and has many different people involved in negotiating deals. To help ensure that policies are not eroded, boilerplate (model) agreements form the starting point for negotiations. A high throughput on licences is achieved by negotiating for "reasonable terms", not necessarily "best terms" and not worrying about obscure risks, *"providing we stay within our important policy guidelines and don't get anywhere near ethical problems. It's further enhanced by local autonomy in our office: we don't need to go to legal approval"*. There was much to learn from this for Cambridge as it then operated.

3.118 It was decided that learning could best be shared through secondments and a joint project proposal was put to CMI to fund this. Efforts were initially made for a one year secondment from a younger member of the MIT team. This foundered for personal reasons. Instead, the MIT TLO's director (who was underpinned by a very capable team) herself came to Cambridge for six weeks. Crucially, the Cambridge team gave priority to making this visit a success, exposing her to a great deal of the UK TT scene through visits to other Universities and a Bank of England

[16] An evaluation of CMI has been undertaken for the Department for Innovation Universities and Skills (Technopolis, February 2009) but its scope was broad and its analysis was not consistently penetrative.

report highlighting the dearth of Technology Transfer Officers and the lack of training for them.

3.119 The head of the Cambridge office, then the Research Services Division (RSD), paid several shorter visits to MIT, but his deputy visited MIT for six weeks and similarly speaks very positively about his reception in Boston, where he was supported by a carefully chosen and highly capable mentor from the TLO who took his task seriously. Positive and friendly personal relationships were established through these and other visits and this greatly helped subsequent collaboration. Moreover, a great advantage of such exchanges is that *"they help distinguish what is generic from what is idiosyncratic"*.

3.120 In the event, Cambridge did not feel able to make a sudden switch to the MIT style. Aspects of the "market" which work well in seeking out and exploiting MIT technology are not present in the UK. However, the current structure, with Cambridge Enterprise as an organisation separate from research services, is much closer to the MIT approach than was previously the case. Furthermore, the University's IP policies are now clearer and better framed. More generally, the standard "Lambert Agreements", while not mandatory, offer many of the same benefits as MIT's standard agreements. While it would be ambitious to directly attribute these changes to the CMI-facilitated dialogue, it was certainly a help rather than a hindrance.

Praxis

3.121 Praxis is an educational not-for-profit organisation set up to support the commercialisation of public sector and charity research through measures including training. As with many successful initiatives, there is more than one version of Praxis' genesis. The problems it addressed – too few TT professionals and a lack of training – were certainly highlighted to MIT's TLO director by the Bank of England report, but for others the problems were highlighted in one of the workshops funded by the National Competitiveness Network. In either event, CMI activities can claim credit. However, it was the good relationship between the director of the MIT TLO and director of Cambridge's RSD which was the crucial factor leading to a positive response.

3.122 They reached the view that the institutional basis for TT was lacking in the UK – it was peripheral to the Association for University Research and Industry Links (AURIL), and the University Companies Association (UNICO) was restricted to institutions with a company structure. Praxis was to have two objectives: most importantly to provide training to expand and enhance competences, but also to catalyse TT practitioners into a community.

3.123 In the US, training for TT staff is provided by their professional association, the Association of University Technology Managers (AUTM). The initial thought was to bring AUTM courses to the UK, however:

- after attending an AUTM course, the director of RSD was not wholly convinced they would transfer directly to the UK;
- AUTM were preoccupied with other issues when approached about providing a franchise; and
- MIT believed the aim should be for UK leaders in the field to train UK practitioners, drawing on outside help where appropriate.

3.124 The upshot was that the RSD director brought together a programme committee from other leading research universities and a tentative start was made. CMI made an oral offer to underwrite the initial venture and subsequently gave financial support. For two years Praxis successfully operated its finances on a project code in the Cambridge RSD. It later received a cash injection from a DTI competition award of £1 million which was shared between AURIL (the main beneficiary), UNICO and Praxis. This was used to convert Praxis from a CMI project to a company limited by guarantee.

3.125 With CMI providing a fallback, Praxis took a tentative initial step in November 2002, posting details of a course to be held in Bristol on the web in the hope of attracting around 20 delegates, with a planned course capacity of 40. The actual response was surprisingly high. Capacity was expanded to 55, but the course was still over-subscribed. This provided a vivid confirmation of latent demand and Praxis courses have continued to be popular. Nonetheless the commercial approach has been cautious and an ethos maintained of training provided by the TT community for the TT community. The model is one of a self-help community initiative[17], with every effort made to

[17] It should, however, be noted that a number of speakers from MIT contributed to early Praxis courses and the MIT TLO director has taken a sustained and active involvement, with MIT's blessing, for eight years. "MIT likes its administrators to have a reputation in their sphere, so continuing with Praxis was gently encouraged."

keep the costs down and the prices low with the objective of making the course available to the 'foot soldiers' and not just the directors. This is achieved as:

- practitioners provide the training;
- they are not paid (though given a good dinner!);
- directors, programme committee members and course managers are also unpaid;
- there are some speakers from commercial firms but they agree not to market overtly;
- some academics and private sector participants attend which extends the scope for informal learning through networking;
- marketing is through word of mouth; and
- Praxis uses its resources to provide first-rate administration (administrative and clerical staff are paid) and avoid any hassle for participants.

3.126 At its peak two years ago, Praxis achieved a turnover of about £500,000, though its activity overseas has recently increased and at a recent course in Peterborough one-third of the delegates came from outside the UK. Despite this turnover, the policy of keeping fees low has meant that Praxis has depended on grants and subsidies – often small ones from local development agencies – to stay afloat financially.

3.127 From the outset Praxis only intended to keep going as long as there was a need. At the same time it hoped to simplify the UK's institutional landscape for TT through mergers. Praxis has now merged with UNICO (AURIL has consistently been concerned to preserve its individual identity) so there is an established base from which its work can continue.

The National Competitiveness Network

3.128 The National Competitiveness Network was the fourth (and least costly by far) of CMI's overarching programmes (the others being integrated research; student teaching; and professional practice). The Network was CMI's outreach to other universities; which was a delicate task given it faced a degree of antagonism from some universities over the process by which Cambridge had emerged as the sole partner for MIT.

3.129 Links between Cambridge and other universities were to be developed through Science Enterprise Centres (SECs) which had already been established through competitive bids in 1999/2000 and 2001. Each SEC served a number of universities. Overall some 40 were involved. The centres were funded for a limited period and expected to:

- support the teaching and practice of entrepreneurship among science faculty and students;
- promote links between universities and business;
- promote a culture of enterprise; and
- facilitate the commercial exploitation of scientific research.

3.130 These aims meshed well with those of CMI, but in practice a number of factors made the task of the CMI team far from straightforward. They included:

- significant differences in the remits for SECs - some concentrated on teaching (with varying foci), some on research, and there were different degrees of emphasis on technology transfer;
- short-term concerns among some centre managers about funding precipices (exacerbated when they discovered that they could not get cash from CMI) and changes in personnel during the programme period;
- a lack of genuine connectedness between the SECs and their universities *("grafted on by a grant")* in certain cases;
- somewhat blinkered attitudes to learning from MIT and (especially) Cambridge – *"you're different from us"*; and
- the paucity of universities' connections with their regional innovation eco-systems and business communities (lawyers etc).

3.131 Nonetheless, the CMI team pursued its remit energetically. There were quarterly workshops, hosted by one of the SECs, to which all others were invited. CMI met the costs and worked together with the host to structure the workshops. Funding was also provided for entrepreneurship development projects and to improve entrepreneurship teaching.

"The Enterprisers programme, formerly known as CMI Connections, was established by the Institute as a bold experiment to see what happens when you take talented young people from all corners of the globe, each with diverse cultural backgrounds and disciplines, and combine this with retreat. 1000+ students have been inspired by the programme to date and

over 45 entrepreneurial ventures are currently being pursued by Enterprisers alumni."[18]

3.132 There was also engagement with Regional Development Agencies in a series of regional events, some of which addressed issues of particular policy interest such as social enterprise and the role of universities in regional economies. Nationally, there was a high profile annual "Competitiveness Summit".[19]

3.133 In summary, the decision for CMI's outreach to be channelled through SECs added to the challenge of the task, but there were arguably few alternatives once the remit had been set of taking a very inclusive approach. MIT believed one of the goals was to *"spark the leadership of provincial universities and give them the material on which to build enterprise/innovation education"*. Of the universities involved *"about half did something positive during the three years of the programme but only five or so really embedded the activities in a serious way"*.

3.134 From the US perspective a wide outreach would have worked well if there had been more serious people to partner with. Given that there were not, it would have been better to identify a smaller number of universities to work with on a more intensive basis and let others learn from them as and when attitudes became better attuned. However, to do this would have missed the aim of general inclusiveness and the work with SECs has led to the creation of Enterprise Educators UK – a network that supports over 600 enterprise educators from more than 90 higher education institutions.

Points for further reflection[20]

3.135 The National Competitiveness Network seems to have been well executed and was very positively reviewed in the Technopolis evaluation. However, in retrospect there are important questions about the remit it was given, the choice of SECs as interfaces with universities, and the pressure to make haste, partly to compensate for the inevitable lack of visible progress of some of the CMI's other programmes.

3.136 Experience with research commercialisation and Praxis certainly underlines the advantages of a measured process of knowledge exchange based on people. The factor behind much of the success achieved can be succinctly summarised as – **it's the people, stupid**.

University of Manchester: Proof of Principle Programme[21]

Nature of the initiative

3.137 Grants to further develop IP showing commercial promise.

Background

3.138 The original proposal made in 2004 to Gatsby, asking for support for a *"proof of concept fund"* came from UMIST Ventures Ltd and Manchester Innovations Ltd. As anticipated in the proposal, these organisations were combined into the University of Manchester Intellectual Property (UMIP) as part of the merger between the University of Manchester and the University of Manchester Institute for Science and Technology. The model adopted post merger was for:

- UMIP to take responsibility for intellectual property;
- the research office to administer contracts for research and consultancy; and
- a separate unit to be responsible for the incubator, events and other outreach activities.

3.139 Responsibility for the Gatsby grant was therefore allocated to UMIP, which has a clear remit to make money from IP: *"we don't take out patents we cannot afford."* This remit is within the context of a generous framework of incentives for academics – a tricky balance as the PBL experience shows.

3.140 There are several interesting initiatives that help to generate good projects for the Proof of Principle (PoP) Programme, for instance:

- the University offers grants, open to younger academics, to fund translational research. Applications, which typically bid for £15,000 to £20,000, require a business plan. For larger external translation research grants, ranging from say £250,000 to £2 million, UMIP provides assistance to researchers in preparing their business plans; and
- the University has joined forces with the

[18] Specifically in respect of business plan competitions, MIT noted they were helped in the US by a greater permeability of boundaries between Masters students and undergraduates and, to a lesser extent, PhD students.

[19] Seen from a personal (and partial) perspective as an individual participant these were well organised, well attended and worthwhile events.

[20] It is important to note that the Technopolis evaluation gave a positive commentary on research commercialisation, Praxis and the National Competitiveness Network. While the commentary in this section raises critical questions about the remit given to the National Competitiveness Network, it is generally positive about the effort to fulfil that remit (although it was beyond the scope of this review to assemble definitive evidence on either score).

Greater Manchester NHS and Primary Care Trusts to create Manchester: Integrating Medicine & Innovative Technology – an initiative which facilitates collaborations between clinicians, scientists, engineers and industry to develop innovative technology for patient benefit (this is affiliated to the Center for Integrating Medicine & Innovative Technology in Boston)[22]

3.141 Provision is also in place to support projects that continue to show real promise after their PoP award but are still not ready to attract second phase seed funding. Subject to a tough review process, they can be awarded a "super PoP" to double up the award.

3.142 Following on from this, the MTI £32 million UMIP Premier Fund is a late-seed fund which *"will look to initially invest between £250,000 to £750,000 per spin-out, but with the capacity to continue investing up to an average of £2 million to £3 million to academics with promising technology found within the University"*. The PoP programme was an important dimension in attracting investors in the Premier Fund, which by Spring 2010 had invested in seven University spin-outs and 12 proof of principle projects (three of them licensing projects).

3.143 The Gatsby grant of £375,000 was spread over three years from 2004/5 to 2005/6. Before making the grant it was ascertained that the University would provide funding from its own resources and that there would be strong support from the University leadership, which proved the case. Funding came initially in broadly equal proportions from Gatsby, the University and the North West Development Agency, and was later augmented by a Higher Education Innovation Fund (HEIF) allocation to bring the total available to £1.5 million. The University has subsequently indicated a willingness to make up to £1 million available per year for PoP over a five-year period.

3.144 UMIP's Chief Executive Officer prepared a report at the end of April 2009 which documents the progress made up to that time and emphasises the importance of Gatsby's initial advice and subsequent involvement in addition to the finance it provided. This report, which forms Annex H, tabulates activity over the first three and a half years, noting that of the 61 projects there were 24 spin-outs and 37 licences, and that 24 of the 163 patent filings were granted:

3.145 These data suggest a good performance, reflecting a well-managed initiative able to draw on a strong and large research base, and supported by the University as a whole. The management process is that:

- applications for PoP funding are submitted to a panel which includes people from corporate finance, venture capital, technology transfer, consultancy and Gatsby;
- as the panel may not have domain expertise, applications have to be supported by expert testimonials on the project's merits in terms of its science and its market relevance;
- the Principal Investigator reports back to the panel towards the end of the grant period.

3.146 UMIP's CEO emphasised the importance of scale. A portfolio of around 30 projects a year gives comfort in being able to demonstrate success, but it requires access to a major base of excellent research and some £2 million of funding. A typical PoP grant is now in the range £80,000-£90,000. This has grown substantially because it now needs to cover mentoring and preliminary market development, recognising that second-stage seed funds are looking for deals of £500,000 rather than the £150,000 deals of 5-10 years ago.

Points for further reflection

3.147 The question of scale merits careful consideration when setting up a PoP type fund and the size and experience of the commercialisation office needs to be part of this consideration (UMIP has 39 staff). Stand-alone smaller initiatives may find it difficult to attract the attention of follow-on funding. They may also lack the portfolio spread necessary for a reasonable likelihood of some "winners" emerging in the mix.

Table 4: University PoP fund – UMIP managed – formally initiated in Oct 2004 (table to Jan 2009)

No. of projects	No. of patents	Investment cost	No. of exit events	Value realised	No. of PoP projects written off	Value written off	Third party seed leverage inc. IP grants
61	163	£3.8 million	3	£1.25 million	6	£640,000	£33 million

[21] Further details of the Programme are given in Annex H.

[22] The intention in the proposal to Gatsby was that the PoP would focus on department and institution cross-linking.

3.148 From the Gatsby perspective, it is noteworthy that UMIP welcomed the visibility and imprimatur which the Foundation brought when the fund was being considered by the University leadership. It also appreciated the expertise and wider perspectives that Gatsby brought to the early years of the fund's operation.

New Engineering Foundation: KTT development in Further Education colleges

Nature of the initiative

3.149 Development of an overall framework for KTT in further education and grant funding for selected mini projects as pilots.

Background

3.150 The New Engineering Foundation (NEF) is a grant awarding charity focusing on vocational education in science engineering and technology. In mid-2007 Gatsby made a grant of £331,000, spread over two and a half years, to establish a national framework to facilitate KTT partnerships between FE colleges and local companies. The proposal, which was developed in dialogue with regional development agencies (RDAs), envisaged the following activities:

Phase One

- surveys of college capabilities;
- surveys of business needs (using five priority sectors identified by nine RDAs);[23]
- synthesis of findings;
- regional and stakeholder focus groups; and
- dissemination of report.

Phase Two

- call for college participation in mini projects;
- awards of £15,000 each to 12 mini projects;
- selected case study write-ups;
- final report to include framework and case studies; and
- event and dissemination.

3.151 The initial survey work identified pockets of enterprise within college departments of which the senior managers were unaware. The final report at the end of Phase One – *Knowledge and Technology Transfer in Further Education,* May 2008 – noted that while some colleges saw KTT as 'mission critical', *"a greater number of colleges are showing little activity and little awareness"*.

3.152 The final report summed up the position as follows:

"Challenging the culture is seen as a critical factor in generating more, and more effective, KTT activity. This also requires the resolution of some of the dilemmas in the system: businesses want a pay-off for their investments in time and colleges need additional income. Colleges are geared to delivery to obtain unit funding returns and hit performance indicators and contracted outputs (e.g. qualifications), yet developing new and responsive business relationships will be a priority if KTT is to be real, not charitable."

3.153 The report noted that to accelerate KTT activities would require significant investment in "creating the conditions for KTT to flourish in the FE sector". It made 16 specific recommendations - 13 to government departments and agencies, and three to the FE sector. Interestingly, in view of the main focus of the other Gatsby grants, one of the latter recommendations was that:

"FE colleges should seek to extend their existing relationships with HE institutions and employers to support a broader range of business-facing innovation interventions."

Phase Two: mini-projects in colleges – Knowledge Transfer Exchange Nodes (KTENS)

3.154 There were twenty-two responses to the call for proposals and 11 of these were selected. Two of them were collaborative projects involving more than one college – a deliberate intervention by NEF to facilitate regional working on specific regional priority areas. While the grants awarded were not large (£15,000 - £25,000) they could be used flexibly and NEF were highly appreciative of Gatsby's approach in this respect – looking for key outcomes not outputs. Importantly, the size of the grants meant that they had to draw on and use existing resources in the college as the grants were not large enough to warrant the hiring of additional personnel. However, they acted as 'seed funding' and most of the supported KTENS are now an integral part of the colleges' provision.

3.155 All the KTEN grants were written up as case studies in an NEF report *The Impact of the Knowledge Transfer Exchange Nodes*. The case

[23] The survey of business needs is not covered explicitly in published reports and it is unclear whether or not five sectors were selected and, if they were, which ones.

studies were written by the colleges themselves which, in most cases, adds to their approachability; though the drafting in a few lacks clarity. A short evaluation report based on structured telephone interviews and some face to face interviews was published by NEF in October 2009. NEF indicates that independent consultants were given a small budget for this work.

3.156 From telephone discussions with the NEF and a review of the case studies, the following points seem of particular interest:

• all the KTEN projects focused on the development of technician education (level 3/level 4) and the dialogue with industry helped to reinvigorate both the curricula and the people involved in the KTENS;

• the key approach of the KTENS was to free up time and provide the resources to create networks to bring people (from the colleges, industry and, in some cases HE) together which would catalyse knowledge transfer and exchange; and

• in all cases the KTEN project has started a culture shift towards greater awareness of KTT in the College and in most cases the KTENS have continued.

3.157 By way of illustration, a personal reading of the case study summaries from a selection of four projects indicates some of the benefits:

• improved training and outreach to business. Business-friendly timetable introduced. Helped win a major grant to deliver industry training;[24]

• improved collaboration between colleges. Led to serious dialogues with industry which should result in future activity. Better staff understanding of KTT and improved training;

• very productive dialogue with firms and an example of KTT from industry to the college which results in more competent lecturers, better focused courses and up to date teaching materials; and

• brought industry expertise back into the college. Developed a testing lab for use by business start-ups and micro businesses among others.

3.158 The NEF believes that it is seen as a supportive organisation which understands the key issues in FE. This results in a relationship of mutual respect and understanding which creates an atmosphere conducive to innovation and experimentation. It reports that:

"the KT in FE agenda is firmly still high in NEF's strategy and KTENS project has been followed in 2010 by the Knowledge and Technology Transfer Champions project (funded by LSIS) which has focused attention on the development of a KT culture at curriculum level particularly looking at Emerging Technologies and Technician education.

"NEF has also delivered over 18 Innovate to Educate workshops and Action Learning Sets throughout the UK (funded by Gatsby) in partnership with the Technology Strategy Board to 200 key decision makers in FE which again is heightening the awareness of KT and its role in FE. The KTEN concept has now been adopted by a number of RDAs such as emda, SWRDA and Yorkshire Forward."

Points for further reflection

3.159 Experience from the FE sector underlines the allusion in the first paragraph of this report to the two-way transfer of knowledge and technology i.e. Knowledge and Technology Transfer and **Exchange**. It is crucial that teachers of vocational education courses have the opportunity to develop relationships with industry. These will often lead to direct benefits for the involved firms but, more fundamentally, they will lead to a more relevant and more stimulating educational experience for students and encourage technicians from industry (and their employers) to give greater priority to updating their skills through Continuing Professional Development.

3.160 A great deal of energy appears to have been put into this initiative by the NEF. Some aspects of the initial proposal appear to have been shelved, in particular the final report, but overall the important issue of KTTE in relation to the FE sector has been given a heightened profile and valuable evidence has been generated in support of the case for further efforts in the future. In view of the importance of the topic it is perhaps disappointing that a fuller independent evaluation has not been undertaken.

[24] Several of the KTENS leveraged other funding to enable further curriculum development (for example in the composite nuclear and engineering sectors).

4: Grants for research projects relating to KTT

4.1 This chapter deals with a small number of grants which covered a variety of activities ranging from support for specific reports to the appointment of a research fellow at Sussex University's Science Policy Research Unit (SPRU). The table shows them in chronological order:

Table 5: a summary of grants for research projects related to KTE

Institution	Name of project	Nature of project	Year	Amount of grant
13. Committee of Vice Chancellors and Principals of the Universities of the United Kingdom	Technology Transfer – the US Experience	A visit to leading university technology transfer offices in the US by a group of Vice Chancellors and managers of UK technology transfer offices	1998	£106,000
14. St John's College and SQW Limited	Cambridge Phenomenon Revisited	Research to update the 1995 report on the Cambridge Phenomenon, with an early focus on the two leading property schemes fostering the development of science-based firms	1999	£40,000
3. University of Cambridge and St John's Innovation Centre	Funding of Technology Reports	A series of four reports looking at finance and other support for innovative, technology-based firms	2000 to 2007	see footnote [25]
16. University of Sussex and University of Brighton	Gatsby Fellowship at the Freeman Centre	To analyse Gatsby Technology Transfer projects and conduct research in the area of technology transfer	2002	£282,000
17. St John's College and SQW Limited	University Spin-out Companies: Starting to Fill the Evidence Gap	A research project prompted by a concern about the crude use of data on university spin-outs as a performance indicator	2003	£40,000
18. University of Sussex (Science Policy Research Unit) and the University of Manchester	The Benefits From Publicly Funded Research	A review of new literature to update SPRU's seminal research to identify the nature and scale of benefits arising from publicly funded research	2006	see footnote [26]
19. University of Sussex	Patent protection report	Research into how well universities are handling their patenting activities	2008/2009	£147,000

Technology Transfer – the US Experience

4.2 The original idea for this initiative came from Sir Ronald Cohen, chairman of the venture capital firm Apax, who felt that UK academic leaders and practitioners would benefit from a better understanding of technology transfer experiences and practices in the US. He also offered to make introductions to venture capital firms in the US.

4.3 The idea was progressed in partnership between Gatsby and the Committee of Vice-Chancellors and Principals (CVCP) (now Universities UK), who selected a group of Vice Chancellors/pro-Vice Chancellors and directors of technology transfer offices. The university leaders came from Leeds, Portsmouth, Sheffield, Southampton and Warwick. The TT practitioners were from Cambridge, Imperial College (London), Oxford, Manchester, Strathclyde and University College (London). The other members of the mission were CVCP's policy adviser, Gatsby's Technical Director, an Apax partner and a rapporteur from the consultancy Segal Quince Wicksteed (SQW).

4.4 Considerable effort was invested in maximising the benefit from the one week visit and subsequently disseminating the findings. Firms and institutions visited were (in broadly chronological order):[27]

- MIT's Technology Licensing Office;
- Quantum Energy Technologies (Cambridge MA);
- Harvard University, Office of Technology and Trademark Licensing;
- Massachusetts General Hospital, Office of Patents, Licensing and Industry Sponsored Research;
- Massachusetts Biomedical Institute;

[25] A part of one of the author's time costs was covered by Gatsby grants to the University of Cambridge. In addition, Gatsby contributed modest amounts towards travel, printing and distribution.

[26] This work was undertaken through the grant made to the University of Manchester.

[27] The mission divided into two groups for the West Coast visits and the University of Chicago was visited by a single member of the team.

- Boston University Office of Technology Transfer;
- University of California San Diego Program in Technology Transfer and Entrepreneurship and the CONNECT programme;
- Praja Inc, San Diego;
- Signal Pharmaceuticals Inc, San Diego;
- University of California San Francisco Office of Technology Management;
- Genentech Inc, South San Francisco;
- Tularik, South San Francisco;
- California Institute of Technology Office of Technology Transfer;
- Stanford University Office of Technology Licensing;
- Cooley Goodward LLP, Palo Alto; and
- University of Chicago, ARCH programme.

4.5 An important first stage in the learning was to prepare a list of topics to be explored through the visits. These helped to build a mutual understanding among team members and served to brief the organisations to be visited. The questions were grouped under four headings: *"institutional values and attitudes; organisational arrangements; successes and failures; and prospects."*

4.6 The second stage of learning was during the visits themselves and it derived both from meetings with US universities and firms and from the interchanges between the Vice Chancellors and the TT practitioners. The final stages were agreeing a report of the visit (*Technology Transfer – the US Experience* – published by CVCP) and a dissemination event.

4.7 Despite the considerable lapse of time, several of the participants have provided feedback on the value of the initiative:

- *"I understood for the first time the eco-system within which MIT works and how the market puts everything in place – start-ups can hire everything which makes for a low cost of failure. Academics are encouraged to do more in research commercialisation if it's made easy for them."* – TT practitioner
- *"This convinced me of the need for the university to look outside the box and help to build a supportive environment."* – TT practitioner
- *"The report was considered important at CVCP. The Vice Chancellors who came were themselves "turned on" and spread their enthusiasms to others."* – CVCP
- *"The timing was prescient and helped in the formulation of the Challenge Fund and HEIF."* – CVCP
- *"The TT practitioners understood the basic concepts though not the US milieu (especially in terms of company behaviour)."* – TT practitioner
- *"The report came at a perfect time as we were just at the point of putting up a case for significant funds to set up the University's venture company, involving a seven figure investment; it gave confidence to lay members."* – Vice Chancellor
- *"Highlighting the consequences of the Bayh-Dole Act subsequently influenced the UK decision to introduce tax credits in relation to research."* – Vice Chancellor
- *"We learned that the big pharmaceutical companies did a lot of their research in effect through small start-ups, which they then bought if they were successful."* – Vice Chancellor
- *"We gained an impression of the importance of clusters in Massachusetts and Southern California."* – Vice Chancellor
- *"I found the whole trip to be very informative and helpful – and still refer to some of its lessons. One that particularly struck me and which comes up in current debates is that even MIT receives (then did) only a small percentage of recurrent income from IP. The lessons on rewarding staff for IP developments (lucrative or not) are still with us and our staff promotions criteria are now more liberal in that regard."* – Vice Chancellor

Points for further reflection

4.8 Gatsby invested a substantial sum of money in this initiative and it is hard to think of another organisation that would have been comfortable to back what was, essentially, a high risk venture. Gatsby and CVCP also gave strong emphasis to preparation before the mission and dissemination afterwards – both of which paid dividends.

4.9 The broadest conclusion, in the words of the director of MIT's TLO (made in another context) is that "technology transfer is a contact sport". This is true of the connections made between the UK contingent and the US hosts, and of networking between members of the mission.

4.10 However, complacency is inappropriate. In the words of one of the Vice Chancellors in the group:

"The UK has still not sorted out the ownership issues around IP from publicly funded contracts and should learn from the US. I also take the view that the IP issue should be looked at from an economy perspective not as a way of enhancing (or replacing) income sources for institutions."

Cambridge Phenomenon Re-visited

4.11 The original Cambridge Phenomenon report, published by SQW in 1985, made a significant contribution to understanding university industry links, the functioning of a cluster (though the term was not then used), the role of science parks and the importance of venture finance.

4.12 In 1998 SQW applied to the European Commission for matched funding to undertake an evaluation of the Cambridge Science Park and St John's Innovation Centre. The local finance was provided by Cambridgeshire County Council, St John's College, Trinity College and the then Cambridgeshire Training and Enterprise Council (TEC).

4.13 The report was warmly received both by the Commission and by the science park movement, and it gave support to the case for Trinity College to make substantial investments in upgrading the Science Park's social amenities. It also highlighted the continuing interest in the Cambridge cluster – both in the UK and internationally.

4.14 Responding to this, SQW sought support to finance a rounded programme of research into the Cambridge cluster. In addition to contributions from the two Colleges, the County Council and the TEC, funding was offered by the local business community, Cambridge City Council, South Cambridgeshire District Council, and the Department for Trade and Industry. However, there was a substantial shortfall and Gatsby offered to increase its grant to St John's College to bridge this.[28]

4.15 Results from the research were published in a two part book – *The Cambridge Phenomenon Revisited*. The first part detailed the further development of the cluster since 1985 and the second part drew in contributions from leading academics (Professor Erkko Autio and Dr Elizabeth Garnsey) as well as SQW staff to cover:

- the biotechnology cluster;
- the instrumentation sector;
- start-ups and company growth;
- entrepreneurial intent;
- the high-tech labour market;
- physical aspects; and
- advanced business services.

4.16 The book received good reviews in the UK and the US. A review by Professor Martin Kenney [29] commented:

"The level of detail and comprehensive nature of CPR makes it the primary reference for anyone studying the Cambridge Phenomenon or doing cross national comparisons… CPR and its 1985 predecessor are the reference works for those interested in university-industry relations, high-technology regions, and regional economic development."

4.17 SQW sold (mostly) or gave away (very selectively) around 350 copies which generated sales revenue of just over £15,000. A trickle of sales continues.

Research reports supported through St John's Innovation Centre

4.18 Gatsby has provided a range of support to St John's Innovation Centre. The £ for £ Funding Scheme is discussed in Chapter Three and the Foundation also supported other work to assist entrepreneurs – which indirectly was of great assistance to the establishment of Cambridge Enterprise. Gatsby funding was also used to develop the Cambridge Technopole which sought to bring greater coherence to those concerned with business development in the high-tech cluster.

4.19 In addition six published research reports have been financed:[30]

---

[28] Gatsby's support was not acknowledged at the time – at the Foundation's request – but was crucially important. Without Gatsby funds the work would not have gone ahead.

[29] In addition to his position at the University of California, Davis, Professor Kenney is Senior Project Director of the Berkley Roundtable on the International Economy.

[30] David Gill, Dr Tim Minshall and Martin Rigby co-authored all the *Funding Technology* reports, joined by Chris Martin for America, and Bob Campbell for Israel. The main authors of the *Spin-Out* report were Tim Minshall and Bill Wicksteed.

• *Funding Technology – Lessons from America,* March 2002

• *Funding Technology – Israel and the Virtues of Necessity*, January 2002

• *Funding Technology – Germany Better by Design*, June 2003

• *University Spin-Out Companies: Starting to Fill the Evidence Gap*, January 2005

• *Funding Technology – Britain Forty Years On,* January 2007

• *Funding Technology – India* (in preparation)

Funding Technology reports

4.20 In the *Funding Technology* report on America there is a particular focus on interpreting the findings from America in terms of their relevance to the UK. This is true to some extent, though to a lesser degree, for Germany and Israel. The report on Britain is a 'tour d'horizon' and ends with a well reasoned call to arms for improving the policy framework for high-technology enterprise (going well beyond funding issues).

4.21 The reports had the following print runs (only a small number of printed copies remain):

• America	10,000
• Israel	7,000
• Germany	7,000
• Britain	2,500

4.22 All the reports are available for free download from the website **www.fundingtechnology.org** and the level of downloads for each of the PDFs over the past three months suggests an encouraging picture of durable relevance:

• America	800
• Israel	700
• Germany	700
• Britain	1600

University Spin-Out Companies: Starting to Fill the Evidence Gap[31]

4.23 This report aimed to bring a greater clarity, based on evidence, to discussions about university spin-out companies as the authors felt there was an unacceptable confusion about:

• what constitutes a university spin-out – is it just a matter of having an academic among its founders (the criterion applied in *The Cambridge Phenomenon Revisited*) or should the term be restricted to companies with a university equity investment?

• how long should a university continue to claim essential causality for the companies' outputs – until a venture funding round (as in Oxford) or in perpetuity (as in the Bank of Boston report on MIT)?

• the performance of university spin-outs over a period of time (the report plumped for 5 years from the beginning of 1998 to the end of 2002).

4.24 There was a print run of 750 copies, of which few remain. There have been 300 downloads of the free PDF from the IfM website over the past three months. There were 16 citations of the report in policy and academic papers (including one by Lord Darzi in the Lancet) and generous feedback from the Vice Chancellor of Cambridge University:

"Thank you for sending me your report on university spin-outs. I read it with great interest. I am struck all over again by the extent to which knowledge transfer activity is a "work in progress", with a range of models and ideas about objectives and best practice amongst institutions and considerable dynamism within institutions (not least Cambridge) as well.

"It's really helpful to have cross-sector perspectives including quantitative and qualitative assessments such as this."

Research funded at the University of Sussex

Gatsby Fellowship at the Freeman Centre[32]

4.25 The Science Policy Research Unit (SPRU) at Sussex University is the doyen of university research groups with a focus on KTT. A proposal was made to Gatsby in April 2002, 12 months before the planned opening of the Freeman Centre which *"aims to advance the frontiers of research and make a major impact on government polices and business strategies towards S&T"*. The request was to fund a postdoctoral fellowship to undertake a project to:

• deliver a solid empirical and theoretical

[31] Also published as a chapter within *New Technology-Based Firms in the New Millennium* by A. Groen, R. Oakey, P. C. Van der Sijde and G. Cook.

[32] Professer Martin Meyer, who held the Gatsby Fellowship, has written a thoughtful overview commentary on the work he undertook and its impact. This forms Annex I.

knowledge base on technology transfer in the UK and assess the effectiveness of transfer policies and programmes at the national and university level; and

• develop practical tools to evaluate technology transfer at the university and firm level.

4.26 The proposal, submitted jointly with the University of Brighton's Centre for Research in Innovation Management (CENTRIM)[33], laid out an ambitious research methodology and set of deliverables in some detail. Interviews for the post were held in December 2002 and Dr Martin Meyer (subsequently appointed) questioned at that time whether the large number of deliverables might prove to be over-ambitious. This (wise!) observation reflected the fact that Dr Meyer already had experience (aged 29 and with four or five publications) and, of particular interest to the selection panel, brought knowledge of other European systems. Another implication of this experience was that the budget had to be readjusted to cover a four, rather than five, year appointment.

4.27 Dr Meyer started work in April 2003. In 2006/7 he was given an administrative appointment as "head of teaching" in SPRU. He has recently been appointed as Professor in Business & Innovation and Head of Business & Management in the new School of Business, Management and Economics.

4.28 Feedback from Professor Meyer is largely very positive:

"Professor Alford's flexibility in allowing changes to the proposal was much appreciated[34]. I was able to use the grant as a platform to build a research agenda in this topic area which is a rare privilege for a young researcher. Gatsby's continuing interest, including the discipline of three to four monthly reports was helpful to the work, to maintaining visibility in Sussex and to 'winning' valuable time from the head of research.

"The duration of the grant and ongoing flexibility were both really important. They enabled a high rate of publication and a broader set of policy engagements."

4.29 The publications and other dissemination activities listed in Annex I provide a clear indication of energy and effectiveness. There was a tricky balance to be struck between external and internal activity, and between dissemination and publication in the very top journals. In view of Gatsby's objectives, the appropriate balance was struck and Dr Meyer's subsequent appointment and promotion suggest that he also satisfied the academic agenda.

4.30 However, there was one major disappointment. During the period of the Fellowship, and with the help of CENTRIM, a website was developed which featured:

• a pilot self-evaluation tool to help universities assess and benchmark their organisation's progress in becoming more entrepreneurial (which ran online);

• a pilot for companies that helps them assess collaborative activity or points them to appropriate kinds of collaboration (using a spreadsheet); and

• a set of UK and international case studies to illustrate best practice, covering aspects such as governance, potential sources of finance, creating entrepreneurship etc.

4.31 Owing to the departure of a key individual from the University's library staff, none of this material is currently online. However, Professor Meyer has recently contacted the company which developed the website and hopes that the material has been saved on their servers. If this is the case, he has obtained a small amount of funding to ensure the web pages are made available again.

The Benefits from Publicly Funded Research

4.32 The principal aim of this project was to assist the government department responsible for the science budget in presenting evidence to the Treasury during the Comprehensive Spending Review. There had been three predecessor reports by SPRU addressing the same question, first for the Treasury, then for the Higher Education Funding Council for England, then for CVCP.

4.33 While new work was initiated, including a review of academic work on the commercialisation of research undertaken for the health sector, the main thrust was to update the previous studies and confirm that their conclusions remained sound. There was sense of a need *"to win hearts as well as minds"* and a set of recent case studies was added to bring immediacy to the report's findings.

[33] At an institutional level, relationships between the Universities of Sussex and Brighton cooled when Sussex started to teach business studies.

[34] The time devoted to monitoring and building a network between Gatsby TT grant holders was, perhaps, less than initially envisaged. A report was produced in July 2005 but recipients were keener on being showcased than reviewed.

4.34 The report was used as underpinning evidence in presenting the case for spending on science. Because it lacked novelty it did not capture the headlines – which typically went to work on topics such as Foreign Direct Investment in research, and research funded through the charitable sector. Nonetheless it made a valued contribution.

Managing Intellectual Property in Universities: Patents and the Protection Failure Problem

4.35 Patent protection failure is the withdrawal or abandonment of patent applications by universities. Anecdotal evidence, which was entering into common currency, suggested that "universities were abandoning a large proportion (up to 60%) of their Patent Cooperation Treaty (PCT) applications".

4.36 Were this perception accurate, it could be inferred that technology transfer offices were displaying poor judgement, or possibly that they had inadequate resources to carry through commercialisation of worthwhile IP.

4.37 An extensive programme of research concluded that the anecdotal evidence was ill-founded and the percentage of abandoned PCT applications was 30% rather than 60% – which if not "good" is clearly considerably "better". It reported researchers seeing an increasing professionalism amongst the Technology Transfer Officers (TTOs) they used (though the researchers were selected by TTOs).

4.38 Rather than identifying individual universities in the research results, the report constructed a typology of universities based on their levels of (a) third stream (HEIF) income and (b) their net income from IP. The adoption of an anonymous typology, while perhaps inevitable, makes it difficult to bring other knowledge to bear alongside the report's findings.

4.39 However, there is a great deal of important material in the report, not least the suggestions made for policy improvements. A series of articles is planned (the first one provisionally titled *UK Academic Commercialisation: Looking at selection capability*) and it will be interesting to follow the subsequent debate.

Points for further reflection

4.40 The University's failure to preserve on its website the content prepared during the Fellowship has been a waste of resources. It is encouraging that Professor Meyer is seeking to redress this, but perhaps Gatsby should consider whether the terms of future grants can guard against similar eventualities.

4.41 The work on patent protection has encompassed a broader review of university KTT structures and approaches. There could be advantage in pooling aspects of that research with some of the elements of this review.

Annex A: People who helped this review

A.1 Many of the grants date from some time past and particular gratitude is owed to people who trawled their records and memories in response to requests for assistance. There were very few people who failed to reply when approached which, probably, reflects a sense of gratitude for the help received for their particular project and a more general admiration for the Foundation's work in relation to knowledge and technology transfer. The work was guided by Gatsby's adviser on KTT matters Professor Neil Alford. Professor Roger Baker (Gatsby Technical Director at the time) gave helpful guidance on a number of the earlier grants.

Face to face discussions were held with:

- Dr Robin Jackson – British Academy
- Professor Phill Dickens – Loughborough University
- Dr Kathryn Walsh – Loughborough University
- Dr Lita Nelsen – MIT
- Professor Michael Scott-Morton – MIT
- Professor John de Monchaux – MIT (a social conversation)
- Dr Jan Chojecki – PBL Ltd
- Dr Richard Jennings – University of Cambridge
- Dr Michael Kitson – University of Cambridge
- Dr Tim Minshall – University of Cambridge
- Dr David Secher – University of Cambridge
- Clive Rowland – University of Manchester IP
- Dr Trevor Farren – University of Nottingham
- Dr Paul Hamley – University of Nottingham
- Professor Ben Martin – University of Sussex
- Professor Martin Meyer – University of Sussex

Telephone conversations were held with:

- Dr Jeff Skinner – London Business School
- Anna Seddon – Loughborough University
- Liz Ogilvie – New Engineering Foundation
- Professor Stuart Palmer – University of Warwick
- Dr Tony Raven – University of Southampton
- Dr Graeme Reid – Department for Business Innovation and Skills

Emails were exchanged with:

- Professor Sir Alan Wilson – University College London
- Professor John Craven – University of Portsmouth
- Dr Puay Tang – University of Sussex
- Professor Dianna Bowles – University of York

Annex B: Plant Bioscience Limited (PBL)[33]

Background

B.1 The John Innes Centre (JIC) is a large national research establishment in Norwich, in Eastern England, supported by the Biotechnology and Biological Sciences Research Council (BBSRC) and specialising in crop science. The 650 JIC scientists share the site with a further 70 scientists from the Sainsbury Laboratory who are employed by the University of East Anglia. This, therefore, represents a significant concentration of high calibre staff and facilities, known collectively as the John Innes Centre Institutes (JIC/SL).

B.2 In 1994 a proposal was made for establishing a "Technology Interaction Office" at the JIC, to deal with the issues involved in establishing and exploiting intellectual property rights. Three objectives were proposed

• **primary** to bring the Centre's research into public use

• **secondary** to facilitate interaction between its scientists, industry and commerce

• **tertiary** to generate revenues to support the Centre's research (a share of net revenue was to be paid to its shareholders and the inventor scientists).

B.3 Although the generation of revenues was the third of these objectives, the overall tone of the proposal was commercial; almost to the point of being strenuously so in the way it proposed that the new office would charge for some of its services. It was, however, made absolutely clear that, as well as being commercial, the relationship between the office and the scientists would have to be a voluntary one. It would have to win their confidence and, equally, should not be obliged to spend time with scientists whose ideas it did not rate as commercially attractive.

B.4 The key issue which the proposal identified for JIC corporately was that it should take a much tougher stance in respect of the Intellectual Property Rights arising from sponsored research. As the proposal put it:

"Commercial sponsorship does not automatically entitle the sponsoring company to any claims with regard to research results".

B.5 This initial thinking was accepted by the John Innes Centre and the Sainsbury Laboratory and led to the formation of a company, Plant Bioscience Ltd (PBL), initially known as JIC Innovation Limited, designed to serve the interests of JIC/SL collectively.

Progress of the Company

B.6 The company's aims and operating principles were set out in agreed Working Guidelines, which are also appended to PBL's agreements with scientists. The five key points are as follows:

• the mission of Plant Bioscience Limited is to bring the results of research in plant and microbial sciences at JIC/SL into public use for public benefit through commercial exploitation

• the Company will operate as an independent fully commercial entity, providing such services to the management and scientists of JIC/SL as are required to fulfil its mission

• the Company's services will be provided only to those researchers who freely elect to use them. The Company shall not be obliged to accept commissions from researchers where, in the judgement of the Company's management, to do so would not serve the Company's mission or its commercial objectives

• in order to achieve its aims, the company will actively identify, protect, market and license intellectual and other properties and services arising from the activities of JIC/SL and the Institute's scientists

• the Company's activities will be conducted so as to achieve its mission without compromising (A) the long-term sustainability of its activities and viability of the company, (B) the stated missions of JIC/SL which it serves, and (C) the interests of the scientists working at JIC/SL.

B.7 In the event it took a good deal of time and effort to establish the appropriate professional relationship between PBL and JIC/SL, though the two underpinning policies remain in place – the relationship is mutually voluntary and PBL operates on a commercial basis according to its independent judgements. What has changed is an acceptance that it is counterproductive to the overall objectives for PBL to be aggressive in its cost-recovery from the Institutes. For instance, PBL had initially charged JIC/SL a sponsored

[33] Extract from Wicksteed and Herriot, *Six Studies in Technology Transfer.*

research levy of 10%, deducted from the sponsored research funding. This led to individual scientists being tempted to conclude commercial arrangements without seeking proper advice, in order to avoid paying the levy. The levy system has now been abandoned.

B.8 PBL's first director started work in 1994 and initially devoted a great deal of time and energy to changing the attitude of researchers towards the protection and exploitation of IP. By 1999 the annual income of PBL had risen to almost £1 million, over half of it from licensing agreements, and the staff complement had grown from two to five, led by a Managing Director with considerable academic and industrial experience. It had taken some time to build up to these activity levels, but PBL can now be considered a well-founded business. During 1999 PBL also played an important role in helping to conclude a major collaborative arrangement between the Institutes and the major multinational company Zeneca. This involves Zeneca providing a £6 million building with the latest equipment, in which the Institutes can occupy around 75% of the space. There is also a guaranteed annual level of research funding (£1m per year), for a period of ten years, which JIC/SL can apply for from Zeneca.

B.9 PBL has achieved visibility and credibility amongst the scientific groups and has established their (and its own) credentials with the major firms. It now has 50 independent patented technologies each of which has a wide array of potential applications. It is also now easier than hitherto to convince the Institute's scientists of the benefits to them from choosing PBL in order to achieve effective commercialisation. The inventor(s) receive between 10 and 20% of the gross income as personal rewards. The aim is to educate scientists to think " this is commercially interesting – let's call PBL". To help reinforce this there is a continuing need for informal visits by PBL staff to the laboratories and there are also annual reviews with group leaders which, even if the they cannot hope to capture everything, can at least help point to where it may be fruitful to focus a watchful eye.

B.10 Management quality has been an important element in achieving this level of progress. In its recruitment policies since inception PBL has been clear about what it needs from staff in leading positions – a good understanding of the technologies that are being dealt with, combined, crucially, with up to date knowledge of the markets into which it is being sold (which firm is interested in what, how much they will pay and how likely they are to make it work commercially). In addition, PBL has been prepared to pay market rates (which are significantly above those on offer in Universities) to attract high calibre staff matching these demanding requirements.

B.11 At the same time, there has been a strong group of non-executive directors whose previous experience has been of direct relevance to PBL. Two of the four have connections with main shareholders. The other two, one of whom is based on the USA West Coast, are active businessmen with strong biotechnology credentials. Their expertise and contacts are warmly welcomed by the Managing Director, who makes active use of them. The Board meets three times a year and is attended by an observer from the BBSRC, which is the main provider of core public funding for JIC. The relationship between the board and PBL's executives appears to make a genuine contribution to its success.

Issues from the Case Study

B.12 PBL is an example of taking a highly commercial approach to the creation of an intermediary organisation for technology transfer, based at a large scientific institution of national importance. The approach appears to have been successful, once the relationship had settled down. PBL's experience may not represent a model for wide application in a range of different contexts. It is most likely to be applicable where there is a major focus of scientific expertise in which there is a high level of current commercial interest – "hot spots" in the interface between research and commercial communities. Nevertheless, it provides some important general experience for technology transfer practice.

B.13 The importance of the following issues seems particularly well illustrated by the experience of PBL:

- getting the policy for sponsored research within a research establishment clear – and making it tougher

- developing sufficient business, perhaps through out-reach to serve a wider range of research bodies, so that a significant team can be employed (more robust when staff leave) and a real market presence established (with active deal flow) being prepared to pay commercially competitive salaries (with performance elements) and having a small but well-balanced board, with members who are themselves commercially active

• establishing an independent company with a transparent remit and, therefore, genuine performance indicators

• accepting that there is a need to start with a fairly deep purse and to leave resources in the company. Heavy annual drawdowns will weaken the balance sheet, denude cash flow needed for growth and reduce the company's credibility in defending its IPR

• sustaining the commitment to a voluntary rather than mandatory basis for the relationship between researchers and the company.

B.14 It should also be noted that the technology transfer approach embodied in PBL may contain some potential risks for the future, though these are ones that derive from its success. They include:

• the difficulty faced by a relatively small company, not least in terms of its balance sheet, in defending its IPR. This means looking carefully at arrangements to minimise the likelihood of infringements. It also means looking at, for instance, selective insurance cover so that resources are available for enforcement measures

• retention of PBL staff as the demand for high calibre technology transfer professionals continues to grow and to outstrip supply. Some element beyond salary and annual performance bonus may be required – perhaps similar to an option scheme in concept – if there is a desire to lock staff in to a greater extent

• how to balance the clear opportunities that arise to win business from outside JIC/SL with the shareholders' primary objective of developing a source of funding for the Institutes, over the long term. How far can PBL go towards developing a national and international clientele of research teams without damaging its focus on the "parent" Institutes?

• how to deal with the substantial and "lumpy" requirements that arise from special projects and to make sure that they don't divert efforts from the continuing licensing work. The opportunity costs from such a diversion, in terms of licensing business not achieved, may be substantial. One example of a pre-emptive project is commercialisation through a spin-out which, in this field, is likely to involve a substantial investment yet has to 'get to market' quickly if the technology is not to be overtaken by competitors. Here the staff resources and financial commitment required may well be substantial and a different balance of skills may be needed for a spin-out from those required for the licensing route.

Annex C: Calyx Plantech Ltd[34]

C.1 In 1995 six UK universities (Birmingham, Glasgow, Leeds, Manchester, Warwick and York) established a jointly owned company called Calyx Plantech Ltd, for the purpose of the "promotion and exploitation of plant science". All six of the parent universities are of a substantial size and each has a strong research base but following an independent review they had concluded that, in the field of plant biotechnology, there were advantages in operating collaboratively. It was believed that the company could bring added value to the partners through its role in helping transfer individual projects and IP and possibly also establishing multi-campus, large scale projects targeted on specific themes beyond the capability of any single university.

C.2 Each of the six universities contributed an equal share of the annual costs for a four year period and their total contribution was matched by a leading UK educational charity. Thereafter, the aim was to make the company self-financing. The company was initially allocated, without charge, an office in the Centre for Biochemistry and Biotechnology at Leeds University. Subsequently this office was moved to the Department of Biology at York University. The company's Board of Directors was made up of representatives of the shareholder universities, meeting quarterly to agree the company's activities and to assess the financial position.

C.3 After a difficult period of initial operations led by a business development manager, who concentrated on supporting individual scientists in the commercialisation of their research, the Directors decided to strengthen the management structure by appointing two part-time Scientific Advisers, supported by a CEO, on a one-day-a-week basis. The CEO had previously been head a University research support group, and the Scientific Advisers had experience in the private and government sectors. In addition, the Board appointed an independent non-executive Chairman with extensive direct experience of research and technology transfer in a major food company.

C.4 Under the new management the company established a small internal Initiatives Fund (to provide start-up grants that specifically encouraged research with industrial potential and promoted multi campus projects). New publicity material was produced and a website set up. The company continued to support commercialisation of the work of individual scientists through introducing them to individual commercial sponsors, working with and supplementing the industrial officers of the individual universities, but also considered how to promote cross-campus strengths. To give strategic direction to this work, the Board identified four broad themes, or technology platforms, which it felt could be marketed to private sector partners:

- Transgenic Technology and Molecular Genetics
- Defence mechanisms
- Signalling
- Novel plant products.

C.5 Each of these platforms was overseen by a Board Member and the Scientific Advisers defined a distinctive programme that Calyx could offer. Although there was an encouraging initial reaction from major multinational companies in the biotechnology industry, no major deals in these technologies were concluded by Calyx Plantech. There were relatively few applications under the company's New Initiative Fund, though projects being funded at the partner universities are believed to have potential for future industry support. One such project is a joint programme in Arabidopsis (gene-tagging) involving all six universities (and also Nottingham following the move of a key person from Warwick) which has the aim of giving Calyx researchers an academic advantage to protect and market their Intellectual Property (IP) independently of other genetic libraries.

C.6 More recently there has been considerable adverse publicity in the UK about genetically modified organisms and the company has extended its remit to marketing the consultancy expertise of the partner universities on diagnostics issues and food safety, contacting a range of producers, manufacturers, retailers and regulators. Again, however, no major deals have yet been struck. The officers of Calyx feel strongly that the adverse public reaction to GMOs could seriously undermine the plant biotechnology sector – as well as restricting Calyx income.

[34] Extract from Wicksteed and Herriot, *Six Case Studies in Technology Transfer.*

Issues from the Case Study

C.7 At the four year point where core funding ceased, the concept of Calyx Plantech, as a jointly-owned vehicle for exploiting university research, was at best not proven. In some ways, working together had created problems for the partners. Among the universities there were initial concerns about defining the boundaries of the programme included in the contract, as well as about ownership of IP. On the other hand Calyx has provided considerable information to industry on research underway, and it may well be that the individual universities have been able to generate more income than if Calyx had not existed or that individual researchers have been helped by Calyx membership, though the evidence for this is thin.

C.8 Potential commercial partners have been attracted by the company's approach. However, as well as concentrating on individual IP Calyx is asking multinationals to outsource at least part of their "non directed" research. On the face of it, it would seem that most businesses might regard this as a high risk strategy compared to either an embedded laboratory in a single university, which they could control, or having their own staff patrol the relevant universities to identify research of interest, and only then, perhaps, commissioning specific projects. Calyx found some evidence that the companies had in the past been sceptical of the professionalism of university negotiators and of the reputation of scientists to deliver research results to agreed targets. They welcomed the idea of a 'one-stop' entry to six universities and the possibility of central negotiating and management of contracts – but this has not yet secured new awards.

C.9 After early difficulties which included concerns about equal distribution of efforts across the six universities, the company has been run by executives who are professionals with good track records and business experience. With the university directors, they have been proactive and indeed have visited Japan twice to sell their wares. The executives however do not depend on Calyx for their livelihood. It could be argued that this enabled them to adopt a more professional approach, but on the other hand they may not be as "hungry" as if their financial benefit had been directly linked to the success of the company. In either event there has been surprisingly little evidence of direct benefits generated from their work and the overall impression is that they have been limited.

C.10 In summary, there have been difficulties for Calyx staff from seeking to operate across the six universities and the hoped-for benefits, in terms of increased market appeal, have not been apparent.

Annex D: Southampton Innovations Limited[35]

Rationale for the Company

D.1 The University of Southampton, on the south coast of England, is a broadly based, research-led university with 20,000 students. It has internationally recognised strengths in Engineering, Science (particularly opto-electronics), Medicine and Social Sciences. The University has the fifth highest ratio of research to teaching income in the United Kingdom, after Oxford, Cambridge and two University of London institutions, Imperial College and University College.

D.2 In 1992 the University restructured its Office of Industrial Affairs (OIA). This enabled it to recruit specialist staff in contract negotiation, licensing and marketing to add to the existing staff who provided legal and patenting advice. By the mid 1990's OIA had evolved into the Office of Innovation and Research Support, headed by a Director who reported directly to senior management. This structure was successful in developing a more professional approach to the awareness and exploitation of innovation and the need for expert contract negotiations within the University. In 1995, however, the University decided that there was scope to boost their ability to exploit innovation through focusing technology transfer expertise on fast-tracking a number of projects with high potential. The aim was to produce a significant income stream for the University to be re-invested in the research base.

D.3 A number of UK university structures were reviewed to try to identify the best model. Southampton concluded that models which combined support for innovation with support for research might actually hinder technology transfer. This was because support for technology transfer projects, which are by definition longer term, might be sacrificed to the need to seek research grants, which provide short term income and therefore have a more immediate effect on university finances. After consideration the University preferred the approach (as used at Oxford University) which separated research support from innovation and enabled a separate organisation, established as a Limited Company, to adopt a pro-active approach to university departments and industry in order to optimise exploitation. The expectation was that after three years "the company will provide a substantial return to the University".

D.4 It was recognised that the Managing Director of such a company would be the key to success. The ideal individual would have a track record in both academic research and industry, together with a sound knowledge of technology transfer and its various elements. The ability to interact with academic researchers, to understand their priorities, anxieties and ambitions and to treat each innovator and innovation as a unique case would be essential.

Operations of the Company

D.5 On this basis, the University proceeded to set up a wholly-owned company, Southampton Innovations Ltd (SIL), with the mission "to establish an investment return for the University of Southampton and its staff by the commercial development and exploitation of its Intellectual Property Rights." The Managing Director of SIL, whose background was in the electronics and telecommunications industry, took up his post on 1 January 1996.

D.6 The strategic direction of SIL is provided by a Board consisting of 13 members, of whom 4 represent academic interests. The Chairman is an independent figure of standing, from an international business background. The Board meets quarterly. Reports are produced by the Managing Director on "qualitative" progress and up to date management accounts are produced and reviewed against budget. This method of operation, through a limited company, is seen to have provided a number of advantages to the University. For example:

- clear profit centres could be established
- business decisions could be taken in a business like way
- a committee structure worked well in universities but was less appropriate in business
- autonomy was essential if commercial decisions were to be taken
- academics were able to concentrate on purely technical matters without worrying about having to take business decisions where they were inexperienced.

[35] Extract from Wicksteed and Herriot, *Six Case Studies in Technology Transfer.*

D.7 During the three years from start up to the beginning of 1999, some 150 intellectual property cases have been reviewed by SIL's Technical Advisory Committee (TAC), with some 28 considered in detail. Following advice from TAC, SIL focussed on six promising cases for active exploitation. Cases in which SIL was unable to invest effort or funds, or where another exploitation route was judged more suitable, were returned for further discussion with the inventors. SIL has incorporated two companies, participated in equity swaps for Intellectual Property Rights (IPR) in a further two companies, and launched two joint venture companies with University Departments. SIL has non-executive director representation on the boards of all bar one of these companies.

D.8 An important element in the success of these operations was the relationship between SIL and the existing Office of Innovation and Research Support (OIRS). A new Director of OIRS had been appointed in 1995, with a background in university bioscience. The complementary technical background of the Director of OIRS and the MD of SIL is felt to have helped in creating a good working relationship between them and between their organisations. It had been appreciated from the planning stage of SIL that the personal chemistry between the MD of the proposed company, the University's research staff and OIRS would be crucial to success.

D.9 In addition, the roles played by SIL and OIRS had been very carefully thought out and a considerable amount of effort had gone into clearly defining the objectives of both parties, with the intention that there should be a "permeable membrane" between the two organisations. The decision to co-locate the two offices was also beneficial and helped communication.

D.10 Licensing negotiations for projects not requiring seed investment from SIL are the responsibility of OIRS. The resultant net returns, after deduction of professional expenses, inventors rewards and departmental revenues, are credited to an Innovation Fund which supports patent expenditure. There is close liaison between SIL and OIRS concerning SIL funded research projects and licensing opportunities for IPR. The University has 55 active Licence Agreements, most of which are in their infancy. Accordingly, the revenue flow is very uneven and results from a few very successful projects.

Issues from the Case Study

D.11 The SIL initiative has been judged a success by the University, which intends to continue with it. In financial terms, it is encouraging that investments made cover SIL's costs, using an acceptable valuation formula, and that the quality and number of investments is probably what might be expected when compared to other similar professionally managed activities. The business-led approach is judged to have added value.

D.12 The approach taken to structuring technology transfer activities at Southampton, as shared between SIL and OIRS, is generally perceived as being beneficial for the University. It enables the two organisations to focus on their distinctively defined core activities and it has also clarified the position for the academic community.

D.13 In addition, the activities of SIL and OIRS have highlighted the need to protect intellectual property at the appropriate time and more generally to improve the University's systems for managing intellectual property. This could be of considerable benefit to individual academics and to the University in the future.

Annex E: Nottingham University School of Chemistry

E.1 This annex has two parts. The first is a short report prepared by Dr Paul Hamley of Nottingham University specifically to assist this review. The second is an extract from the 2000 report.

School of Chemistry, University of Nottingham Business Partnership Unit: development of business facing activities.[36]

E.2 The School of Chemistry at the University of Nottingham has pioneered the establishment of three different models of university based business engagement post; the Technology Transfer Scientist, the Business Development Executive and the Business Science Fellow. From a starting point in 1996, these have acted as catalysts for various models of business focussed posts which have in the past decade now become widespread, through HEIF funding.

Business Engagement Posts

E.3 The **Technology Transfer Scientist** post (originally funded by Gatsby) involves a postdoctoral researcher, embedded within a particular research group, who is available to respond to industrial enquires, and manage (and often conduct) industrial research projects from enquiry to final report.

E.4 There are a number of other business focussed research units within the University of Nottingham who now employ postdoctoral level staff with a similar remit to the TTS, these include the Centre for Innovation in Carbon Capture & storage, the Power Electronics Group, the National Centre for Industrial Microwave Processing.

E.5 The **Business Development Executive/Manager** post was created following the success of the TTS model, to address the identified need for school based promotion and management of industrial relationships. The original concept was to recruit an individual with experience of the Chemistry Using Industries who could stimulate an entrepreneurial culture among staff and students and help them engage effectively with companies. BDE's are responsible for liaison between business and academia (often acting as "translators") seeking out new opportunities for collaboration, facilitating discussions and negotiating confidentiality agreements and contracts. They are supported by specialists in contract and IP law the central functions of the University. This model significantly speeds the establishment of industrial research agreements and services rendered contracts. The School of Chemistry appointed one of the first BDEs in the University and the scheme has now been extended across the university with a BDE in position in the majority of research schools. BDE's have also been appointed to support specific cross-school themes such as Energy and to support academic engagement with certain funding bodies such as Europe and the RDA's. There are currently 30 BDE's employed by the University.

E.6 The **Business Science Fellow** (BSF) scheme (originally funded by Gatsby) involves employing postdoctoral scientists typically for a year after completing their PhD to work on a range of knowledge transfer / commercial projects while receiving mentoring and formal training in business practice. BSFs have a similar role to the TTS, but are part of the BPU rather than being embedded within any one research group. They are therefore available to work on developing opportunities that arise from research from any area within the school. Their work can include identifying and evaluating research with commercial potential, supporting the filing of patents, identifying potential industrial partners, developing industrial research projects, responding to industrial enquiries, technology licensing and supporting the development of spin-out companies. In addition to helping achieve valuable knowledge transfer outcomes, BSF's find their newly acquired skills are valued highly by potential employers.

SWIFT

E.7 We are currently developing an extension of the BSF concept across schools of Chemistry and Chemical Engineering in other UK Universities. This scheme, called SWIFT, has been piloted in collaboration between the Universities of Birmingham, Cardiff, Liverpool, Manchester and Nottingham. Postdoctoral fellows are employed

[36] Prepared by Dr Paul Hamley, former Technology Transfer Scientist, now Research Business Development Executive, University of Nottingham, April 2010.

to work on knowledge transfer projects in a similar manner as BSFs however access to expertise is shared across the institutions such that enquiries from industry and novel research ideas can be progressed more effectively. All fellows receive the same structured programme of training.

MEDICI

E.8 The university was one of the founding partners of the Midlands MEDICI Scheme which has now been extended to include a number of Universities across the midlands. Medici fellowships have some similarity to the BSF concept in that they can support postdoctoral level business focussed posts in the interface between biology, chemistry, pharmacy and medicine. The BPU has been involved in the management and training of MEDICI fellows and uses some of their sessions as part of the training for BSF's.

BPU – School based business unit

E.9 When Dr. Trevor Farren was appointed as Business Development Manger he set up a a Business Partnership Unit within the School of Chemistry which coordinate the activities of TTS + BSF's and provide a central focus for entrepreneurial and business related activities within the school. We believe that this discipline specific approach is still unique. BPU staff are embedded within the school which helps academic staff and students engage efficiently with business related activities.

University Industrial Focus

E.10 The University has adopted several models to promote University – Industry engagement and knowledge exchange some of which are based upon those developed in Chemistry. For example a number of standalone central units have been established that specialise in industrial outreach, which interface with a number of research schools. These include the University of Nottingham Institute for Enterprise and Innovation, who run the Ingenuity Programme (which introduces local SMEs to university research services and provides Business School run training seminars), The Environmental Technology Centre (RDA funding for consultancy), the Technology Demonstrator Unit (showcasing market ready university innovations).

E.11 The university has recently (2008) established the University of Nottingham Innovation Park (UNIP) where the Sir Colin Campbell building provides the bridge between the academic and business facing resources of the university. UNIEI is located at UNIP, together with the Nottingham Geospatial building and a planned Energy technologies building. The first two have lettable offices for businesses wishing to locate at the university.

Benefits of Gatsby Foundation funding for the TTS post

E.12 Gatsby funding provided the financial security necessary for the TTS role to be developed over a 3 year period, leading to it becoming self sustaining. Without Gatsby funding it is possible that a period of low income during the second year (1998) of PAH's post would have curtailed the project.

E.13 A business focussed researcher embedded within a research group frees up academic time, and allows the pursuit of opportunities, many of which will not turn into contacts.

E.14 Engagement with industrial problems brings new insights into the practical applications of science (and engineering).

E.15 Engagement with industrial problems forces academics to grapple with problems which may otherwise be considered too difficult, and where this has formed part of a long term collaboration, major progress has been achieved in the understanding of important industrial process.

E.16 By remaining in a research and project management role, PAH was able to retain skills and knowledge within the research group which would otherwise have been lost with the rapid turnover of PhD students.

E.17 The Business Science Fellow model has evolved from the initial TTS post. Whereas the TTS was part of a specific research group, BSFs are part of the BPU which services the entire school of Chemistry, and thus may work on development of any commercial focussed project within the school.

E.18 Having multiple BSF's in post concurrently allows a degree of specialisation, for example one focussing on organic chemistry / biochemistry / biomedical applications, and the other on inorganic / physical / clean tech / fuel cells / hydrogen.

Supporting Comments

E.19 The School of Chemistry is a leading school within the University for industrial income.

E.20 There are no other chemistry schools within the UK with a similar business focus, or employing similar business facing fellows.

E.21 PAH has moved into a role [March 2008] within one of the University's central units, RIS as Research Business Development Executive, which involves externally focussed business development.

E.22 BSFs are inherently employable – J. Webster is now a Chartered Patent Agent, B. Walsh and A. Chapman were both offered positions at an environmental consultancy who were impressed with their experience.

E.23 Institutionally, HEIF funding has been used to part fund a number of BDE posts, 7 at 0 at 50% and 6 at 100% – the latter including centrally based roles such as Corporate Partnerships Manager and the Knowledge Transfer Partnerships Manager.

Examples of BSF and TTS Alumni with Employment Destinations

Name	Employer
Wassim Alsindi	CEO of his own company Wazzle Ltd.
Andrew Busby	Qinetiq UK
Adrian Chapman	Oakdene Hollins Ltd.
Laurence Gardiner	University of Nottingham – BDE in the School of Bioscience
Sandy Gordon	Business Manager of Promethean Particles Ltd.
Paul Hamley	University of Nottingham – BDE in Research Innovation Services
Elizabeth Lunt	DeMontfort University (Technology Transfer Manager)
Peter Milligan	University of Nottingham – BDE in the School of Physics
Jennifer Richardson	NHS Commercial Manager now Patent Attorney in Bristol
Phil Stephenson	Bailey Walsh Patent Agents
Ben Walsh	Oakdene Hollins Ltd.
Jeremy Webster	Mewburn Ellis Patent Agents
Martin Whitaker	Critical Pharmaceuticals Ltd. now Sheffield Medical Innovation Centre (Business Manager)
Paul Whiteside	Molecular Profiles Ltd.

Extract from the 2000 report[37]

Background

E.24 The University of Nottingham is a well-established university in the English Midlands with a high reputation for research. Nottingham's School of Chemistry currently has a rating of 5 (the top grade) in the Research Assessment Exercise and has also been rated "excellent" for teaching quality. In recent years the School of Chemistry has been undertaking research work on highly compressed gases ("supercritical fluids"), which offer the prospect of being able to replace conventional solvents. Given the environmental interest in phasing out many toxic solvents from current industrial applications, it was felt that this technology might have significant commercial potential.

E.25 In 1996 the School of Chemistry decided to take a novel approach to the establishment of links between its 25-strong supercritical fluids research team and potential industrial partners. They designated a single member of the team, already qualified with a PhD, as a Technology Transfer Scientist, tasked with building up industrial contacts and taking on sponsored project work while remaining integrated with the team in its research activities.

The Technology Transfer Scientist in Action

E.26 The progress of this initiative was recently evaluated. The Technology Transfer Scientist (TTS) spends about 50% of his time on industrial work and 50% in outreach activities, administration and work with colleagues. He remains a genuine research scientist but, as envisaged, works on short-term projects and has been able to give a quick response to industry. Clients have included SMEs as well as large firms and there have been positive outreach efforts to reach the smaller companies, especially through Royal Society of Chemistry technology transfer days. In this work he has been able to draw support from the Head of the research team and other colleagues. The fact that he can call upon the facilities and expertise of a highly-rated research team also enables him to justify a high daily charge rate (typically £650) for the contracts he undertakes for companies – and this in turn helps to screen out non-serious enquirers. Although only a third of enquiries have been "converted" into business, useful contacts have been established from the rest that might subsequently develop further.

[37] Extract from Wicksteed and Herriot, *Six Case Studies in Technology Transfer.*

E.27 The TTS himself has remained personally enthusiastic about the project concept and about work for industry. Industrial interest in supercritical fluids has been maintained and is likely to be further encouraged by environmental legislation. He believes his work has been useful to industry and has helped his own career development substantially. As planned, he has also remained fully integrated within the research team – helped by his possessing particular talents in the mechanical aspects of establishing experiments, which other researchers are keen to draw upon.

E.28 The head of the research team considers that he has himself benefited from the initiative, in particular because direct contact with industry has given him some insights of real use to his scientific work. The other researchers in his team have also had some benefit from external exposure. They are now "able to explain the work they are doing in five minutes".

E.29 In terms of financial results, the first year generated a strong cash return, though there was a significant drop in the second year. However, results in the third year returned to a healthy level. The research team has learnt that this kind of operation is subject to peaks in demand and unevenness of cash flow. In recognition of this, the money earned has been put into a bank account, held partly as a prudent provision against business fluctuation and partly so as to feature what has been achieved. It has not been overly difficult to get paid by industry or to account for how the money has been spent.

E.30 The University overall considers the initiative to have been a success, although in terms of administration the handling of quite numerous small payments had initially been difficult. They feel the work with industry has been positive for the University's image – and they like the idea of the interface being provided by a researcher. Moreover in financial terms the outcome has been around break-even, depending on the view taken of appropriate charges for inputs made by members of the team other than the TTS himself.

E.31 Partly encouraged by the success of the Technology Transfer Scientist, the University has now co-funded Technology Transfer Officers in other Schools. The Schools of the Built Environment, Pharmaceutical Sciences and Psychology have found 50% from their own budgets, with a further 50% coming from University central strategic funds.

Issues from the Case Study

E.32 The key factors for success in the Technology Transfer Scientist initiative are believed to have been:

- the right appointee for the post, who knew other members of the team, related to them well, was keen to take the job and was ingrained in research
- a research group that was both excellent and big enough in scale
- genuine industrial interest, prompted by the prospect of regulation
- positive attitudes and enthusiasm from the head of the research team and the other senior researchers – who are still "on the way up" in their academic careers
- positive support from the Departmental management and the University Industrial Liaison Officer
- an appropriate degree of management and an effective appraisal structure for the Technology Transfer Scientist.

E.33 However, an approach to technology transfer which places so much responsibility for success on a single individual is not without its risks. Ideally the School of Chemistry would like to appoint a second Technology Transfer Scientist who would overlap with the current post holder and, therefore, provide continuity if he left. There is a feeling that the effort is vulnerable as currently arranged. On the other hand, the additional costs of doubling up the post are unlikely to be covered by additional income, so the cost/benefit equation might be less attractive to the University than the current arrangement.

E.34 The success of this initiative suggests that, where the circumstances are right, there can be a strong case for a Departmental or School-based approach to the provision of resources for technology transfer, as against the more common option of building up structures at the level of the University. The proviso for this approach, however, is that the Department/School has to be able to demonstrate not only the necessary excellence in research but also a commercial relevance for a key aspect of its work and a level of "maturity" in the attitudes of its leading staff members.

Annex F: St. John's Innovation Centre, Cambridge:
Technology Transfer £ for £ Funding – case study notes from 2009[38]

Company A

Interviewee: CEO and Founder

F.1 From their base in Cambridge, the firm offers a range of products and services meeting the IP intelligence needs of the technology sector. Their clients range in size from blue chip corporations to individual inventors. Some of the uses of their work include: rapid patent search delivery, customised patent map development, informing freedom to operate decisions, developing IPR strategies and helping with sustainable intellectual property management.

Contribution (additional funding, intellectual property, etc.)

F.2 The money was part of a bigger pool of funds (around £30k) available to the company at the time, mainly from brought forward by the founders.

"The St. Johns fund helped in speeding up the process… allowed us to shave off months from the start up of the company…"

F.3 The firm was founded in February 06, received the funding from St Johns in May06 and their first sale was in August 06. Therefore, it can be said that the fund contributed greatly to accelerating the start-up of the company.

"If it were not available we would have done it in a slightly different way, which could have possibly prolonged the process."

F.4 The funding went towards the development of an initial prototype database software and building the intelligence platform which is used in the trade marked software offered by the company at the present date. Graduate students and researchers were commissioned for this task and to put together a software guide once it was completed.

"The funding led to the development of the base platform for the database structure, which has since been constantly modified and updated."

F.5 The database software/workflow system that was developed could be patented, but they have not chosen to do so, however they may in the near future.

Overall satisfaction and ongoing collaboration

F.6 *"Very satisfied with the quality of research that was carried out… however, this was not done to the fund, as it is up to the company to source the researchers; which I believe is the right way."*

F.7 When asked if he would consider the university again in the future, he responded:

"Whatever I do in the future in the UK, that is technology or innovation based, I will probably give Tim a call."

Additional Information

F.8 It was perceived to have helped expand the network of the company, increased technological knowledge, increased insight into the market, and increased the willingness to innovate (all of this to the extent of the £10k funding). He explained how *"all contacts were identified through the university network…"* The business area in which the company is working in is a new, unexplored area. The firm believes they made some fundamental improvements to this area.

Company B

Interviewee: Co-Founder

F.9 The firm was set up by Cambridge University graduates in 2004, with the goal of providing a novel and improved solution for the identification of infectious diseases such as malaria, tuberculosis, and gonorrhoea. The initial business idea won the Cambridge entrepreneurial award and later received the St John's Innovation voucher.

Contribution (additional funding, intellectual property, etc.)

F.10 The funding was perceived as a "first step for easy initial funding for starting the work". The award had very low requirements therefore it was perceived as easy to access. *"It's really important as it gives a jump-start..."*. The funding went towards contracting university staff and students for consultancy work for the company. In particular, it went towards initial feasibility studies and market research. It was explained that the funding was: *"critical to having the initial feasibility studies carried out"*. Apart from

[38] Extracted from *'The long-term effects of innovation vouchers on high-tech start-ups'* by Ebrahim Rostin Haj Seyed Javadi, of Wolfson College.

the feasibility studies the funding was also used to support the patent application. Due to limited funds the company was not able to afford patent attorney fees, however, they were able to hire an expert using the funding from the voucher to help draw up the application within the business. The company later received a patent for their IP.

"Having cash at such an early stage was quite important for gaining better quality information from consultants."

F.11 Additional funding was generated; the company was able to secure matched funding from South African for up to 150k to be used in collaboration with local universities. However, the firm did not have the money required to match the South African funding so it was never used.

"… The Gatsby Fund helped to build a credible enough proposal to secure the South African funding."

F.12 However in the end, the company was abandoned. This was partially due to the unavailability of funding, and partially down to the team who had to finish their PhDs. He described how:

"The company had good promise but due to not having enough resources at their disposal to push the product through it had to be abandoned."

Overall satisfaction and ongoing collaboration

F.13 The perception by the founder and entrepreneur was very positive as he explained:

"It gives spending money for a real- life learning opportunity for entrepreneurs… its really important that before you go to the proof of concept stage to have this sort of opportunity."

F.14 He also explained:

"…for the small money of amount money, the influence is enormous."

Company C

Interviewee: Founder and Managing Director

F.15 The firm is based in Cambridge, UK, with manufacturing facilities in the North East. They develop new businesses in superconducting products, and explore innovative ideas in the 10-40K temperature range for wire, motors, magnets, instruments and devices.

Contribution (additional funding, intellectual property, etc.)

F.16 The money was used for a study exercise to see whether a market existed for a particular superconductor electric motor. Heading the research was the founder of the company, who used the money to fund the research he was doing at the time, and to finance the work of a student researcher. The research involved finding applications for the superconductive material. Therefore it was mainly for experimentation, however, none of the initial opportunities translated into anything viable. It was credibility that the start-up was after and the funding helped in the way that:

"By paying for an academic visiting post, and some experimental work at the university, we gained a lot of credibility in the research area and amongst other universities researching this area."

F.17 No IP or patents were generated directly. However, the fund helped in terms of networking and helping to get to know all involved.

"If it weren't for the Gatsby Fund we would not have been involved in the links grant, and the grant would have been on research on an entirely different set of materials."

F.18 The company moved on to become a commercial wire making company. However, the interviewee believed that St John's Fund did not help to expand the market knowledge, or particularly the willingness to innovate in the company.

Overall satisfaction and ongoing collaboration

F.19 Summed up as:

"In terms of credibility and meeting people it was absolutely invaluable"

F.20 When asked if he considered using the university since for research, he responded:

"Yes continuously … we retain a couple of university consultants from the university and pay them several hundreds of pounds per year."

F.21 Also, another company he is involved with are currently working with the Cavendish polymer electronics group.

Company D

Interviewee: Founder and Managing Director

F.22 The firm was set up by a senior academic with the aim of developing a revolutionary approach to current requirements for ventilation in houses and flats. The initial research focused on addressing two main problems: the growing problem asthma and allergies due to poor air quality inside homes, and the issue of conservation of energy. In order to address these

problems the firm have developed a full solution to passively ventilate a building without losing much energy.

Contribution (additional funding, intellectual property, etc.)

F.23 The firm received the St. John's award for £1k in February 2006. The aim of the funding was to develop a marketing plan for the solutions identified by the research carried out by the founder and his team of researchers. Therefore, the actual fund awarded had no direct contribution to the technical research being done on the product (this was done through funding received from the Carbon Trust). It helped pay for an exploratory investigation that was done by one of the students at IFM, which was geared towards identifying the market segment and in helping to understand the market drivers. It was very helpful in that it suggested a format for published documents and suggested an audience that the company should address. The format has been used by the company ever since.

F.24 No patents were generated from the work carried out using the St John's voucher. However, it was felt that it contributed towards business opportunities and consultancy work. A business plan was entered into the University Challenge and won (with the help of consultation from the university), however this was not as a result of the work done in relation to the voucher.

Overall satisfaction and ongoing collaboration

F.25 The researcher was said to have been ideal for the job and completed the task in a timely and professional manner. As for the actual scheme it was very unbureaucratic, meaning very little time was lost filling out forms and waiting for responses.

"… it was very helpful indeed."

F.26 The interviewee rated the quality, speed, and value of the research at 5/5, in terms of satisfaction.

"Yes certainly still maintain a connection with the university… but it is unlikely I will be starting up another company in the future…"

Additional Information

F.27 The interviewee believed that the fund expanded the company's network of expertise and helped increase their insight into the market. However, it did not contribute to their technical knowledge or increase the willingness to innovate within the company. He explained how he *"strongly recommend continuing with the fund as it was very helpful to the company."*

Firm E

Interviewee: Founder and Managing Director

F.28 This is a private company, profitable and based at St Johns Innovation Centre in the United Kingdom and focused on providing Water & Wastewater Treatment process solutions including compact biological treatment systems and large sewage and industrial wastewater treatment plants with design-engineering services, servicing Europe and the Middle East Regions.

Contribution (additional funding, intellectual property, etc.)

F.29 The project was in research and development of wastewater treatment, using a device to create larger surface area to get more microorganisms. The idea was to build a plant with a series of reactors. Once the initial designs were finished, the only thing remaining to carry out the trials was the funding. An application was made to the Department of Trade and Industry (DTI), who confirmed that the firm would be eligible for the SMART grant. This grant would provide 75% of the total funding required (which was estimated at 50k), and out of the remaining 25%, 5% was privately sourced, and the other 20% came from the St John's Fund.

F.30 The funding acquired from this SMART grant went towards the cost of designing, creating detailed drawings, and fabrication of the initial prototype in mild steel; which went towards proving the concept and preparing the product for commercialization. Later the Greek agent agreed to become Manufacturer under licence and are now producing and distributing the products around the world.

Overall satisfaction and ongoing collaboration

F.31 Currently are designing, manufacturing and supplying water treatment solutions to number of countries worldwide. The interviewee explained how crucial the timing of the funding was for the company. He explained:

"Had I not be given the funding from St John's… I don't think it would have got this far…"

F.32 Therefore although the funding was put towards leveraging the larger SMART grant, it was still a fundamental component to the company's start-up.

Firm F

Interviewee: Co-founder and Managing Director

F.33 This is an award winning company which is currently located at the Cambridge Science Park. The company was formed as a result of acquiring intellectual property from the Engineering Department at the University of Cambridge. They are currently working with selected partners for commercial release of the groundbreaking PVKey product.

Contribution (additional funding, intellectual property, etc.)

F.34 The company received the funding in 2004. At that time the company founders had just finished their PhDs and had written a business plan that won 30k from Cambridge university entrepreneurs. The St John's Fund was combined with the winnings from the university challenge to match the SMART or R&D Award of £125k. In order to get the R&D award certain specific requirements had to be met, mainly proof of concept or a bench top model. The St John's fund contributed towards meeting the requirements for the R&D award. As the founder explained:

"It absolutely helped towards getting the SMART funding and without that we would have been stuck…"

F.35 Also some of the money in the initial R&D project paid for some of the IP generated. They had a patent before the funding, but since have developed a portfolio of nine patents, which support the company's product. The R&D award funded the project that was completed by early 2005. Towards the end of 2005 left the university and got further funding from the Carbon Trust.

Overall satisfaction and ongoing collaboration

F.36 The St John's Fund was seen as extremely helpful as it was difficult to find such funding at that early stage.

"It was only £10k but combining that with our winnings enabled us to unlock a further £75k which at that stage was quite critical... and without that we would have struggled"

F.37 The founder explained:

"We were very satisfied with the fund … kept the link with the university going and helped to finance research for some students…"

F.38 At the time it was a new fundamentally new area, there had been one or two failed attempts, but in this case the final result was success.

Firm G

Interviewee: Founder and Managing Director

F.39 The firm was formed in 2004 as a spinout of the Department of Chemical Engineering at the University of Cambridge. The company focus on providing specialist solutions and addressing environmental and regulatory challenges across industrial, commercial and municipal sectors to deliver value from waste.

Contribution (additional funding, intellectual property, etc.)

F.40 The founder did the design for the process, and initial business plan during his post doc for the university. The funding was used to complete the first prototype, which was done in the department. The prototype required some additional components and equipment. These modifications/adaptations to initial prototype were for the initial proof-of-concept stage, and were made using the funding from the St John's Fund.

"The Gatsby fund contributed towards 20% of the money that was used to prove the prototype."

F.41 However, it contributed to the most crucial initial 20% as well as expenses of the researcher who founded the company.

"Yes the fact of having that little push from the Gatsby fund came at the crucial moment … to prove that the prototype worked in a certain way."

"By no means was it the only money that was needed … but it came at a crucial moment…"

F.42 Having proven the concept, first the company won the University challenge fund of £60k, and this later led to a syndicate of inventors investing up to £200k. A patent for the process had already been pending at the time, however, the fund helped to prove the patent content during the proof-of-concept stage.

Overall satisfaction and ongoing collaboration

F.43 Because the Gatsby Fund was going towards financing the research and contributing towards the researcher's expenses, it was critical. The founder seemed satisfied with the outcome as he explained:

"If I had not received the funding from the Gatsby fund I would have more than likely packed my bags and left Cambridge, and nothing would have happened..."

F.44 When asked about continuing work with the University he explained:

"Although my involvement gets less and less … however we are still in contact with the university all the time trying to develop new concepts."

F.45 The work was in a completely new business area and this work has significantly improved this area.

Firm H

Interviewee: Managing Director

F.46 The business founded in 2001, is a privately owned UK based software applications company that delivers a variety of location-based products, services and solutions worldwide from its offices in Cambridge. It focuses on two principle markets: Proximity Marketing Solutions and Visitor Attraction Solutions.

Contribution (additional funding, intellectual property, etc.)

F.47 The funding went towards continuing the development of the prototype, which later became the company's main selling product. The interviewee explained how the prototype was at a point where it was near completion, however it was the Gatsby fund that came at the crucial timing that helped push the prototype through to completion. Shortly after the firm received 1 million pounds in funding. As a direct result of the completion of the prototype there has been 3.5 million pounds worth of sales of the product. As the Managing Director explained:

"If it weren't for that ten thousand, we wouldn't: A) have a company B) have received 1.5 million pounds worth of extra funding or C) have sold 3.5 million pounds worth of stuff. So I would say that is why it was important."

F.48 Because it contributed to the development of the prototype, and there was IP generate from that prototype, it can be said that the money from the St John's Fund contributed to that IP being generated.

Overall satisfaction and ongoing collaboration

F.49 When asked for his opinion of scheme:

"Very good experience… working with an academic by the name of Tim Minshall… a great experience"

"Quality of the research was great but by in large it was work done in house by researchers in the company."

F.50 When asked whether they have continued to work with the university, he responded:

"Yes we continue to work closely with the university and with the academics and consultants."

Additional Information

F.51 He explained if the company had not received the fund:

"The company may have gone bust… Assuming the company carried on realistically would have found the money from somewhere else, but the fact that we got it from Gatsby meant we were able to continue at the same speed…"

"Without a doubt it would have had a bad effect on us if we hadn't have received the grant…"

F.52 As a result of the work done, the firm's network of expertise expanded, as well as their technological knowledge, insight into market, and willingness to innovate. It was this was a new business area at the time, however it was an improvement to an existing technology.

Firm I

Interviewee: Founder and Managing Director

F.53 The firm was set up an optics and electronics applications. The main goal was to develop a compact projector array utilising new display technology. Therefore, the business was set up purely to undertake the research with the view to commercializing or licensing the technology produced.

Contribution (additional funding, intellectual property, etc.)

F.54 The funding that was received from several sources and the aim of the funding was to create physical prototypes, and to evaluate through further research, the practicality of using the new displays in a projector array in the manner that had been conceived. The practical research resulted in confirmation that there were design compromises or trade-offs. Those trade-offs meant that it was impossible to get a large enough image viewable from a singularity or a large enough i-box, there was an image produced but the image was too small.

"The findings were that it wasn't practical with those optical trade-offs, so the project was shelved."

"The research was successful in coming to a conclusion: yes it could be done but not with the practical performance ability it would need to be used outside of a lab. "

Overall satisfaction and ongoing collaboration

F.55 Heading the research was the founder, who was making use of university researchers. He was quite satisfied with the resources available and the abilities of the research staff commissioned.

"Being involved with the university during times of research gives you enormous reach were you don't have to have individuals working full time to draw upon their experience in a very natural way…"

F.56 He also had the support from some professors from the university, who were experts in the field and he perceived that to be incredibly useful.

"The benefits of working with a small number of individuals from the university are that you gain access to the university's network of top-flight researchers and professors, and that is valuable beyond any moneys that could be paid…when used correctly access to university network is incredibly powerful."

F.57 At the time the research was in a new business area and he explained how:

"If we had been successful at the time it would have been a very ground breaking technology… way ahead of its time."

F.58 The company have taken work experience students from the university and they continue to have links with the university through their new business. Also some of the students who came to work at the new firm, having learned about entrepreneurship and taken experience from the internship, moved on to start their own businesses. He explained how the company would be keen to work with the university in the future and possibly provide some interesting masters projects and or similar. However he also explained how:

"As a small business we are not in the position to pay full rate university involvement in our projects, and this is even more acute in the current economic climate."

Firm J

Interviewee: Founder and Managing Director

F.59 The firm was founded in 1999 and has been since been developing 'Variable Mass Technology'. The innovative VMtechnology™ dramatically reduces the vibration experienced by operators, decreases the risk of injury from 'Hand Arm Vibration Syndrome' (HAVS) and improves handling characteristics, increasing operator productivity. The company has received funding from a variety of sources and has also been the recipient of the St. John's Voucher.

Contribution (additional funding, intellectual property, etc.)

F.60 It was coming to the end of the funding from the DTI grant (or 'SMART' grant at the time and the firm were in between funding, when the company applied for the St John's voucher. The St. John's Fund came at a time when the company was experiencing a dip in the cash flow. It was explained that

"the funding from the St. John's was instrumental in taking the project forward and it contributed to the development of the business."

F.61 The St John's voucher was used for the vibration modelling, which was done in the Cambridge University Engineering Department. The academic in charge of the modelling and technical consultancy later became a shareholder and has contributed to the development of the company since. In Sept 2002, the company received funding from NESTA (£60k). From the NESTA funding a prototype was developed and the first round of orders secured, however NESTA did not approve the follow up funding required for going into production. Because of this the company was put into voluntary liquidation. Shortly following the liquidation, the intellectual property was rescued by another company.

F.62 It was explained that due to the change in the market, moving away from hand held tools towards construction vehicles, it is unlikely that the main product will go into production in the future. However, as a result of the developed tools a new technology was developed for pipe coupling applications in which there has been much interest.

Overall satisfaction and ongoing collaboration

F.63 When asked if he was satisfied with the St John's voucher scheme the interviewee responded:

"Yes, very satisfied with the voucher from the St John's Innovation Centre, it was received at a much needed time to help with the development of the business."

F.64 The company was generally satisfied with the quality and speed of the research carried out. This is also reflected in the fact that academic researcher was later made a shareholder in the company in order to gain from his expertise.

Annex G: Loughborough University

G.1 This annex has two parts. The first is a short report prepared by Anna Seddon specifically to assist this review. The second is an extract from the 2000 report.

Loughborough University: background to the development of research commercialisation[39]

Introduction

G.2 Loughborough University's 10 year strategic plan, "Towards 2016", explicitly assigns the highest priority to the development of a culture in which *Enterprise*, encompassing knowledge transfer and research exploitation, is established as a core activity, accorded the same status as Research and Teaching. In 2006, we created the role of Pro-Vice Chancellor for Enterprise, to lead an Enterprise Office of around 25 staff, and to work closely with the Pro-Vice Chancellor for Research and the Research office on research exploitation. In addition, in partnership with the Pro-Vice-Chancellor for Teaching, the PVC(E) is leading the expansion of enterprise education and training across campus. The Enterprise Office utilises multiple sources of funding for exploitation, including the HEFCE HEIF 4 allocation, RDA funds and private sector capital to create support structures for research exploitation, and new business creation. Previous EPSRC KT awards, including our current £15.3m Collaborative Training Account, successive HEIF awards, a significant KTP portfolio and strategic investment of our own funds have driven forward genuine engagement with industry, commerce, social enterprises, the public sector and government, the 'real users' of our research, and have given us a body of experience and learning on which to build for the future.

Our aims and guiding principles

G.3 While proud of achievements to date, we fully recognise the potential for greater impact from our EPSRC research portfolio. Our substantial experience has given us a firm foundation on which to build for the future and we aim to enhance the exploitation of our EPSRC research portfolio through innovative mechanisms in the following 3 areas:

- developing people – the knowledge transfer ambassadors
- better exploitation – embedding KT through the research project lifecycle
- engagement with users – turning collaborations into partnerships.

G.4 Our approach will be guided by the following principles:

- To combine maximum flexibility for the research user with strong governance and clear accountability.
- To concentrate KTA funds at the project level, using institutional and HEIF funds to provide infrastructural support, and so focussing EPSRC KTA support very specifically on EPSRC-funded research outcomes.
- To exploit the alignment between our key strengths and EPSRC's 'critically important areas', focussing our effort in the UK's emerging sectors, knowledge-based industries and low carbon economy.
- To enhance further our engagement with research users, utilising, in particular, the unique opportunities presented for direct engagement by our ambitious plans to develop the next phases of our Science and Enterprise Park.
- To work with EPSRC in the spirit of our Framework agreement.

Research background

G.5 Loughborough University has always taken great pride in its close working relationships with industry, commerce, social enterprises, the public sector and government. This is given weight in our mission[40] where the third strand, alongside teaching and research is "To influence the economic and social development of individuals, business, professions and communities."

G.6 Our strong commitment to our research base has seen the value of our total research portfolio more than double over the past decade. Our current EPSRC portfolio is approximately £88m, and around £62M excluding areas covered by collaborative bids and further excluding our CTA/DTA awards. Research groups active within

[39] Prepared by Ann Seddon, Head of Marketing & Communications, Enterprise Office, Loughborough University, May 2010.

[40] Loughborough University, *Towards 2016: Strategic plan* 2006/2007 edition.

EPSRC typically draw funding from a range of other sources, including TSB, EU, government departments and contract research, and EPSRC funding represents around 30% of the value of our research portfolio. Our strategic approach is characterised by a number of large multi-partner projects and academia-industry Centres. In 2008, we accepted the EPSRC invitation to become a Framework University, based upon consistently strong portfolio and strategic alignment.

G.7 The portfolio is notable for its extensive interaction with industry and end users (83% is collaborative). Underpinning our approach is the imperative to develop long term relationships with industrial partners, being adaptable, flexible and innovative to meet their evolving needs. This has traditionally centred on research, training and recruitment. We will now consolidate our growing enterprise activities within these relationships.

G.8 We recognise the differing knowledge transfer agendas of different domains of our research portfolio, particularly with regard to maturity. At one end of this spectrum we are building on our traditional research strengths in engineering, manufacturing, construction and ergonomics. We have invested in sectors now exhibiting strong growth such as renewable energy, fuel cells, nanomaterials and advanced ceramics. At the other end of the spectrum, we are developing our portfolio in emerging areas, anticipating new industries such as regenerative medicine, where the challenge is scale up of cell therapies from the lab bench to safe, economic production. Our institutional research strategy has brought interdisciplinary research schools forward. These are, by definition, research areas where we are developing a critical mass of internationally excellent research. The interdisciplinary nature of the schools enables us to address societal problems and research questions that transcend departmental boundaries. Consequently these also figure heavily in our Knowledge Transfer plans over the next three years.

Institutional track record of research exploitation

G.9 Loughborough University has a distinctive ethos of research exploitation. The headline citation in the recent announcement of our Sunday Times University of the year award was **"Excellence to benefit industry"**. The Enterprise Office of around 25 staff, supports researchers and academics in a wide range of knowledge transfer activities, ranging from secondments, KTP and significant industrial partnerships to consultancy, patenting, licensing and spin-out activities.

G.10 Benchmarking against other Universities via the HEFCE HEBCI survey data, one area is particularly striking, which is the area of collaborative research involving funds from both the public and private sector, where we are consistently in the top 10 institutions by value. This reflects the hugely collaborative nature of the portfolio, with many large, multipartner awards.

G.11 Whilst large collaborative programmes are attractive to a wide range of companies, some smaller companies prefer to operate on a smaller scale, and find the Knowledge Transfer Partnership scheme attractive. Campbell Scientific is an example of a smaller company that has used the KTP scheme to good effect over a number of years, a collaboration which has resulted in new products to market.

G.12 Our achievement has been recognised on many occasions, most recently (30/10/08) in the CBI report 'Stepping Higher: Workforce development through employer-higher education partnership', published jointly with Universities UK and HEFCE, and in the Council for Industry and Higher Education (CIHE) report (29/9/08) 'Influence through Collaboration: Employer Demand for Higher Learning and Engagement with Higher Education' where we are a lead case study.

G.13 The University has received six Queen's Anniversary Prizes for Higher and Further Education, an achievement equalled only by the University of Oxford. These are awarded for work that creates real benefit for the nation, and topics have included partnerships with aerospace, optical engineering and more recently for contributions to vehicle safety research.

G.14 We have had particularly fruitful relationships working with regional development agencies (particularly *emda* for the east midlands and AWM in the west midlands) in building innovation-led capability in Midlands high-technology and knowledge-led sectors. A notable recent example involving both agencies is our hosting of the government's £1B Energy Technologies Institute, on behalf of the Midlands Energy Consortium.

G.15 In 2003, we acquired land and high quality premises, immediately adjacent to the campus, to initiate the creation of our Science and Enterprise Park. The Park's first phase has concentrated on building academic-industry collaboration and features the flagship Systems

Engineering Innovation Centre (SEIC) with BAE Systems, government-industry centres of excellence, CENEX Low Carbon Centre and the £1B Energy Technologies Institute, alongside facilities occupied by Germanischer Lloyd, Intelligent Energy and the Transport i.Net, as the core of a vibrant low-carbon cluster. We have also placed industry-facing university research centres in Sports Technology and Healthcare Engineering within the Park, creating a dynamic and truly mixed research community. We are actively seeking to develop the Park further, and aim to extend this vision of clusters of knowledge-intensive organisations, public and private sector, located close to relevant research and knowledge transfer activities.

G.16 Our on-campus incubator, the Loughborough Innovation Centre, features prominently in our strategy for enterprise and houses 35 companies. These companies are provided with a high quality environment at modest cost, as well as with business mentoring and advice. These facilities are open to our spin-out companies, as well as others with an appropriate knowledge-intensive business that meets the gateway policy.

G.17 We have consistently spun out high quality companies as a result of our research. One of our most successful spin-outs, Intelligent Energy, grew out of a series of EPSRC grants (1991-96) to become a leading fuel cells company with over 100 employees and collaboration with major manufacturers such as Suzuki and Boeing. They remain on campus, as part of our cluster of low carbon organisations. Our current live spin-outs provide a solid contribution to the UK economy, with a joint turnover of around £15m per annum and providing employment to over 150 people. Our partnership with IPSO Ventures is assisting with access to funding for spin-outs, and is increasing our access to the skills required to professionally develop new spin-out concepts.

G.18 We have consistently and enthusiastically engaged with technology transfer initiatives such as Faraday Partnerships, and subsequently Knowledge Transfer Networks (KTNs). Loughborough hosts two KTNs, in Integrated Products Manufacturing and in Low Carbon and Fuel Cells, and works with many other sectors. This augments the platform for effective knowledge transfer built using HEIF funding received from HEFCE. We also encourage more informal groups, "Communities of Practice", uniting practitioners, end-users, industrialists and academics to drive forward innovation at the boundaries of conventional disciplines. For example, our partnership with the University Hospitals Leicester matches the needs of clinicians with the capabilities and potential applications of new electronic, IT and engineering technologies.

G.19 As an institution, we have significant track record in managing large funding awards. The evaluation report from our £15.3m five-year pilot Collaborative Training Account (CTA) stated *"Loughborough University have used the flexibility offered by the CTA award to successfully and proactively increase the scope and breadth of their industrial partnerships for the benefit of students, industry and the university. It is an exemplar of how CTA funding should be used and managed."* In section 3, we discuss our learning from this pilot, and how we will build upon lessons learnt.

Engagement with users – turning collaboration into partnership

G.20 Loughborough prides itself on its strong partnerships with users of research. Many such users collaborate with us through multiple mechanisms and over extended timescales, as evidenced by letters of support from companies such as Rolls Royce Fuel Cell Systems, Caterpillar, and Delphi Automotive Systems. We are aware, however, that as we grow new areas of the portfolio, we need to refresh our pool of end users who work with us, not just as a collaborator on a single project, but develop real partnership working with the University, sharing future plans and helping to influence our institutional thinking.

G.21 As an example of innovation in an emerging portfolio area, our spin-out company Dialog Devices emerged from an IMCRC project looking at innovation in healthcare, combining electronics, drug delivery and information technologies. The company's first product is Padd, for rapid, non-invasive assessment of blood circulation in the lower limbs and feet. The much-simplified test can be operated at a primary care level, reducing the need for patients to go to hospital, speeding diagnosis of Peripheral Artery Disease. The successful translation of research into a product, centred on having a working prototype for review by GPs and clinicians at an early stage, responsive rapid product development and attention to the regulatory process. This was facilitated by our development of the Da Vinci network of

clinicians and engineers to provide a thriving community of practice.[41]

G.22 The concept of creating communities is also at the heart of our ambitions for our growing Science and Enterprise park. In announcing the award of hosting of the £1B Energy Technologies Institute, the Science and Innovation minister, Ian Pearson referred to our **"outstanding energy innovation environment"** within our Science and Enterprise Park. This comment refers to not just the excellent facilities we have on campus, but also the growth of a community comprising academics, industrial researchers, spin-out companies such as Intelligent Energy and public-private organisations such as Cenex, with its lead role in the associated Low Carbon and Fuel Cell KTN.

G.23 Our objectives for this theme are therefore to:

- create mechanisms that ensure that research is informed and inspired by the context of use
- build partnerships with users, characterised by multiple interactions with the research base
- build on successful schemes that have seen direct placement of skilled researchers in collaborating research users, increasing flexibility to encompass a broader range of career levels, and allowing for exchanges in either direction.

G.24 Barriers to progress in this area are complex. We have learnt that relationships take a long time to build, and require investment at a number of levels from senior institutional to operational relationships. We have learnt from our Science and Enterprise Park tenants that proximity in itself is not enough to drive real dialogue. At the heart of this issue is relationships between people, and it is here where our efforts and resources would be concentrated. Most of the mechanisms proposed involve the transfer of people between academia and industry, with some resource dedicated to building new communities of practice as our research portfolio in emerging areas evolves.

G.25 Expected outcomes are new relationships. Such relationships built between researchers and users of research can be extremely powerful, informing the next era of research enquiry and paving the way for a virtuous circle of research exploitation and refreshed research agendas.

Section of the 2000 report on Innovation Fellowships[42]

Background

G.26 Loughborough University is, like Nottingham, in the English Midlands. Overall it undertakes a lower volume of research, though it has a successful history of working closely with industry. The University has also proved innovative in its curriculum and in the creation of niche markets within higher education.

G.27 Situated in an industrial area, the University is committed to working with industry. However, there was a sense that more progress could be made in this direction. The University therefore commissioned a market research study in the late 1990s, covering the views of staff currently involved in the exploitation of research and the experience of former Loughborough staff who have successfully taken technological developments to market and built up substantial companies. This identified a number of barriers to successful commercial exploitation. For example:

- time was needed to develop ideas to a sufficient stage to demonstrate commercial viability. Unless special arrangements were made available, time is too pressured by existing teaching research and administration commitments to enable the ideas to be followed through
- space was needed to exploit the ideas, in particular the continued use of equipped laboratories where previous research work had been undertaken
- academics were faced with an "all or nothing" dilemma should they want to move projects forward commercially. It would be helpful to have a trial period where potential could be properly evaluated. As things stood academics, if they wanted to develop their ideas, had to resign their academic post and, if things did not work out, could lose all.

G.28 From this analysis evolved a formal proposal that a means should be found to enable University staff to be relieved from university duties for a full time or part time sabbatical period whilst permitting them to continue development work in a well equipped and supportive environment. This would require the establishment of a

[41] www.davinci-net.org

[42] Extract from Wicksteed and Herriot, *Six Case Studies in Technology Transfer.*

number of Innovation Fellowships, for which funding was sought from a combination of University and external sources. The funding is needed to pay for:

• the proportion of time for which innovation leave is granted. This cost has to be reimbursed to the relevant department to buy in replacement staff to cover normal duties

• other direct costs, for example consumables and materials, technician time and the provision of specialist advisors, in market assessment etc. It was assumed that the costs of access to facilities, infrastructure and other overheads would be met by the University as part of its funding of the initiative.

Operation of the Fellowships Scheme

G.29 With funding secured, the Innovation Fellowships initiative was launched early in 1999. The project is run by a Programme Management Committee, chaired by the University's senior academic manager responsible for research. The Committee has two external members with both academic and business experience and it includes also the University's Intellectual Property Officer. It meets twice per year, making its award decisions (in which the Committee assesses the individuals as well as their ideas) by interview, following the submission of a costed and detailed plan from the applicant. Grants are in the range of £12,000 - £45,000. The University co-ordinates and manages the individual projects and the overall scheme through its Intellectual Property Office.

G.30 The initiative was thoroughly marketed in the University. All staff were e-mailed, an article was written for the staff magazine, a press release was issued, the programme was posted on an electronic bulletin board for all staff and written notification was sent to all Heads of Departments and senior university staff. From 18 initial enquiries 11 applications were received, leading to a short list of six applicants to be interviewed. The first two awards were made following the interviews in the summer of 1999. Although the numbers of applicants was felt to be satisfactory, given the start up nature of the operation, the Committee felt that more applications might have been received if the process timing had been altered to avoid clashing with examinations. Timing has now been reviewed to take this into account.

G.31 The two external members of the Committee, who take the lead in assessments, have also been assigned as mentors to the Innovation Fellows for the duration of their projects. In addition, the support of the Deans of the three faculties (Engineering, Science, and Social Science and Humanities) is essential if the scheme is to be successful. In practice they have proved very supportive.

Issues from the Case Study

G.32 It is too early to evaluate the scheme in terms of successful commercialisation outputs (ie spin off businesses). However it is possible to make a judgement on the processes and procedures, which appear to be effective. In particular it is extremely helpful to have as assessors successful academics with empathy with the University who also add considerable business experience and can speak authoritatively on commercial matters.

G.33 Looking ahead, the following issues may have to be tackled if the initiative is to be continued or expanded:

• more effective marketing exposure of the scheme within the University. One approach might be to hold a special seminar prior to the start of each funding round, at which existing Industrial Fellows outline the initiative and their experiences in going through the process. The initiative could thereby be shown to be working and such a seminar should certainly raise its profile and encourage more applications

• the availability of a wider range of assessors and mentors, without whom the scheme appears resource limited. This may require other organisations to be brought into the process, such as the local arm of government-supported agencies responsible for SME and innovation development

• the means for assisting the Innovation Fellows and their mentors to take the projects to the next stage of commercialisation after the Fellowship period has finished, and particularly obtaining seed finance. Such funding can be particularly difficult to find. What may be required is the establishment of a local group of potential investors in technology-based businesses – so-called Business Angels – or of a "seed-corn fund". This has happened in other areas where universities are developing their commercial links

• the definition of ground-rules for the University's involvement in commercial enterprises which may result from the work of the Innovation Fellows. It is envisaged at present that the University would usually take an equity

stake in any resulting company and have an interest in any IP generated. It could be argued that it might be better at the outset to define more precisely the terms under which the scheme would operate and in particular how much equity the University would look for if a company was launched. There may be disputes at a later date which would have been avoidable if the ground rules were clear at the outset

• the time horizon of the scheme. A notional three year period has been identified for the project, although this is flexible. However, in the event that companies are formed it is unlikely that they will have realised their value in cash terms within three years. (Seven years is a fair average for this type of spin out business). In three years time it is possible therefore that the University will have assets in the form of shares but will not have any cash to continue the initiative should it wish to do so

Annex H: University of Manchester Intellectual Property Proof of Principle Programme[43]

Intellectual Property (IP) commercialisation: The Gatsby Charitable Foundation contribution to a new landscape at The University of Manchester

H.1 UMIST and The Victoria University of Manchester (VUM) were early in to the new field of technology transfer in the 1970s, which followed the earlier introduction of industrial liaison offices at UK universities in the late 1960s. It is believed that UMIST was the first UK university to set up an industrial liaison office and that VUM was the first in the UK to establish a technology transfer company. Over many years, UMIST and VUM were both very active in technology transfer and successful in pursuing complementary but somewhat different models. By the Spring of 2004, it became clear that there could be an opportunity for Manchester (occasioned by the planned creation of a new University of Manchester in October 2004) to take a significant leap forward in technology transfer by integrating IP fully into the heart of the University. Few, if any, get the chance to think about starting all over again with a new philosophy and a new model, fit for a modern university building upon a wonderful legacy.

H.2 The new University executive management team was determined to carry this opportunity forward and incorporated IP management and commercialisation into the University's stated main mission, goals and key performance indicators. This prominence given to IP and confidence in the top management support for it encouraged the new interim IP management team to consult widely with the stakeholders of the University's IP activities including UoM academics and with venture capitalists for spin-outs and with established firms for licences. In particular, helpful counsel was provided by Gatsby, whose long experience in supporting various university-business initiatives over many years provided good benchmarking of practices, with the first such Gatsby award being made to Southampton University in 1995, to assist in its setting up of a technology transfer office, Southampton Innovations.

H.3 This indeed did lead to a new model, organisation and resources for IP commercialisation. The new organisation, The University of Manchester Intellectual Property Limited (UMIP), took on the mission to translate as many worthy IP projects to the market-place as possible; the emphasis being to be value-creating through liberating IP rather than to operate as a profit maximiser or be a high return-on-investment (ROI) operation. Nevertheless, to be successful, UMIP knew that it would need to run as a commercial concern and at least cover its costs. An important dimension of this new approach was a requirement for a proof-of-principle capability sufficient to meet the deal flow of applications projects arising from the University's significant volume of highly-rated research.

H.4 At around the same time, Gatsby had also identified that there was a crucial gap in the early stage of the technology transfer process, where private equity capital and few business angels would venture. Gatsby was concerned that many economic benefits of research outputs would never materialise because many inventions might literally never make it "off the lab bench".

H.5 After initial brainstorming with UMIP as to what should be done as a long term solution rather than a short term fix, especially with a goal of creating value-added impact rather than simply lots of activity, a discussion between the President of the University, Professor Alan Gilbert, UMIP and Gatsby took place in early September 2004. Arising from this it was suggested that the University and Gatsby could jointly fund a £750K Proof-of-Principle Programme, to be managed by UMIP, which would get projects out of the lab and onto the first rung of the commercialisation ladder, which everyone agreed was the fundamental roadblock to getting technology transfer moving at scale and with momentum.

H.6 The North West Development Agency (NWDA) was quite taken with the idea and joined the funding group and The Higher Education Funding Council, via its Innovation Fund, matched the University's initial capital. Thus the University was soon able to open a £1.5M PoP Programme for business, being a serious sized fund able to back good early stage propositions properly.

[43] Prepared by Clive Rowland, CEO of UMIP, April 2009.

H.7 A form of TV's *Dragons' Den* was set up – inviting presentations of proposals from the University's research community which had already been rigorously screened by UMIP and independently referenced by specialists in the relevant field as part of the Manchester model.

H.8 From the outset, the University and Gatsby thought that the involvement of outside people who could add value to the process should be a key part of anything that we might do ourselves in this regard.

H.9 So in the UMIP "den" a pitch is made to a panel of people from a variety of relevant walks of life, including corporate finance, venture capital, technology transfer, consultants and Gatsby (Professor Neil Alford, Imperial College). Conscious that an enterprise value case/proposal also has to have an eye on the people aspect too, the attitude of the academic proposer and his/her commitment and willingness to work with others such as managers, venture capitalists and industrialists is also part of the evaluation and decision making process. Awards are made on a business basis; they are typically for around £75K with an ambition to deliver a device/prototype, data package or limited clinical study data/indications within a year or less.

H.10 As successes have materialised and top-up funding secured, the PoP fund has been refreshed and therefore been in a position to fund continuously since October 2004. The Scheme has attracted a lot of interest from investors – from grant funding bodies with formal competitive translation programmes through to venture capitalists – and has given rise to the PoP projects "gearing in" nearly ten times the amount invested and creating or saving approximately 100 full and part-time jobs. Pleasingly, the projects supported fall almost 50:50 between engineering and physical sciences and biosciences. Not every project survives, but, to-date, complete failures have been at a rate of about 1 in 10 though the "jury is still out" on some others. The summary of actual performance to-date is:

University PoP fund (UMIP managed) – formally initiated in October 2004 – FY 04/05 (table to 31 January 2009)

No. of projects	No. of patents	Investment cost	No. of exit events	Value realised	No. of PoP projects written off	Value written off	Third party seed leverage inc. IP grants
61	163	£3.8 million	3	£1.25 million	6	£640,000	£33 million

N.B: Total of 61: Spin-outs = 24, Licences = 37 *Total of 163 patent filings, of which 24 granted*

Two case studies from the Proof-of-Principle Programme:

CASE STUDY 1

Nanoco (spin-out)

Nanoco produces large volumes of "Quantum Dots" which are semi-conducting materials whose unique electronic and optical properties enable the development of high performance displays, solid state lighting, solar cells and biological imaging. Nanoco, now 20 people strong, is run by CEO Dr Michael Edelman and Dr Nigel Pickett, Chief Technology Officer. Professor Paul O'Brien (the University's Head of Chemistry) has a scientific advisory role and sits on the board of directors. Nanoco is based in the University's state-of-the-art spin-out incubator.

A PoP award was made in 2005 to see if the production of quantum dots could be produced in quantity. This was used by the North West Development Agency's seed fund manager (Aquarius) to arrange an investment and development programme. A CEO, a US national, was identified and recruited. Following initial success at proof-of-principle, a second round of investment was secured form Ora Capital and UFJ Mitsubishi Capital.

With the financial ability to secure and enhance the patent position, to move into the University's state-of-the-art incubation premises, and to put a management and a research team together, Nanoco was able to conclude substantial development contracts with a number of leading corporations who have applications interests and business in the field.

By late February 2009, Nanoco had secured strategic partnerships with many important quantum dot application developers around the world which placed it in a business and marketing position to be able to acquire, through a reverse takeover, a listing on the AIM market, with a value of £40M.

CASE STUDY 2

Acoustek Pipeline Monitoring (licence)

Monitoring the health of pipelines is of great importance in many industrial sectors. In particular the ability to detect and locate partial and complete blockages as well as leaks in long lengths of gas filled pipelines is critical, most notably in the exploration and distribution of natural gas.

Natural gas pipelines are often difficult to access and unplanned disruptions to production can cost many millions of dollars per day. Detection methods such as radiographic detection and diver interventions can cost multiples of £100k's and when added to the cost of lost production and the environmental implications should the use of chemicals be involved, then the benefits of early detection become obvious.

For such situations, a portable or permanently installed tool that can rapidly and accurately locate features in a pipeline is highly desirable.

By early 2005, the University had researched an acoustic based technique that might be used to survey long lengths of gas-filled pipelines (up to 10km). UMIP provided PoP funding of £44k in that year to explore the feasibility of applying the technique in liquid/gas filled pipes.

Whilst the PoP work did not go entirely as predicted, the work and trials proved successful and in 2006-07 this led to the University collaborating with BP and Pipeline Engineering (PEL) to develop the technology as a commercial ATEX certified system. Arising from this collaboration PEL was appointed as a licensee in field of Oil & Gas applications in 2008. The collaboration and project activities have produced in excess of £500K for the University's R&D activities, PhD projects, and contributions towards field trials expenses.

Achievements

Acoustek® has completed successful field trials on the following scales: Leith (0.5km); Montrose (1km); Aberdeen (2.5km); Off-shore gas pipeline (1km); RMOTC (2km).

Most notable is that, in 2008, Acoustek® was able to survey a live offshore gas pipeline and correctly identify and locate a near complete blockage approximately 500m from the host platform. The initial survey was performed in a matter of hours.

H.11 Proposals awarded PoP investment by UMIP are invited back to present during their funded phase and again upon completion. Thus it is a milestone driven and outcome focussed programme. One of the interesting aspects of this is to see how academic researchers quickly pick-up the results orientated approach and the business jargon, once given support and helped to network in a different environment and community.

H.12 The University's evolving reputation in this translation of technologies from university into industry was seen as illustrating good practice and providing case study material by a number of government advisers. Through Gatsby's introduction, UMIP was able to debate the topic in a structured context with Professors Ben Martin and Puay Tang of the Science and Technology Policy Research Unit (SPRU) at The University of Sussex. Building upon SPRU's previous work this was put into a proper framework[44] and used by the then DTI as part of its response to The Treasury's Comprehensive Spending Review, at the end of 2006. It was subsequently quoted widely in various government discussions and at The Royal Society.

H.13 In parallel with introducing the PoP Programme, UMIP, in association with the law firm Eversheds LLP, developed and introduced a series of Guides for Researchers, which would allow researchers to appreciate better not just the detailed aspects of IP but also provide some useful tips and real world experiences to support their active participation in IP commercialisation for the first time through the PoP journey and beyond. Gatsby was very supportive of the idea of a series of guides and encouraging whilst these were being developed. Its feedback on these when they were being generated was very constructive and gave an external informed view of what such guides should cover and how they would be received by readers. This confirmed the benefit of consulting with our stakeholders to improve the relevance and effectiveness of UMIP's work and is a practice we continue with all key activities and before embarking upon new initiatives.

[44] Martin and Tang, *The benefits from publicly-funded research*.

- **The Researcher's Guide to Intellectual Property and Confidentiality**
- **The Researcher's Guide to Licensing**
- **The Researcher's Guide to Spin-outs**
- **The Researcher's Guide to Research**
- **The Researcher's Guide to Consulting**
- **The Researcher's Guide to Academic Materials and Publishing**
- **IP Workbook**
- **Case Studies of Spin-outs**
- **Case Studies of Licensing**

H.14 These guides have been made available to the wider research community and have been taken up by other universities and organisations. As an extension of these guides, an intranet Resource Guide has been developed and introduced at the University, which translates the Guides into practical examples and tips and is supported within the Resource by video clips and web links. This has been very popular with the University's researchers since its launch in early 2009, with hundreds of "hits" on the site.

H.15 Having a value-adding mechanism in the form of the PoP Programme to support the ideas and inventions passing through initial screening, it was recognised that the funding landscape for spin-outs was still missing a substantial and proper link with the capital markets. So, the University embarked upon a plan to raise a dedicated late seed fund for The University of Manchester. In July 2007, UMIP selected MTI Partners to market and manage the late seed fund proposition. MTI, a 20 year veteran of technology venturing, had at the same time identified such a market gap (seen as an opportunity) and so was an ideal partner for the University and UMIP: the mindset and ambition were identical even though the skills and contributions of MTI and UMIP are different.

H.16 The proposition, known as The UMIP Premier Fund **(www.theupf.com)** was aimed to be a £40M plus limited partnership fund, to invest in spin-outs from the University, with an ability to invest up to £2M+ per spin-out during a 5 year investment programme.

H.17 By March 2008, £32M had been committed and the fund opened for business. Whilst we were fortunate to arrange funding just before the banking crisis and economic recession impacted upon the fund raising, it has meant that UPF is unlikely to raise any more capital at this time. Nevertheless UPF has got on with its investment job and has already made 6 investments into University propositions (3 spin-outs and 3 proof-of-principle projects) amounting to in excess of £2M of commitments. This is clearly very helpful in itself but particularly important to a university IP business during a very difficult funding climate.

H.18 During the 2007/08 UPF fund raising period, one of the key aspects of the UMIP model that notably captured the attention of potential investors in the UPF was the Proof-of-Principle Programme. It was the system, as well as the deals in that pipeline, that impressed the investors, which include NESTA and The European Investment Fund (EIF) along with pension funds and others.

H.19 Therefore the 2004 vision and the subsequent but early practical implementation of the PoP Programme has been fundamental to leveraging in additional funding for the University's IP projects. It has also led – through MTI – to the establishment of serious streamlined and professional links with technology funders. This has not eliminated routes and options for the University, as it still retains the freedom to work with a range of early seed funders and indeed this is the goal that UPF has too, which is to network with co-investors to share risks and rewards.

H.20 In turn, the expertise gained with such a programme as the PoP has allowed UMIP to be invited to seek Carbon Trust Incubator status. This seeks to operate in a very similar fashion to the University's PoP programme, albeit in the specific carbon/environmental conscious field. If successfully followed-up this will enable the University to contribute innovation and enterprise value to relevant companies in the region, in addition to those spin-outs generated and supported at the University.

H.21 To complement the support to the spin-out programme provided by UPF, with Johnson & Johnson, the University has launched a co-managed a $500K licence PoP fund. This new corporate licence fund, similar to one at Imperial College, was able to be established at Manchester due to the existence of the University's successful PoP Programme which gave J&J confidence in the University's IP process and to which J&J is able to connect.

H.22 Looking forward, the University is making excellent progress towards its overall ambition,

to be in the worlds "top 25" by 2015. Whilst this is obviously spearheaded by its research and teaching quality standing, it continues to see IP as a core of the 2015 mission and we would like to think that IP is a value adding and reputation building part of the University's total ambition.

H.23 To assist UMIP, particularly in increasing this profile and momentum, it has recently appointed Imran Hakim as its Director of Entrepreneurship to work alongside UMIP's Chief Executive and also to help selected spin-out companies find new connections and ways to market.

H.24 Imran, TV's *Dragons' Den* favourite (of the successful *i-Teddy* pitch) is the epitome of entrepreneurship – he has great energy, tremendous enthusiasm and he can spot things that others don't and he has the knack of getting things done in a way that others don't consider: especially new business models for the modern age.

H.25 Imran, who is an alumnus of the University, an optometrist by profession and who has been running various successful businesses since he was 16, was attracted to the University because of its reputation for spinning-out successful businesses. Imran now attends relevant PoP pitches at the UMIP Investment Committee meetings.

H.26 In a way, we have come full circle in that, with Gatsby's continued support and financial pump priming assistance, and with UMIP having established its own in-house version of *Dragons' Den* in 2004, we now have a Dragon who graduated from the TV den, though we don't have the cameras – yet!

H.27 In another sense, Gatsby itself has also come full circle. Having stimulated many technology transfer programmes over many years, starting with assisting Southampton University in setting up its technology transfer office, it has completed its support in this area with the last such technology transfer grant to The University of Manchester (to establish the PoP Fund), which is likely to have an impact way beyond the year in which it was originally supplied.

H.28 However it won't end here. The process will evolve – we already have ideas how to evolve and enhance the PoP Programme. The North West Development Agency has just provided feasibility funding to UMIP to look into how the University's IP assets in the drug discovery arena can best be promoted through a Proof-of-Principle programme, given the very expensive nature of developing such assets. Gatsby continues its contribution and support through the on-going attendance at PoP meetings and counsel of Professor Neil Alford, an adviser to Gatsby's Board of Trustees.

Annex I: University of Sussex: Gatsby Fellowship for Technology Transfer – an overview[45]

Objectives and Background

I.1 The Gatsby Charitable Foundation awarded SPRU and CENTRIM a four-year fellowship on university-industry technology transfer. The main objectives of this research programme were twofold:

• to improve our understanding of university-industry technology transfer processes

• to contribute directly to the technology transfer activities of participating universities. For this purpose audit tools are to be developed and applied.

I.2 A research fellow was hired in 2003 to work on the fellowship for a period of four years. During the active research phase of the project, updates were delivered to Gatsby on a regular, quarterly basis. The Fellowship was organised in a way that has led to multiple outputs rather than a single final report. This document provides an overall summary of results and outputs of the project.

Findings from Research

I.3 The fellowship contributed substantially to our understanding of university-industry technology transfer in a number of specific areas:

• University patenting and IP management approaches:

– the fellowship highlighted the importance of local practice in relation to legislative or regulative frameworks;

– international comparisons of universities' approaches pointed to strong differences within rather than between countries;

– different approaches to IP were highlighted for research-intensive UK universities and the question raised to which extent there was a patent protection failure within the UK university context;

• Entrepreneurial university and the role of the academic entrepreneur:

– the fellowship examined closely the relationship between organisational characteristics of universities and entrepreneurial outputs;

– case based research raised the question whether technology transfer interventions really give rise to academic start-up entrepreneurs or rather support entrepreneurial academics;

– good practice cases for global innovation environments were developed and presented;

• Indicators of UITT and science-technology exchange processes:

– new, innovative indicators of tracking university inventions were developed that helped uncover 'hidden innovations'

– a comparison of patent output between countries with different IP regulations indicated that Bayh-Dole type legislation will not necessarily lead to greater level of academic patenting than in countries that retained faculty privileges

• Innovation in emergent science based technologies:

– Here the fellowship focused on one particular area, nanoscience and nanotechnology and challenged the conventional wisdom on broadly converging science based technologies, suggesting integration between technologies would be far more incremental and focused in nature

Output

I.4 A total of 29 articles were published by the Gatsby fellow in international, peer-reviewed journals during the active research phase of the Fellowship (2003-2006).[46] He also guest edited five special issues during this period. In addition, the Fellowship has also led to a number of book chapters, reports and conference papers.

I.5 On the more practitioner-oriented side, the fellowship also developed self-assessment framework and an associated good-practice case library that was made available through an extensive tech transfer website.[47] The model was tried and tested with partners in the participating universities, notably with the Head of the Research Services Division at Sussex who supported the development of the tool and

[45] Prepared by Professor Martin Meyer, February 2009.

[46] This figure includes also publications that were submitted during the active research phase of the fellowship.

[47] The University discontinued the external tech transfer webpages. A demo version is still available at this private site: http://mmeyer.info/gatsby/gatsbytooldemo.html

applied it to his area of responsibility. Later on the principles of the model were applied to benchmark entrepreneurial activities at an international research university (the Free University of Brussels, ULB). The tool was also presented and promoted at various practitioner related events in the UK, including AURIL and HESE meetings, and abroad (see the relevant appendix on presentations at practitioner events).[48]

I.6 In addition an appreciative review of Gatsby pilot projects was undertaken in the initial phase of the Fellowship highlighting good practice cases that were eventually included in the abovementioned case library.

I.7 One line of the Fellow's research led to a follow-up project on UK universities' IP management practices (led by Puay Tang) in which the Fellow could not participate anymore due to his administrative duties as Head of Department/Head of Teaching. Gatsby fellowship research could also be leveraged to extend research in the area. The project researcher, encouraged by the funder, saw the Fellowship very much as a platform to develop a range of research and consultancy projects to communicate insights to different audiences and develop further the research agenda of the fellowship. (A list of projects associated with the Fellowship is included in the Appendix.).

Impact

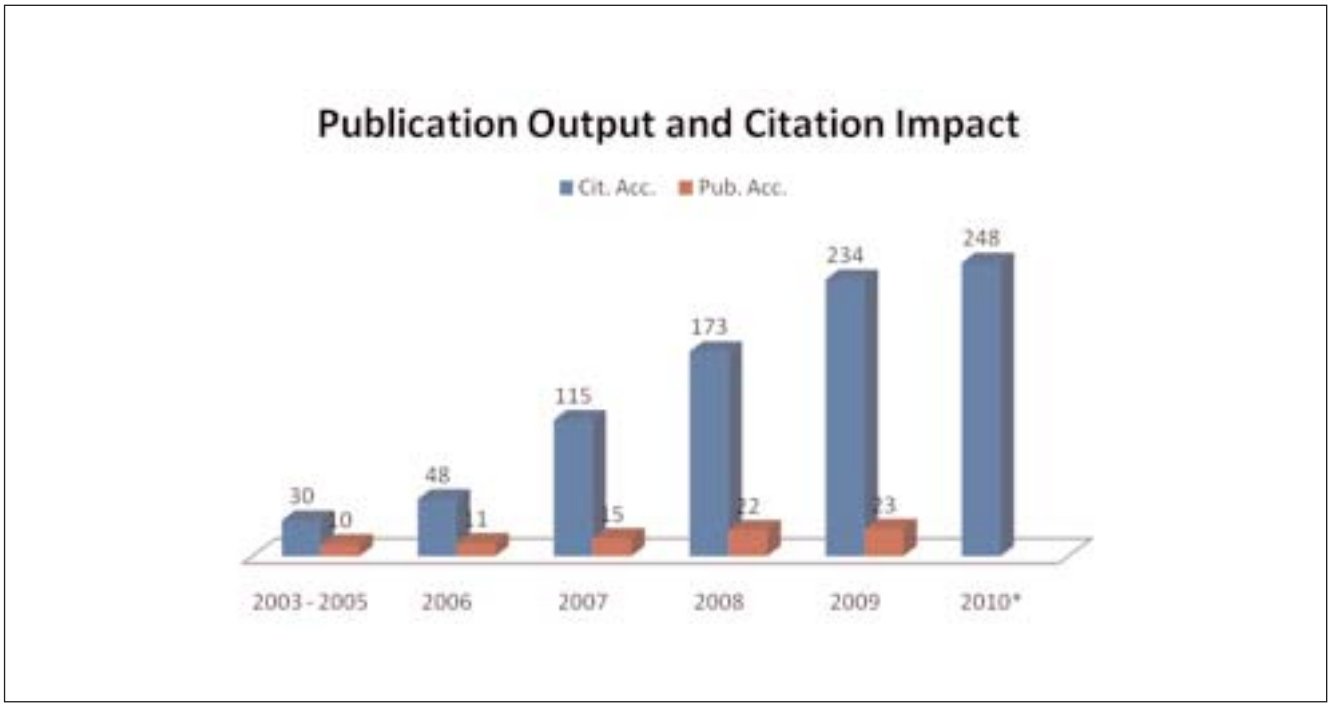
Research Impact

I.8 A bibliometric analysis indicates that 22 of the 29 articles are indexed in the Web of Science. These indexed publications have been cited 248 times so far, which means that on average every paper was cited 11.27 times. This is comparatively high within the social science context. The figure below offers an overview of project related publication output and citation impact.

I.9 The successful special issues in high-impact journals, such as *Research Policy*, could be seen as another indication of the academic standing of work carried out during the fellowship. The fellow's visiting appointments at other universities and board memberships of journals and a learned society may be seen as another sign of the overall impact of the research that was carried out.

Policy Impact

I.10 Arguably the research has had some policy impact, especially within an international context. The Fellow served as a member of the Economic Advisory Group of the European Patent Office and also advised or presented relevant work to audiences at organisations, such as the World Bank, OECD, or the Royal Swedish Academy of



Note : 2010 includes citations to date.

[48] Some of this work has also been published in relevant journals.

Engineering Sciences.[49] Advisory roles within the UK included a panel membership at DEFRA as well as work for Hefce and the ETB. The Appendix contains a list of other research and consultancy projects that were related to the Fellowship.

Outlook

I.11 While active research on the fellowship came to a conclusion in 2006/7, the Fellowship has been utilised as a platform to attract further funding and developing new research, leading to a legacy project on mapping regional impact of universities. Currently a pilot study is underway at Sussex. A short outline can be found in the Appendix.

I.12 Finally, one should mention the positive side effect the Fellowship has had in providing a platform for young researchers to develop further expertise in a research area and make a name for themselves. This concerns the Fellow himself who develop an international reputation thanks to the opportunities presented by the Fellowship who went on to get a professorship at Sussex as well as the students and project researchers he worked with, some of whom are now researchers in their own right.

Legacy: Follow-up study on University Regional Impact

I.13 This study seeks to map the impact the University has on business development in Sussex and beyond. Universities have long been recognised as a driving force behind regional economic development and technological change. Little information is available that illustrates clearly the multifaceted links of universities with businesses and their importance for the economy.

I.14 We intend to develop maps to capture impact and help close this gap. These maps will:

- illustrate how the university has given rise to new business development
- track and illustrate the success of the firms drawing on selected indicators (e.g. employment generation/job growth, capital raised, technologies developed),
- track and visualise links between firms, distinguish different clusters of industry the university or research institute may have impacted on.

I.15 These outcomes would support University/Industry stakeholders in communicating their successful work more effectively and be helpful as input in universities' strategic planning processes.

I.16 Through interviews and a survey we seek to collect the underlying data that will be used as input for generating maps. In particular we aim to collect information on:

- university spin-outs' and start-ups' licensing to third parties,
- key technologies and products developed,
- employment generation/enterprise size
- amount of venture capital raised by spin-offs and start-ups

I.17 The final maps will be made available as poster-size charts and also are to be made available online. We plan to make the maps searchable and clickable online with hyperlinks leading to a brief case file detailing all relevant indicators and then onto descriptions relevant companies' and institutions' websites

[49] Some of the fellow's research was taken up in European Commission's communication on the 3% R&D spending target.

Appendix

Publications

1. Martinelli, A.; Meyer, M.; Von Tunzelmann, G.N. (2008), Becoming an entrepreneurial university? A case study of knowledge exchange relationships and faculty attitudes in a medium-sized, research-oriented university. Journal of Technology Transfer, 33 (3) 259–283.
2. Meyer, M. (2007), What do we know about innovation in nanotechnology? Some propositions about an emerging field between hype and path-dependency. Scientometrics, 70 (3) 779–810.
3. Kuusi, O.; Meyer, M. (2007), Anticipating Technological Breakthroughs: Using bibliographic coupling to explore the Nanotubes paradigm. Scientometrics, 70 (3) 759-777.
4. Rafols, I., Meyer, M. (2007). How cross-disciplinary is bionanotechnology? Explorations in the specialty of molecular motors? Scientometrics, 70 (3) 633-650.
5. Glänzel, W., Debackere, K., Meyer, M. (2007). 'Triad' or 'Tetrad'? On China's new global role in science and technology. Science Focus, 2 (1) 1-9.
6. Leydesdorff, L.; Meyer, M. (2007), The Scientometrics of a Triple Helix of University-Industry-Government Relations. Scientometrics, 70 (2) 207–222.
7. Meyer, M. (2006), Are patenting scientists the better scholars? An exploratory comparison of inventor-authors with their non-inventing peers in nano-science and technology. Research Policy, 35 (10) 1646-1662.
8. Leydesdorff, L.; Meyer, M. (2006), The Triple Helix, Indicators, and Knowledge-Based Innovation Systems. Research Policy, 35 (10) 1441- 1449.
9. Meyer, M; Tang, P. (2007), Exploring the "value" of academic patents: IP management practices in UK universities and their implications for Third-stream indicators. Scientometrics, 70 (2) 415–440.
10. Rapmund, A.; Nygaard, S.; Meyer, M. (2007), Developing Indicators and Maps for Tracking Techno-Science Networks: A Case Study of Fuel Cells and Related Hydrogen Technology R&D in Norway. Scientometrics, 70 (2) 491–518.
11. Meyer, M. (2006), Inventor-Authors: Knowledge Integrators or Weak Links? An exploratory comparison of patenting researchers with their non-inventing peers in nano-science and technology. Scientometrics, 68 (3) 545-560.
12. Meyer, M. (2006) Academic inventiveness and entrepreneurship: on the importance of start-up companies in commercializing academic patents. Journal of Technology Transfer, 31 (4) 501–510.
13. Libaers, D.; Meyer, M.; Geuna, A. (2006) The role of university spinout companies in an emerging technology: the case of nanotechnology. Journal of Technology Transfer, 31 (4) 443–450.
14. Meyer, M. (2006) Measuring Science-Technology Interaction in the Knowledge-Driven Economy. Scientometrics, 66 (2) 425–439.
15. Meyer, M. (2005) Independent inventors and public support measures: insights from 33 case studies in Finland. World Patent Information, 27, 113–123.
16. Meyer, M.; Du Plessis, M.; Tukeva, T.; Utecht, J.T. (2005) Inventive output of academic research: a comparison of two science systems. Scientometrics, 63 (1) 145–161.
17. Meyer, M.; Sethupathy, D.S.K. (2005) Co-activity in emerging nano-science technology. Journal of Information Management and Scientometrics, 2 (2) 41-45.
18. Meyer, M.; Santos Pereira, T.; Persson, O.; Granstrand, O (2004) The scientometric world of Keith Pavitt: a tribute to his contributions to research policy and patent analysis. Research Policy, 33 (9) 1405-1417 (special issue in honour of Keith Pavitt).
19. Meyer, M.; Bhattacharya, S. (2004) Commonalities and differences between scholarly and technical collaboration: an exploration of co-invention and co-authorship analyses. Scientometrics, 61 (3) 443-456.
20. Meyer, M.; Kuusi, O. (2004) Nanotechnology: Generalizations in an interdisciplinary field of science and technology. Hyle, 10 (2) 155-170.
21. Hullmann, A; Meyer, M. (2003) Publications and Patents in Nanotechnology. An overview of previous studies and the state of the art. Scientometrics, 58 (3) 507-527.
22. Bhattacharya, S.; Kretschmer, H.; Meyer, M. (2003) Characterizing intellectual spaces between science and technology. Scientometrics, 58 (2) 369-390.
23. Bhattacharya, S.; Meyer, M. (2003) Large firms and the science/technology interface – patents, patent citations, and scientific output in thin films. Scientometrics, 58 (2) 265-279.
24. Leydesdorff, L.; Meyer, M. (2003) The Triple Helix of university-industry-government relations: a model for innovation in the 'knowledge-based' economy. Introduction to the Triple Helix special issue of Scientometrics, 58 (2) 191-203.
25. Meyer, M. (2003) Academic patents as an indicator of useful university research? Research Evaluation, 12 (1) 17-27.
26. Meyer, M. (2003) Free Patent Information as a Resource for Policy Analysis. World Patent Information, 25 (3) 223-231.
27. Meyer, M.; Siniläinen, T.; Utecht, J.T. (2003) Towards hybrid Triple Helix indicators: A study of university-related patents and a survey of inventors. Scientometrics, 58 (2) 321-350.
28. Glänzel, W.; Meyer, M. (2003) Patents Cited in the Scientific Literature: An exploratory study of 'reverse' citation relations. Scientometrics, 58 (2) 415-428.
29. Meyer, M. (2003), Academic Entrepreneurs or Entrepreneurial Academics? Research-based Ventures & Public Support Mechanisms. R&D Management, 32 (2) 107-115.

Guest Edited Special Issues

1. Research Policy, vol. 35 no. 10 (2006): 'Mapping the links between universities, the economy and government: combining scientometrics and evolutionary economics' (with Loet Leydesdorff).

2. Scientometrics, vol. 70 no. 2 (2007): 'The Scientometrics of a Triple Helix of University-Industry-Government Relations' (with Loet Leydesdorff).
3. Scientometrics, vol. 70 no. 3 (2007): Special issue dedicated to quantitative studies of nanotechnology and related sciences (with Tibor Braun).
4. Scientometrics, vol. 58 no. 2 (2003): 'Triple Helix Indicators' (with Loet Leydesdorff).
5. Research Evaluation, vol. 16 no. 4 (2008): 'New challenges in quantitative science and technology research'.

Presentations

At practitioner events (selection)

1. Nature and Challenges of University-Industry Collaboration in Nanotechnology, OECD Nanotechnology Workshop, Helsinki, 6-7 Oct 2008.
2. Wissenschaftsunternehmer und neue Universitätsmodelle – Being entrepreneurial in different university settings: a comparison of four UK universities, WZB Entrepreneurship Workshop, Berlin, 6-7 June, 2008.
3. University Patenting in Europe – On the influence of legislative frameworks, IP management practices, and entrepreneurial culture, European Patent Office, Economic Advisory Group Meeting, Munich, 23 November 2007.
4. Using Patents as an Information Source for Nanotech Policy & Business, IPR in Nanotechnology Workshop, Brussels, 16 April 2007.
5. Assessing the Interaction Between the SDF Project and the Institution's 3rd Stream Mission, Hefce, SDF Metrics Workshop, Bristol, 28 March 2007.
6. Academic Patenting & the Entrepreneurial University in Europe, European Patent Office, The Hague, 26 April, 2006.
7. Instruments of Transformation: Developing a Self-Assessment Tool for Entrepreneurial Universities. AURIL Conference, Brighton, 6-7 April, 2006.
8. Tracking Patenting Activity & Links Between Nanotech Firms and Swedish Science Nanotechnology in Sweden. Royal Swedish Academy of Engineering Sciences (IVA), 14 December, 2005.
9. An Overview of Bibliometric and Patent Studies. Royal Swedish Academy of Engineering Sciences (IVA), June 2005.
10. The Gatsby Fellowship: Presentation of a Self-Assessment Tool for Universities & Findings from a Regional Impact Study of Sussex University. South-East Higher Education Business Development Managers Meeting, SEEDA, Guildford, 21 October, 2004.
11. Individual Inventors, Entrepreneurial Activity and Public Support Measures, CIP Symposium 2004, Center for Intellectual Property, Chalmers University of Technology/Gothenburg University, 1-3 June, 2004.
12. Science & Technology Performance, Innovation Support, and Commercialisation Strategies in Nanotechnology. European Workshop on Social and Economic Research on Nanotechnologies and Nanosciences: held at the European Commission, Brussels, 14-15 April, 2004.
13. CPD in emerging technology sectors. ETB one-day conference, London, 27 January, 2004.

Invited presentations (selection)

1. Invited Panel Member, EXIST Entrepreneurship Kongress, Berlin, 30 September-1 October, 2008.
2. Patenting and the Entrepreneurial University in Europe, University of Newcastle-upon-Tyne Business School, 19 April 2007.
3. Explorations in the Nano-World: Big Visions on a Small Scale. Helsinki University, Renvall Institute, 23 November, 2006.
4. What do we know about innovation in nanotechnology? Between Hype and Path-Dependency. National University of Singapore, NUS Entrepreneurship Center, 4 October, 2006.
5. Academic Patenting & the Entrepreneurial University in Europe, European Patent Office, The Hague, 26 April, 2006.
6. Inventor-Authors: Knowledge Integrators or Weak Links? Dalian University of Technology, April 2005.
7. Knowledge Integrators or Weak Links? Invited presentation. ISTIC, Beijing, April 2005.
8. Are co-active inventors on top of their class? An exploratory comparison of inventor-authors with their non-inventing peers in nano-science and technology. Invited presentation, Henan National University, Xinxiang, April 2005.
9. Inventor-Authors: Knowledge Integrators or Weak Links? CIRCLE, Lund University, February 2005:
10. Individual Inventors, Entrepreneurial Activity and Public Support Measures CIP Symposium 2004, Center for Intellectual Property, Chalmers University of Technology/Gothenburg University, 1-3 June, 2004
11. Nanotechnology – Generalizations in an interdisciplinary S&T field (with Osmo Kuusi), Workshop on Expectations in Science and Technology, Risø National Laboratory, Roskilde, Denmark, 29-30 April, 2004.
12. Academic Inventiveness and Entrepreneurship: On the Importance of Start-up Companies in Commercializing Academic Patents. University Incubator Conference, Université du Québec à Montréal, Montréal, Canada, 27 February 2004.
13. Inventiveness and Academic Entrepreneurship: Achievements and Challenges. A look behind the Finnish success story. SUNY State University of New York at Purchase, 3 November 2003.
14. Towards Hybrid Triple Helix Indicators: An analysis of university-related patents and a survey of academic inventors. CIRST Conference, UQUAM, Montreal, 31 October 2003.
15. Inventiveness and Academic Entrepreneurship: Achievements and Challenges. A look behind the Finnish success story. Inter-University Seminar for Knowledge-based Economic Development in New York City, Pace University, 6 November 2003.

Related Projects and Advisory Work

2007-2009: Managing IP in Universities, project for Gatsby Charitable foundation

2007-2008: Training Programmes for the Korean Ministry of Science and Technology (MOST) and the Korean Intellectual Property Office (KIPO)

2007: ETEPS EURONANO

2006-2009: ProKnow: Production of Knowledge Revisited: The Impact of Academic Spin-Offs on public research performance in Europe, Specific Targeted Research Project, European Commission

2006-2008: Marie Curie Postdoctoral Fellowship: *Patterns of multi- and interdisciplinary research in bionanotechnology*

2006-2007: Evaluation of SDF projects, for HEFCE, the Higher Education Funding Council for England, in collaboration with Quo-Tec

2006: Global Innovation Environments, for HEFCE, the Higher Education Funding Council for England, in collaboration with Quo-Tec

2005-2006: CREA: Creativity capabilities in science and technology, project within the European Commission NEST programme

2005: Training programme on S&T indicators for UK Research Council Staff, funded by the EPSRC (http://www.sussex.ac.uk/spru/bibliometrics)

2003-2004: Continuous Professional Development in Emergent Technology Sectors, for the UK Engineering and Technology Board (ETB)

The Gatsby Charitable Foundation

Registered Office:
Allington House (First Floor)
150 Victoria Street
London SW1E 5AE
Tel: +44 (0)20 7410 0330
Fax: +44 (0)20 7410 0332
Website: www.gatsby.org.uk
Registered Charity No. 251988