



BBSRC Institutes: Technology Transfer Review

A Report for the
Biotechnology and Biological Sciences
Research Council



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1.0 Introduction

Background

- 1.1 The Biotechnology and Biological Sciences Research Council (BBSRC) appointed DTZ in May 2009 to undertake a review of Technology Transfer (TT) policy and operations within the BBSRC Institutes.
- 1.2 Delivery of financial impacts and wider benefits to society relies on efficient transfer of research findings to the market place. Government is increasingly interested in the socio-economic return on research funding.
- 1.3 The aim of this report is to present evidence to allow BBSRC directors, Strategy Advisory Board and Council to assess where BBSRC's technology transfer performance sits in comparison to other organisations, what it needs to do to be "best in class" and whether TT policy and operations need to change.
- 1.4 Whilst BBSRC funds extensive research in Universities and institutes, the scope of this review of TT policy covers the following Institutes:
 - The Institute for Animal Health (IAH)
 - The Babraham Institute (BI)
 - The Institute for Food Research (IFR)
 - Genome Analysis Centre (T-GAC) – in the process of being set up
 - The John Innes Centre (JIC)
 - Rothamsted Research Institute (RRes)
- 1.5 In addition, two further BBSRC Institutes have recently been embedded into University departments. Although they were not the principal focus of the study, it is important to learn from their experience:
 - IBERS (Aberystwyth University)
 - Roslin Institute (University of Edinburgh)

Objectives

- 1.6 The objectives of the work were as follows:
 - Review and assess the current status of TT operations in BBSRC institutes.
 - Review and assess the three technology transfer organisations (TTOs) used by BBSRC institutes
 - Compare current practice in BBSRC institutes against 'best in class' technology transfer operations elsewhere
 - Present and evaluate options for improving the efficiency and effectiveness of technology transfer operations in BBSRC institutes.

- Provide suggestions on how BBSRC should evaluate the efficiency and effectiveness of technology transfer operations including a review of current metrics.

Approach

1.7 The work programme involved:

- Desk review of TT performance indicators in BBSRC institutes to gain understanding
- Consultation with staff at the BBSRC institutes (BI, IAH, IFR, JIC, RRes and T-GAC)
- Consultation with staff at university-embedded institutes (RI and IBERS)
- Consultation with staff at the three TTOs used by BBSRC institutes
- Review of technology transfer arrangements in other 'comparator' organisations
 - MRCT
 - Cancer Research Technology
 - Imperial Innovations
 - Scottish Crop Research Institute and
 - Wellcome Trust.

Definitions

1.8 This report is concerned with technology transfer arrangements recognising that these form one part of wider knowledge transfer arrangements. Whilst knowledge transfer includes all mechanisms, networks and relationships that involve scientific knowledge being transferred from one organisation to another, technology transfer is concerned with:

- identification, protection, marketing and conveying of rights to intellectual property often protected by patents or other forms of protection (trademarks etc);
- exploitation requiring interaction between inventors and users;
- some kind of commercial return relating to the perceived value of the intellectual property;
- TTOs being all about facilitating the technology transfer process and adding value.

1.9 It is outwith the scope of this review to consider wider knowledge transfer arrangements, but BBSRC will need to give consideration to these wider arrangements because they are critical in generating wider economic and social impact from research.

Report Structure

1.10 The structure of the report is as follows:

- **Section 2** analyses current arrangements for technology transfer in BBSRC institutes
- **Section 3** reviews technology transfer arrangements in other 'comparator' organisations
- **Section 4** compares BBSRC situation with the 'best in class' findings and draws out the issues arising from the study
- **Section 5** sets out future organisational models
- **Section 6** sets out recommendations for the future.

2.0 The Current Situation

- 2.1 Current technology transfer arrangements differ significantly between BBSRC Institutes. The structures have developed over time, largely independent of each other.
- 2.2 Consideration is now being given to whether this diversity is the optimal approach for the institutes, or for BBSRC.
- 2.3 Table 2.1 shows which TTOs support which BBSRC institutes. T-GAC is not yet established and a final decision has yet to be made in relation to technology transfer for this institute.

Table 2.1 Current Technology Transfer Organisations

BBSRC Institute	TTO
Babraham Institute (BI)	Babraham Bioscience Technologies (BBT)
Institute for Animal Health (IAH)	Genecom
Institute of food Research (IFR)	Plant Biosciences Ltd (PBL)
John Innes Centre (JIC)	Plant Biosciences Ltd (PBL)
Rothamsted Research (RRes)	Rothamsted own staff/ Plant Biosciences Ltd (PBL)

- 2.4 Table 2.2 summarises the governance arrangements for the TTOs that support BBSRC's institutes.

Table 2.2 Governance arrangements for Technology Transfer Organisations

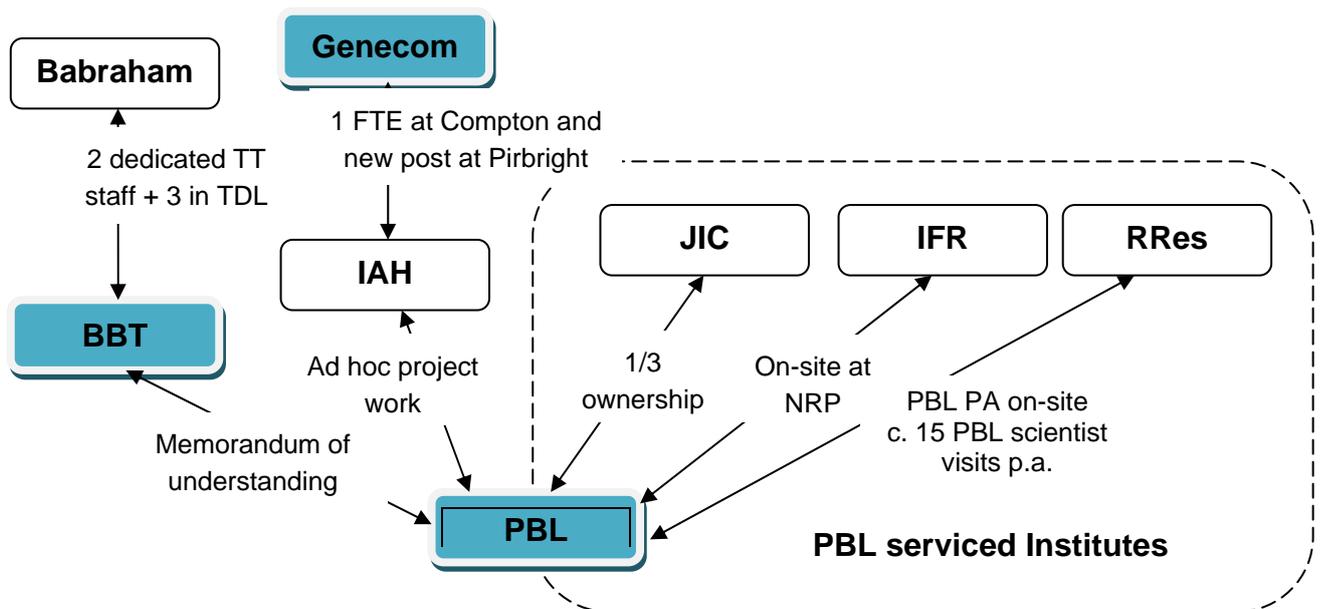
TTO	
BBT	BBT is a limited company wholly owned by the Babraham Institute (BI). BI wished to have a separate entity to pursue commercial interests on its behalf and BBT was established in 1998 to fulfil this role. BBSRC has no equity stake in BBT but it has a right to share in long term profits as a result of the provision of land and loan finance for the bio-incubator and bio-park developments. The Chief Operating Officer of BBSRC is a member of the BBT Board.
Genecom	Genecom is a not-for-profit organisation that supports the translation of science in areas relating to animal health & welfare and crop science. It works with the Institute of Animal Health, the Moredun Research Institute and the Scottish Crop Research Institute. Its work with the Institute of Animal Health is financed via PSRE funding from BIS. As it is a not for profit organisation, it does not take a share of commercial revenue generated and is essentially a free technology transfer resource for IAH. BBSRC is represented on Genecom's Board of Directors by Martin Shirley (Director of IAH).
PBL	PBL was established in 1994 by JIC and the Gatsby Charitable

Foundation (for Sainsbury Laboratory) as the IP management and commercialisation arm of these research institutes. BBSRC became a shareholder in 2004 when a £2million cash investment was made in return for 33% shareholding in the company. PBL is a commercial 'for profit' company that is now jointly and equally owned by JIC, the Sainsbury Laboratory and BBSRC. While much of its work is for these three shareholders, it also works for a range of other research organisations. BBSRC is represented on PBL's Board of Directors by Celia Caulcott.

PBL terms of engagement vary between BBSRC-supported Institutes. In terms of revenue sharing – on a per technology basis - JIC receives 20% net of Reward to Inventors and PBL's patent costs, while IFR and RRes receive 40% net of PBL's patent costs.

2.5 Figure 2.1 provides an overview of the complexity of arrangements surrounding the current technology transfer model for BBSRC institutes.

Figure 2.1: Current Technology Transfer Model and Activities



2.6 The remainder of this section provides further information on technology transfer arrangements at the five BBSRC institutes which are the principle focus of this review - in terms of governance, structure, financials, processes and nature of engagement with the TTO (summary information is provided for IBERS and Roslin Institute).

Babraham Institute (BI)	
Type of science	Human Health, fundamental
TTO	Babraham Bioscience Technologies (BBT)
Governance	BBT is a limited company wholly owned by BI. As a registered charity, BI wished to allow a separate entity to pursue commercial risk and liability on its behalf. BBT fulfils that role. Babraham Institute Director sits on the BBT Board, and BBT CEO attends the Board of Trustees of BI and sits on the BI executive committee for science and operations. The Chief Operating Officer of BBSRC is a member of the BBT Board.
Structure	BBT's primary purpose is to serve BI and surplus is gift-aided back into BI. BBT sees itself as offering a service to BI and does all it can to help in the TT process. BBT employs 23 staff. Two are directly involved in TT day to day, five in managing the bio-incubator, three in BBT's Technology Development Lab (TDL), ten in contract research and the balance in admin.
Financial	BBT makes a trading surplus, largely from running the bio-incubator (£600k latest year). KT income was £311k in the latest year - one main royalty income forms around £300k of this. Grant and contract income was £1 million in the latest year. BI latest year turnover was £28.6m.
TT processes and engagement	BBT undertakes the following activities: <ul style="list-style-type: none"> • Mandatory screening of all BI output for IP potential • Managing the patenting process and bearing the costs of maintaining the patent portfolio on behalf of BI. • Technology spotting pro-actively at lab level • Contract research within BBT or with BI scientists and organisation of consultancy • Managing royalties, Proof of Concept funds and Commercialisation Awards. • Gift-aid funds to BI, and providing BI access to equipment in TDL • Hosting networking events with industry and industry visits. • General assistance to scientists on commercialisation including writing proposals. • Supporting spinouts, licensing, substantiating patents and assisting in the development of technologies to an appropriate stage • To generally trade on behalf of BI • Resourcing the TDL • Creation and sustaining the bio-incubator • Promoting regional and national bioscience BBT is properly embedded and engaged with BI at both strategic and operational levels.

Institute for Animal Health (IAH)	
Type of science	Infectious diseases of farm animals related to animal health and welfare, and food security; fundamental, strategic and applied.
TTO	Genecom Ltd
Governance	Genecom is a not-for-profit company jointly funded by Moredun, IAH and SCRI (taking over from Roslin) and financed via PSRE funding. The IAH institute director sits on the board. Genecom does not take a revenue share of any IP generated by the Institutes, so is essentially a low cost TT resource to IAH.
Structure	Genecom has a 7 person team providing solutions for member Institutes for commercialisation of their research base. Genecom has 1 person based at the Compton IAH site, operating as an Intellectual Property Manager. IAH Pirbright had an additional staff member appointed to site in August 2009. An allocation of Genecom CEO time is also given to IAH (around a third)
Financial	Genecom is a not for profit operation with annual turnover of around £575k (latest year). Its main funding sources are PSRE (£881k PSRE4 and £437k ERDF still to be drawn down). £290k of staff costs are ring fenced for IAH over a 3 year period. There is also BBSRC funding of £218k for translational grants.
TT processes and engagement	Genecom bids for competitive follow-on funds based on on-going review of IAH's portfolio. There is currently no formal process for transfer, but Genecom is trying to introduce this for diagnostic science opportunities. Business development is done on a scientist-to-scientist basis. Genecom interprets scientist and lab discussions and facilitates the process, taking an entrepreneurial approach towards market assessment and delivery of opportunities. Engagement between Genecom and IAH does not appear to be very strong at either operational or strategic levels.

Institute of Food Research (IFR)	
Type of science	Food and Health, applied
TTO	IFR Innovation manages the interface with PBL and Exploitation Platform (EP) activities. PBL is the preferred provider for potentially patentable technology though some EP patents are not with PBL due to industrial collaborations.
Governance	Ownership of PBL is split equally between JIC, the Sainsbury Lab and BBSRC with all three represented on the Board. IFR is not represented on the Board (no shareholding) but the arrangement works as JIC, IFR, Sainsbury Lab and PBL are based on the same site. PBL is revenue driven and takes a share of IP in order to fund the commercialisation process. Through the current contract IFR receives 40% of total commercial revenue, net of patent costs which are met by PBL. From this share, IFR then pays rewards to inventors. This 40% is negotiable.
Structure	IFR and PBL are both located on the Norwich Research Park which helps communication. There are frequent timetabled meetings with PBL to review IFR's portfolio and opportunities. Two-way discussion: IFR presents the pipeline and PBL progresses on IFR's behalf. PBL has a 7 person team. There are no dedicated PBL staff for IFR: all operate flexibly with the scientists and

	management. IFR estimates that the vast majority of its science is passed to PBL for review of market opportunities.
Financial	TT income is less than 4% of turnover - IFR latest annual turnover was £17.1m (07/08)
TT processes and engagement	IFR sees more potential from wider knowledge transfer including services to society and industry, not all of which are necessarily protectable. Transfer includes the process of translating academia to application, knowledge or tools that are immediately useful. IFR explores exploitation platforms in-house (including direct industry engagement through the Food & Health Network) which don't carry IP. PBL is responsible for: <ul style="list-style-type: none"> • Identifying, assessing and protecting academic IP. • Funding and managing patent prosecution. • Investing in, and helping to manage technology development (addressing the current technology gap). • Marketing technology to commercial development partners. • Concluding and monitoring licences for commercial exploitation. • Business/start up catalysis. PBL is properly engaged with IFR at an operational level.

John Innes Centre (JIC)	
Type of science	Plant Science and Microbiology, fundamental
TTO	PBL
Governance	JIC is a 1/3 share owner of PBL and is represented on the PBL board, along with Sainsbury Lab and BBSRC. PBL takes an 80% share of IP commercialisation revenue (on a per technology basis) in order to fund the commercialisation process (including PBL's investment in patent costs on behalf of JIC). JIC gets a 20% share of revenues, net of rewards to inventors (paid by PBL to JIC, for onward payment to individual inventors) and patent costs, which are met by PBL. PBL makes no other deductions (eg for its staff time, marketing costs, or other operational costs). As a shareholder of PBL, JIC would receive dividend income if PBL were in a position to pay dividends.
Structure	Both PBL and JIC are based on Norwich Research Park, and have strong, on-going communication. PBL is embedded in JIC and engages with scientists and project leaders across the 6 JIC clusters. PBL encourages informal discussion, and face-to-face is always felt to be more constructive than telephone discussions. Visibility and drive of PBL staff is crucial to engagement with the scientists. There are no specifically dedicated PBL staff for JIC: all operate flexibly with the scientists and management.
Financial	TT income is less than 4% of turnover - latest annual turnover was £27.5m (07/08)
TT processes and engagement	PBL becomes involved whenever patent opportunities arise from JIC research and has a contractual first right to acquire JIC's IPR. It sources follow-on funding and building networks/contracts with the private sector and other commercial partners. Not all JIC technology/knowledge is protectable. JIC also engages directly with industry (usually breeders). PBL is embedded and engaged with JIC at both strategic and operational levels.

Rothamsted Research (RRes)	
Type of science	Agriculture and environmental, fundamental and applied
TTO	PBL is the TTO that is intended to support RRes. However, RRes manages over half of its own IPR-based TT projects.
Governance	<p>RRes operates its own TT function, while choosing to pursue some commercialisation projects by assignment to PBL. One main person is responsible for providing this service and spends approximately 50% of his time working on IP / commercialisation issues (with high-level back-up expertise in his line manager who was originally employed at Rothamsted to provide technology transfer competency).</p> <p>PBL terms for commercialising research are considered to represent poor value for RRes. The deal is that any revenue generated from research is first used to cover PBL's costs and then there is a 60:40 split of subsequent revenue between PBL and RRes (essentially the same deal as for IFR); RRes is yet to see any income from existing agreements.</p> <p>RRes feels it is well placed to progress chemistry research commercialisation as it has in-depth knowledge / contacts and a history of working with companies. PBL specialises in plant biotechnology and has good networks with the ag-biotech sector internationally.</p>
Structure	<p>RRes has an IP and Contracts Manager responsible for delivering the in-house TT service (although he has high-level back-up expertise in his line manager who was originally employed at Rothamsted to provide technology transfer competency).</p> <p>The IP and contracts manager has a law degree and 7 years commercial negotiation experience prior to joining Rothamsted in 2000. RRes consults with scientifically qualified patent attorneys and similar support when necessary as well as using non-involved scientists on site to pre-qualify the science of any inventions.</p> <p>PBL has a patent attorney (with a scientific background) based at the RRes site, with supplementary visits from a PBL business manager every c. 3 weeks for a day. In addition, the head of PBL lives near RRes and seeks further informal engagement.</p>
Financial	Income from commercialisation of research – approx £112k (2008/09) from a mix of licensing and royalty income. This is expected to increase in 2009/10 as more projects start to generate revenue. Total RRes income - £24.4million (2008/09).
TT processes and engagement	<p>Information on potentially valuable IP is usually documented in an invention disclosure form and the IP & Contracts Manager (in consultation with other RRes staff) will decide which projects to pursue and the way in which they should be progressed. Some projects may be referred to PBL but RRes also manages commercialisation projects itself. As RRes has limited resources, the route to market is often to find partners (usually from industry, Rainbow fund or similar) who will fund the cost of additional product development work and patent filing, with RRes benefiting from a share of any subsequent royalty stream as well as the funding for the research. Alternatively, RRes may progress projects itself to a stage where the technology can be licensed.</p> <p>Whilst informal, the RRes arrangements appear to be working but may need further resources.</p>

	IBERS and Roslin
Overview	Both IBERS and Roslin have moved to being part of local universities. In both cases, TT will be provided by the University's central function who will own the IP. However, both institutes highlighted the importance of an embedded TT function to engage with scientists and spot technology. Whilst this function might be small (Roslin one person) they should report to the Institute Director with a 'dotted line report' to the University function. They should be able to draw on the central expertise of the University in contracts, licensing, spin-out funding etc

2.7 DTZ's interim assessment of the effectiveness of the relationship between BBSRC Institutes and their TTOs is shown below:

Institute	Assessment	Comments
BI	High	Good working relationships at strategic and operational levels. BBT is effectively embedded within BI and makes a surplus through property income and royalties. Commercial agreements ensure benefits are returned to BI and inventors.
IAH	Low	Genecom is on site now at two IAH sites but engagement has not yielded significant results. Whilst scientists are actively engaged in knowledge transfer, there is little apparent culture of TT and little structure to support it.
IFR	Medium	Good working relationships with PBL at operational levels and commercial agreements to return benefits to IFR and inventors. IFR sees much of its focus as being on wider knowledge transfer.
JIC	High	Good working relationships at strategic and operational levels. PBL is effectively embedded within JIC. Commercial agreements ensure benefits are returned to JIC and inventors.
RRes	Medium	PBL is the technology transfer organisation that is intended to support RRes in terms of BBSRC's requirement that all institutes should have access to professional technology transfer expertise. However, the current situation is that RRes operates its own technology transfer strategy and function whilst also working collaboratively with PBL on commercialisation projects.

2.8 Section 3 goes onto consider what the critical success factors of technology transfer are on the basis of the benchmarking exercise.

3.0 Benchmarking – Critical Success Factors

Introduction

3.1 As part of the work DTZ reviewed and assessed the technology transfer arrangements of a range of other organisations. The aim of the benchmarking was to try to establish critical success factors for technology transfer.

3.2 Brief details of the five benchmark organisations are provided below:

<p>Medical Research Council (MRC) / MRCT: MRCT is the technology transfer organisation for MRC. MRC owns the IP for all research undertaken in MRC Units and Institutes, and it is stipulated that commercialisation of this research must be through MRCT. The IP for MRC research funded in universities is assigned to the university, and commercialisation is usually via the university's TTO. In the past MRCT only commercialised research owned by MRC (undertaken in MRC Units and Institutes), but now it works in partnership with universities and other organisations to develop research with commercial potential relating to healthcare. In such cases, a revenue sharing agreement with the external organisation is negotiated. This is still a relatively small part of MRCT's operations but will grow in the future.</p> <p>In 2008/09 MRC spent around £600million on research of which about 55% was spent in universities and 45% in its Units / Institutes. In 2008/09 MRCT's gross income was approximately £67million. MRCT's annual costs are about £8.5million, part of which is funded via MRC through a management fee. MRC underwrites MRCT. Thus, MRCT receives core funding from MRC although it now generates more than enough commercial income to cover its costs.</p> <p>Whilst it aims to generate as much income as possible – this is not the overriding purpose of the organisation. MRCT will take on projects that will not necessarily generate a lot of revenue if they have the potential to have a significant positive impact on healthcare.</p>	
	<p>Cancer Research UK (CR-UK) / Cancer Research Technology (CRT): CRT is the technology transfer organisation for CR-UK and is a wholly owned subsidiary company of CR-UK. All CR-UK research grants assign ownership of IP arising from the research to CRT. Thus, all commercialisation of CR-UK research (whether it is undertaken in a CR-UK research institute or a university) must be undertaken through CRT. Universities receive 50% of net revenue (after patent & other costs) from CR-UK funded research commercialised through CRT. Universities pay rewards to inventors from their 50% share. CRT also provides commercialisation services to other research</p>

	<p>organisations but there is an agreement with CR-UK that external projects should not exceed 25% of the project portfolio.</p> <p>In 2007/08 CR-UK spent approximately £350million on research. In 2007/08 CRT's gross income was approximately £33million. Net income to CRT in 2007/08 was about £15-16million because of revenue sharing agreements with universities and other organisations. Annual costs in 2007/08 were about £15million so CRT roughly broke even. It is important to highlight that CR-UK provides core funding and support for CRT. For example, CR-UK has provided substantial resources for CRT to expand its translational research capacity / drug discovery laboratories since 2002.</p> <p>CRT is similar to MRCT in that while it aims to generate as much revenue as possible – it is primarily concerned with maximising the benefit from research in treating cancer, and will take on projects that will not necessarily generate a lot of revenue if they have the potential to have a significant positive impact on treating cancer.</p>
<p>Scottish Research Crop Institute (SCRI) / Mylnefield Research Services Ltd (MRS): MRS is a limited company wholly owned by SCRI. Its mission is to maximise the monetary benefit from SCRI research with all profit recycled back into SCRI for further research. MRS acts exclusively for SCRI at present but does see potential to commercialise knowledge from other plant institutes. Currently, it generates an annual profit of between £50-80,000 (DTZ estimate). SCRI's annual turnover is in the region of £14m.</p>	
	<p>Imperial Innovations: Imperial Innovations is the TTO for Imperial College London (but also provides services for other organisations – in common with MRCT and CRT). It started off being wholly owned by Imperial College London but listed on AIM to raise capital to pursue a particular business model – building high-tech, spin-out companies (it is now 52% owned by the University and 48% owned by private investors). Imperial Innovations is similar to other university TTOs in the range of activities it undertakes (licensing etc) but it has developed a particular niche in developing spin-out companies and providing investment finance for them. It is now one of the top three venture capital companies in the country.</p>
<p>Wellcome Trust: Originally, the Wellcome Trust had a subsidiary company that liaised with universities in commercialising IP arising from Wellcome Trust research contracts. Now the Wellcome Trust does not get involved directly in</p>	

<p>commercialising research itself. Grants awarded by the Wellcome Trust assign IP arising from the research to the recipient organisation i.e. the university. The university must, however, obtain consent from the Wellcome Trust to commercialise the IP. The university then takes the lead on this and there is a standard agreement for sharing revenue between the university and the Wellcome Trust.</p> <p>The Wellcome Trust currently focuses much of its resources for technology transfer on translational research – bridging the gap between fundamental research and commercial application by undertaking further development work to get projects to a stage where they are of interest to commercial companies and investors (typically after proof of concept stage). The Wellcome Trust does not get involved directly in the development work. Instead, it provides funding for universities / research institutes to buy-in the expertise they need to carry out this work. For example, through its Translational Awards and Seeding Drug Discovery Initiative.</p>	
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Critical Success Factors – Strategic Issues

3.3 The organisations above support technology transfer in different ways and operate at different scales, but there are a range of key features that they share. At a strategic level, critical success factors appear to be as follows:

- **Longevity and pump-priming:** organisations such as MRCT and CRT have been in existence in one form or another for 25+ years and during that time have received substantial financial support from their parent organisation. MRS at SCRI is almost 20 years old. The view of these organisations is that a TTO needs maybe 10 years to get established and achieve significant impact.
- **Clarity of purpose:** Each organisation is wholly owned with clear governance and management and clarity of purpose. Some are focused on maximising income but others have wider economic and social objectives where income generation is important but not their overriding goal. They do not invariably prioritise revenue over impact.
- **Specialisation:** The organisations are not trying to be all things to all people. CRT is all about beating cancer. SCRI is all about commercialising plant breeding. Imperial Innovations specialises in spin-outs. Their clarity of purpose is possible because they are in specialised areas.
- **Cash generation:** In each case, the organisations are cash generating with recycling of benefits to the parent organisation and rewards to inventors. The research community clearly perceives the TTO as working in the interests of the parent organisation and hence themselves. There is a sense of ownership of the TTO and sharing in its success.

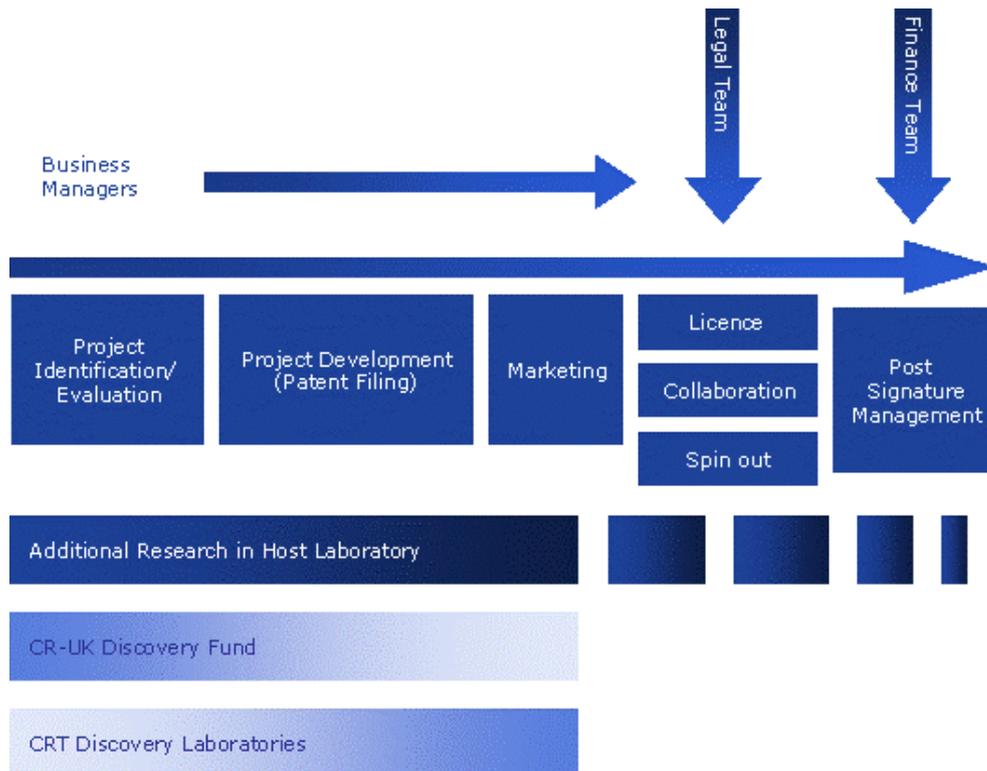
- **Accountability:** There appears to be a culture of clear financial targets and reporting mechanisms allowing accountability and trust to develop.
- **High profile:** In each case, the organisation has a high profile and is the default route for technology transfer, often but not always due to exclusivity. For example, MRCT has exclusive rights to IP in MRC Units and Institutes but is also approached by universities and other organisations to work on the commercialisation of healthcare research. CRT owns the IP for all CR-UK research but is also approached by other organisations to work on cancer related projects. This high profile and cash generation go hand in hand in building the profile of the TTO.
- **Identifying gaps or bottle necks:** TTOs have mapped the required pathways and identified gaps or bottle necks to effective TT. In some cases, parent organisations have given TTOs tools to bridge the ‘development gap’ in terms of getting basic research to market. Venture capital risk aversion means there is a need for more funding for translational research beyond proof of concept stage to bring new discoveries to market. It is rare for MRCT / CRT to have a project which is ready for licensing / commercialisation. MRC / MRCT and CR-UK / CRT have invested heavily in plugging this ‘development gap’ over recent years because it is critical to realising the economic and social potential of their research programmes. Both have discovery / development gap funds to support translational research and both have in-house development laboratories. The Wellcome Trust also focuses much of its resources for technology transfer on translational research although as explained earlier it does not get involved directly in undertaking further development work to get research projects to a stage where they are of interest to commercial companies and investors. Instead, it provides funding for universities / research institutes to buy-in the expertise they need to carry out this work. For example, through its Translational Awards and Seeding Drug Discovery Initiative.
- **Clear business model:** Each organisation has a clear business model. The preferred commercialisation route usually being to licence technology since this has been shown to generate most income. Collaboration with an industry partner where the TTO takes a share of the future royalty stream is also often used alongside licensing. It is recognised that building successful spin-out companies is high-risk and requires specialist expertise. In some organisations like CRT there is a presumption against developing spin-out companies except in very specific circumstances.¹ In contrast, organisations like Imperial Innovations specialise in developing spin-outs, but have deliberately pursued a business model to do this successfully (i.e. capital raising from AIM).

Critical Success Factors – Operational Issues

- 3.4 Figure 3.1 provides an overview of the TT process in CRT. It is helpful in explaining the operational issues underpinning success of the benchmark organisations.

Figure 3.1: Development Pathway for Typical Commercialisation Project in CRT

¹ The research relates to an area of unexplored biology, the company has the ability to make more than one product and the scientists involved have an outstanding reputation.



- 3.5 Project identification / evaluation is critical to successful technology transfer. Unless information on potential discoveries is gleaned from scientists, there can be no technology transfer.
- 3.6 Yet commercialisation of research is not generally part of the performance assessment framework or motivation for scientists. The benchmark organisations recognise this and stress the importance of the following in identifying research which has commercial potential:
- Employing **high quality staff** as ‘scouts’ / business development managers to identify potential projects. They must have sufficient gravitas to be respected by the scientific community.
 - **Building good relationships** between the ‘scouts’ and scientists. This is usually best achieved by having TTO staff **embedded** with the researchers or through an **account manager** system where TTO staff work closely with specific research teams.
 - Demonstrating **mutual benefits** from TT i.e. how the scientist will benefit as well as the TTO. Most scientists want to see their research put to use and become interested in commercialisation once they see it in practice.
 - Providing market information / organising talks to **raise awareness of IP issues** and the benefits from engaging in commercialisation activities.
 - Making the commercialisation process as easy as possible for the scientist and supporting them throughout. There needs to be a **good service culture** in the TTO.
- 3.7 The factors that underpin successful project development subsequently are:



- **Rigorous evaluation of disclosures** - so only the most promising projects are selected for further development (given the considerable cost entailed in this).
 - **Protection of IP** – deciding when and how to file patents. Some organisations have in-house patent expertise, others out-source this work.
 - **Access to ‘development-gap’ funding** – as discussed earlier.
- 3.8 Marketing - TTO staff need to have in-depth knowledge of the industry sectors to which their research relates and excellent relationships / networks with key companies in these sectors.
- 3.9 Routes to Market - The TTO should have the expertise to decide on the best route to market (whether this is through licensing, collaboration with industry or building a successful spin-out company).

4.0 Key Issues for BBSRC in TT

- 4.1 This section sets out the lessons for technology transfer in BBSRC institutes based on the reviews of current practice and benchmark organisations.

Strategic Issues

Longevity and Pump-Priming

- 4.2 The benchmarking review suggests that BBSRC needs to provide a long term secure funding stream for technology transfer operations in its institutes. Successful technology transfer requires high quality staff and access to specialist expertise – and there must be adequate funding for this in the period before sufficient revenue is generated from TT to cover costs. The experience of benchmark organisations is that a TTO needs at least 10 years to get established and achieve significant impact. BBSRC should consider ring-fencing funding for TT operations. There are so many demands for funding at BBSRC institutes that TT may not get the resources it needs unless the budget is ring-fenced.

Clarity of Purpose – BBSRC

- 4.3 BBSRC needs to be clear about what it wants to achieve through supporting technology transfer in its institutes and ensure that all of its policies and procedures are aligned. Despite changes to terms and conditions in relation to rewards to scientists, it was clear that there was a perception that rewards were not aligned with the direction of TT policy. Wider knowledge transfer activities (as defined in Section 1) are also crucial to the achievement of economic and social impact from research undertaken in BBSRC's institutes and whilst this report is focused on TT, BBSRC also needs to consider the way in which wider KT activities are funded, managed and aligned to TT operations in its institutes.

Clarity of Purpose – Institutes

- 4.4 DTZ's view is that technology transfer has not been a top priority at some institutes, with senior management time diverted by many other pressing issues. BBSRC should seek to ensure that the institutes are aligned to its TT strategy through appropriate goals and funding.

Specialisation

- 4.5 There is a great diversity of science across BBSRC institutes covering a wide range of industry sectors. This contrasts with benchmark organisations, for example, MRCT and CRT operate across many institutes and universities but the market for the research is concentrated in a small number of industry sectors (pharmaceuticals / biotechnology). This has helped the organisations to build up specialist knowledge and networks in these sectors which has been vital to their success. It would be very challenging for a TTO to operate successfully across all BBSRC institutes. Aligning science areas with appropriate TTOs will bring the greatest benefits.

Cash generation and Accountability

- 4.6 BBSRC does not have an expectation of significant financial returns from institute TTOs. That may be a function of markets as well as any lack of TT activity, quality or research pipeline. A decision on the priority given to financial targets and accountability will need to be made.

Profile

- 4.7 At the current time, TT is seen as something of an 'add-on' for BBSRC institutes. The main focus is the science. Government policy is changing that perception but BBSRC has a long way to go for TTOs to reach the profile given to it by some of the benchmark organisations. BBSRC will need to decide just how much profile to give to TT and match all its actions accordingly (funding, priorities, strategy etc).

Identifying gaps or bottle necks

- 4.8 The commercialisation of research is seen to be constrained by a lack of 'development gap' funding. This may limit TT to a relatively small number of projects sufficiently advanced to attract commercial interest. The implication for BBSRC is that more could possibly be achieved in terms of commercialisation of research, if more resources were available for translational research.
- 4.9 It is notable that benchmark organisations have invested heavily in plugging this 'development gap' over recent years because it is critical to realising the economic and social potential of their research programmes. For example, it is rare for MRCT / CRT to have a project which is ready for licensing / commercialisation. Both have discovery / development gap funds to support translational research and both have in-house development laboratories. The Wellcome Trust also recognises this issue and provides significant resources for translational research.

Partnership Working

- 4.10 An issue for BBSRC is whether its institutes should be encouraged to develop wider TT partnerships and if so how these partnerships should be developed. For example, building successful spin-out companies is high-risk and requires specialist expertise. Should these be referred to an organisation like Imperial Innovations which is a market leader in this type of work (with appropriate revenue sharing). Similarly, there could be benefits from partnership working with organisations like MRCT and CRT on some types of project (particularly at the Babraham Institute) or MRS in relation to plant breeding. Taking a more holistic view of TT opportunities across BBSRC's university funded research could be of interest. Such partnerships would need to focus on related science areas e.g. Easter Bush Research Consortium.

Ownership of IP

- 4.11 The BBSRC research institutes have complex, but similar, governance structures. Each institute is an independent legal entity – both a company limited by guarantee and a registered charity. Although the institutes have separate legal identities, the BBSRC employs the staff who work in them with the exception of the John Innes Centre, where the institute is the employer although on BBSRC terms and conditions. As formal employer, BBSRC owns any IP developed in the course of staff employment for four of the five institutes. However, there is an agreement that assigns all IP from BBSRC to the institutes (JIC is not part of this agreement as it directly owns any IP as employer). BBSRC expects all its institutes to develop, or have access to, professional technology transfer expertise. However, it does not stipulate use of particular TTOs.
- 4.12 One of the reasons for the success of organisations such as MRCT and CRT is that their parent organisations have either assigned IP, or the rights to commercialise IP, to them. This is an issue BBSRC would need to consider if it were to establish a new TTO(s) for its institutes. The success of any initiative along these lines would require BBSRC to exert greater control over the IP and the way in which it is commercialised than at present.

5.0 Future Organisational Models

5.1 This final section considers the options for improving efficiency and effectiveness of technology transfer operations in BBSRC institutes.

5.2 Moving forward, there are four future organisational models that BBSRC could use:

- Status quo – retain existing arrangements as they are.
- Centralised model - Establishment of a single TTO that would be responsible for technology transfer across all BBSRC institutes.
- Prescriptive model - Establishment of institute-specific TTOs to be responsible for technology transfer in each institute.
- Flexible model - Institutes to receive funding to operate their own technology transfer function with clear specification and agreement on what will be achieved through this funding.

Status Quo

5.3 The current situation is that BBSRC provides Institute Integration Awards to institutes, some of which is intended to be used for technology transfer activities. However, there may be a lack of clarity about what BBSRC expects from this funding and how it is being used.

5.4 BBSRC expects institutes (outside of the university sector) to use professional technology transfer expertise. Currently, these capabilities are provided by three different technology transfer organisations in which BBSRC has varying degrees of involvement.

5.5 DTZ's view is that the current arrangements work well for some institutes but overall do not represent best practice. For example:

- Not all institutes have effective TT arrangements in place.
- The performance reporting and resourcing of TT is variable.
- It is time-consuming for BBSRC (centrally) to monitor and service the numerous governance and management arrangements across the different TTOs.
- The structures appear to reflect historical developments rather than any planned strategy.
- The TT situation of BBSRC cannot be held up as 'best in class' and meeting Government objectives for science with impact.

5.6 There is little justification to maintain the status quo.

Establishment of a Single TTO – Centralised Model

- 5.7 This is the model that MRC and CR-UK have chosen. There is one TTO which largely owns the IP, or has rights to commercialise the IP, from research funded by these organisations outside the university sector. Revenue generated tends to be recycled back into the parent organisation. There are many advantages to this model. It provides economies of scale in particular areas of expertise and it is administratively efficient.
- 5.8 However, the drawback of using this model to support BBSRC institutes is the diversity of research undertaken across the institutes. Whilst MRCT and CRT operate across many research institutes and organisations, there is a rallying call such as ‘cure cancer’ allowing concentration in a small number of industry sectors (pharmaceuticals / biotechnology) around a core mission.
- 5.9 The research undertaken in BBSRC institutes covers a much wider range of industry sectors making it much more challenging for any one organisation to manage the commercialisation of research effectively.
- 5.10 Another drawback is that BBSRC would need to take greater control of IP and the way in which it is commercialised for this model to be successful. At present, institutes behave as if they own the IP (only JIC actually does) and have the right to choose how it is commercialised.

Establishment of Institute Specific TTOs – Prescriptive Model

- 5.11 By prescriptive, we mean that BBSRC would expect each institute to have its own ‘in-house’ TTO. This is the model operated by the Scottish Crop Research Institute and Babraham Institute. It is also the direction that Rothamsted is heading and arguably the model pursued by JIC (though PBL is wider than JIC). The advantages of this approach are the sense of ownership, the embedded nature of the TTO, the depth of relationships with scientists and depth of understanding of relevant industry sectors. The drawbacks are:
- BBSRC potentially funding a substantial overhead and duplication across institutes.
 - An imposed solution could generate resistance and possibly a lack of buy-in.
 - A possible lack of critical mass with potentially not enough opportunities coming forward from one institute to justify its own high quality TTO.
 - A lack of flexibility to use existing TTOs that already provide, or could provide, TT services to BBSRC’s institutes.

Institutes Funded to Operate their Own TT function – Flexible Model

- 5.12 This is a model where BBSRC would set out clear objectives for technology transfer in BBSRC institutes within a specified budget, and then leave it to the institutes themselves to decide the best way of achieving these objectives within the budget. This is similar to the way in which such activity is funded in universities through HEIF or KT accounts funded by EPSRC.

- 5.13 In some ways it is also similar to the status quo – the current way in which BBSRC supports institutes through Institute Integration Awards. However, key differences would be:
- A specific (possibly ring-fenced) budget for TT
 - Clear specification and agreement on what will be delivered through this funding with quantifiable targets
 - Support for a mix of KT / TT activities as appropriate
 - Encouragement to use different TTOs / different technology transfer expertise as appropriate.
- 5.14 Whilst our review has been concerned with TT, this model brings us into the wider realm of knowledge transfer as such an approach would have to be wider than just TT.
- 5.15 This is the option favoured by DTZ because it gives institutes the flexibility to keep things that are working well and to drive change where this is needed. It also allows creative solutions to emerge from existing TTOs and institutes and in particular, the widening of partnerships with other organisations.
- 5.16 The drawback of this approach is if institutes do not use the funding for technology transfer – but that it gets ‘diverted’ into other activities. To prevent this, it would be essential for institutes to prepare a plan setting out how they intended to use the funding including quantifiable targets against which they would be assessed. The way in which TT is organised should take account of the operational factors that underpin successful external TTOs elsewhere as set out in Section 3.
- 5.17 Another potential drawback of this approach is that institutes do not have the senior manager capacity to take on this task and to be more pro-active in driving knowledge / technology transfer. It will be important for BBSRC to assess and address this point providing the necessary support for bidding and implementation.
- 5.18 This approach would require BBSRC to review its involvement with the current TTOs that work with its institutes. In particular, to ensure there would be no conflict of interest in assessing institute TT plans/performance and in being represented on the boards of organisations that may be undertaking TT operations for the institutes.

Monitoring of Technology Transfer

- 5.19 BBSRC collects a large amount of monitoring data from its institutes relating to technology transfer. However, it is clear from this review that these data do not really enable BBSRC to assess what is being achieved from technology transfer. The data are not seen as valuable or important by institutes.
- 5.20 The benchmark organisations appear to focus on a small number of easily verifiable metrics that capture activity and outcome levels. MRS focuses on financial performance such as annual commercialisation income. CRT focuses on a three key metrics:

- **Annual commercialisation income** (excluding income not directly within CRT's control such as royalties). CRT does not exist primarily to make money but it takes the view that making money demonstrates that it is doing something useful and is an informative performance measure.
- The number of '**substantial**' **commercial deals** it negotiates annually – since commercialisation income can be a lagging indicator). For BBSRC – these could be broken down into different categories such as license deals, consultancy, collaborative R&D etc.
- Number of **commercial projects that come out of CRT discovery laboratories**.

5.21 Benchmarking metrics have to be used with caution because they drive performance and can distort behaviour. Conventional TT metrics include disclosures, patent filings, patents granted etc.

5.22 DTZ's view is that future monitoring should include these conventional TT metrics plus revenue generating licenses. However these metrics will need to be within the context of a broader basket of KT related measures (such as collaborative research income) to avoid perverse incentives.

5.23 When considering a broad basket of measures relating to KT, BBSRC should consider HEBCIS data collection which measures university – business engagement and has now been developed to reflect a broad range of interactions as well as asking the institutes to devise their own formative measures for use in their strategic plans.

5.24 Of course, the benefit of a flexible model will be the ability of the institutes to set targets relating to outputs and outcomes similar to EPSRC KTA bids. Institutes will then have ownership for their own metrics rather than reporting on BBSRC imposed metrics.

6.0 Recommendations

- 6.1 BBSRC should provide a long term, (possibly ring fenced) funding stream for technology transfer operations in its institutes.
- 6.2 BBSRC's goal is to maximise the economic and social impact of its research. The commercialisation of research is one way in which this can be achieved. However, wider knowledge transfer activities are also crucial to achieving this goal. We have highlighted the rationale for wider KT but it has not been within the scope of this review to consider wider KT in detail.
- 6.3 DTZ believes there is little justification in maintaining the status quo in terms of current arrangements for funding / managing TT in BBSRC institutes. DTZ suggests institutes are funded to develop their own KT / TT programmes but within a strict commissioning process as outlined in the report.
- 6.4 BBSRC should encourage partnership working in its widest sense so that technology transfer can occur in related science areas not just at institute level. This will require protection of the benefits through appropriate mechanisms.
- 6.5 BBSRC could have a smaller set of more relevant performance indicators for monitoring and evaluating what is being achieved through technology transfer activities in its institutes. Suggestions for metrics have been made for adding to the conventional range of TT metrics. In particular, institutes may wish to suggest their own metrics as part of funding bids.
- 6.6 The commercialisation of research is seen to be constrained by a lack of 'development gap' funding (after proof of concept stage). This can limit TT to a small number of projects sufficiently advanced to attract commercial interest. The implication for BBSRC is that more could possibly be achieved in terms of commercialisation of research, if more resources / funding for translational research were available alongside strengthening linkages with other funders (such as venture capital).
- 6.7 BBSRC could review its relationship with its current TTOs to ensure there would be no conflict of interest in assessing institute TT plans/performance and in being represented on the boards of organisations that may be undertaking TT operations for the institutes.