

**Independent External Challenge Report
to
Research Councils UK**

“Knowledge Transfer in the Eight Research Councils”

April 2006

EXECUTIVE SUMMARY

Knowledge Transfer (KT) is a broad umbrella heading. Knowledge Exploitation (KE), essential to achieve Economic Impact, is even broader and requires far more effort. The interpretation of KT is the source of considerable misunderstandings. Indeed, it is not surprising that KT for Life Sciences can be quite different to KT for large engineering companies. We are good at some aspects of KT but it would put UK competitiveness at risk to assume that this is true for all aspects of KT. There are areas that are quite immature globally and addressing these could present a real opportunity to enhance UK competitiveness or present a real threat if we have to follow others. Underlying much of this is efficient transfer of research output into business capabilities (exploitation of knowledge) to address market opportunities. Although this has to be approached through a range of measures and formulas, some generic features can be identified. A proper understanding of KT and KE, its parameters, its dimensions, its scope, its scales and its dependence on knowledge creation is fundamental to addressing the objectives of this exercise.

This External Challenge activity derives from the objectives

- Increased level of business interaction
- Increased rate of KT compatible with end-user requirements

from a recommendation in the DTI Innovation Report (2003) and the government's Science and Innovation Framework 2004-14. Through RCUK the members of the External Challenge Panel were chosen by the RCs. For a voluntary unpaid activity the demand on Panel members' time has been significant and has had to be accommodated around their existing full time roles. This has extended the expected duration of the exercise i.e. rather than produce a superficial report.

Although the above objectives are directed at the RCs, they work in an environment influenced by many. Historically, assessment criteria and career progression have put far greater emphasis on quality and publications rather than relevance or economic impact. The latter requires awareness of end-user requirements so that academics can evolve and align their skills with needs. If this is not readily available, the academics will simply focus on the next publication, relevant or not, driven by RAE ratings¹. The responsibilities to change this inertial system lie across a number of bodies, including UK businesses, many of whom need persuading to come to the table. However, the funding bodies are in a key position to influence change.

The overarching findings are

- All Research Councils (RCs) have made real progress in Knowledge Transfer with some leading examples of best practice and KT champions in each RC
- There is little doubt that the capabilities of our universities could bring far greater economic value to the UK through a joined up approach to KE
- Knowledge Transfer, in its entirety, is not well understood
- Funding the early stages of Knowledge Creation (research), historically the territory for the RCs, appears to be well served. Funding of the intermediate and later stages, moving towards exploitation, is less clear. The complete cycle from research to application usually involves a number of funding sources. This presents a high risk of failure and it is no surprise that the cycle is rarely completed and many businesses cannot justify involvement.
- Far better alignment between end-user needs and the research directions of universities is needed if business is to increase its investment into universities. The RCs could help break this 'chicken and egg' situation. There is a strong perception in the end-user community that the percentage of funding steered by end-user needs is far too small with beneficial impact too dependent on serendipity. The funding schemes are heavily biased to facilitating academic push rather than *established* business pull.

Whether progress to date is sufficient to deliver a step change in economic *impact* is a matter of judgement. This is strongly influenced by the scale of the activities and the buy-in from sufficient RC staff, many involved in Knowledge Creation activities, the main investment area for the RCs. A key indicator for this judgement is acknowledgement from UK businesses. More needs doing to get consistent end-user acknowledgement of *real impact*. End-user perception needs to be addressed. This should be through greater buy-in from all RC staff, building on and enhancing the best practice examples and developing new approaches. Noting that this exercise is an 'External Challenge', a number of development areas have been proposed.

¹ Research Assessment Exercise organised by HEFCE (Higher Education Funding Council of England)

This report proposes a number of areas where developments should be considered. Amongst these, some of the key areas are:

- A thorough understanding of knowledge transfer *and exploitation*, including parameters, scope, scales and dependence on *knowledge creation*
- An empowered unifying Knowledge Exploitation Department or Council
- Presentation and profile of a coherent set of measures and packages for the complete stakeholder base i.e. universities and end-user community
- Enhanced scale of activities
- Research project management tailored appropriately to deliver impact
- An enhanced understanding of the complete process ‘from research to exploitation and application’ across the RCs
- Step changes in people flow between organisations².
- Balanced investments across small to large problem areas, addressing the default ‘small problem culture’, which drives granularity in investment and limits resources available for challenges that could impact the economy
- Enable sufficient end-user influence on investments and project directions – for many RC investments the involvement and influence of end-users is marginalised e.g. involvement after the main funding decision is taken
- Establish and promote best practice on issues relating to delivering impact.
- Establish better environments and cultures to deliver impact, balancing prevailing academic cultures and inertia as appropriate
- Priorities and grand challenge areas that
 - Have potential to deliver impact
 - Will raise the profile of research and its value
- Demonstrators to provide incentives for academics to get involved, raise the profile in the public sector and attract high calibre youngsters.

Within the timescales of this activity, implementation details have not been considered. However, some of the management and operational aspects of the MOD’s DTC scheme may point to part of the required formula providing *greater business engagement* e.g. competition across the end-user community to identify and manage research projects that are directed towards UK economic impact.

The appropriateness of the Councils plans and goals and the utilisation of additional OST funding should be considered in light of the proposed development areas detailed in this report.

² The RAE assessment can limit the flow of high calibre industrialists into permanent university positions. Universities often want to recruit people who can immediately boost their RAE ratings and the industry focus is somewhat different.

Glossary of Terms

AHRC	Arts and Humanities Research Council
AURIL	Association for University Research and Industry Links
BBSRC	Biotechnology & Biological Science Research Council
CCLRC	Council for the Central Laboratory of the Research Councils
CI	Creative Industries
DTC	Defence Technology Centre
DTI	Department of Trade and Industry
EPSRC	Engineering & Physical Sciences Research Council
ESRC	Economic and Social Research Council
HMT	Her Majesty's Treasury
KE	Knowledge Exploitation
KT	Knowledge Transfer
KTN	Knowledge Transfer Network
KTP	Knowledge Transfer Partnership
M&G	Museums and Galleries
MRC	Medical Research Council
NAO	National Audit Office
NERC	Natural Environment Research Council
OST	Office of Science & Technology
PPARC	Particle Physics & Astronomy Research Council
PSRE	Public Sector Research Establishment
RAE	Research Assessment Exercise
RC	Research Council
RCUK	Research Councils UK
TT	Technology Transfer
UNICO	Universities Companies Association

CONTENTS

<u>Section</u>	<u>Topic</u>
1	Executive Summary
	Glossary of Terms
2	Purpose of this Report
3	Background
4	Initial Findings
5	Definition, Scope and Scale of Knowledge Transfer
6	Research Council Diversity
7	The Role of RCUK
8	Assessment: Delivery Plans, Best Practice and Development Areas ³
9	Summary and Conclusions
10	Annexes:-
	1 Panel Membership
	2 Terms of Reference for the External Challenge Panel
	3 Definitions of KT
	4 Panel's Views on this Process
	5 A Vision for the Future
	6 Frameworks – Structuring the Process from Research Initiation to Exploitation
	7 RCs Initial 6-page Reports (separate document of 40 pages)
	8 Written RC Responses to Panel Questions (separate document available on request)

³ These equate to recommendations, which are also reflected in the conclusions.

2. Purpose of this Report

In December 2005 RCUK established an Independent External Challenge Panel to carry out the following:-

1. Review the progress of the Research Councils in delivering an increased rate of Knowledge Transfer (KT);
2. Comment on the levels of Research Council to business interaction;
3. Establish a baseline for future assessments;
4. Identify best practice; and,
5. Inform future spending reviews.

Panel membership and the Terms of Reference for the Panel are shown in Annexes 1 and 2.

3. Background

3.1 In 2000 HMT and DTI commissioned John Baker to assess the levels of KT in the PSRE community⁴. Following his report⁵ the Government published their response⁶ in 2001, making a series of recommendations and placed actions on the RCs and PSREs. Although some RCs had been developing KT for more than 10 years, since Baker some aspects of KT have matured and the RCs have made further progress with KT outputs. This was substantiated in the 2002 NAO report⁷ “Delivering the commercialisation of Public Sector Science” which reviewed commercialisation at MRC, BBSRC, and NERC units and Institutes.

3.2 The DTI’s Innovation Review⁸ published in 2003 placed an action on the RCs (recommendation 3.16; see box below) to produce KT delivery plans and goals for increasing (i) the rate of KT and (ii) levels of business interaction. A second action was that their progress and plans would be, for the first time, subject to peer review and an independent external challenge.

DTI Innovation Report, summary action from Chapter 3; Technology Innovation

“The Director General of the Research Councils will agree with each of the research Councils plans and goals for increasing the rate of knowledge transfer and the level of interaction with business through activities such as collaborative research, start-up companies and the Small Business Research Initiative (SBRI). Where these are not already in place, Research Councils will establish measures of collaboration, so that progress can be monitored. **Furthermore, the level of interaction with business by each research Council will be subject to peer review within Research Councils UK and to external challenge by a group including business representatives.**”

3.3 The publication of the Science and Innovation Investment Framework 2004-2014 from HMT/DTI/DEfS⁹ endorses the long term Government support for KT and the commercialisation of public sector assets.

3.4 RCUK organised an External Challenge Panel, which heard presentations on 1st-2nd Dec 2005 from each RCs on their KT progress; this report details the findings of that External Challenge. The expectation was for the panel to draft the report after this two day event. However, there was a considerable under-estimate of the required information, interaction and effort required if the panel was to deliver more than superficial findings on the progress against the government’s objectives:

- Increased level of business interaction
- Increased rate of KT compatible with end-user requirements.

The timescale constraints made it difficult to establish a full follow-on meeting¹⁰. Consequently RCUK welcomed the suggestion that RC representatives meet with Panel Co-chairs on 3 Feb 2006. Prior to this meeting all Panel members were asked to construct questions for the RCs to address at the meeting, either verbally or through written responses.

3.5 The primary sources of information for this exercise were:

- Six page reports provided by each RCs, prior to the presentations on 1-2 Dec 2005. These are available upon request;
- The RC presentations on 1-2 Dec, 2005;

⁴ Considered to include: the Research Councils, NHS Innovation Hubs (representing research activity NHS Trusts), Government sponsored research laboratories and museums that carry out research. Baker did not review all PSREs, but probably received info on about 40-50% of PSREs. Of the RCs, Baker only looked at those with Institutes (e.g. MRC/BBSRC/NERC, but not EPSRC/ESRC)

⁵ http://www.hm-treasury.gov.uk/documents/enterprise_and_productivity/research_and_enterprise/ent_sme_baker.cfm

⁶ <http://www.hm-treasury.gov.uk/media/23D/D3/57.pdf>

⁷ <http://www.nao.org.uk/publications/index.htm>

⁸ <http://www.dti.gov.uk/innovationreport/executive-summary.pdf?pubpdfload=03%2F1640>

⁹ http://www.hm-treasury.gov.uk/spending_review/spend_sr04/associated_documents/spending_sr04_science.cfm

¹⁰ External Panel members were not funded and accommodated the workload around their full time roles.

- The experience of the Panel in interfacing with the research councils from their own organisations and their observation of wider interactions between the research councils and university academics with businesses and other communities; and,
- The additional meeting on 3 February 2006 noted above, to discuss RC responses (verbal or written), to questions posed by panel members.

4. Initial Findings

4.1 Operationally the RCs are generally well organised with teams of designated KT staff some with commercial and private sector experience, but all with scientific backgrounds often pertinent to that Council. These multi-disciplinary teams can be highly focussed on the narrow aspects of Technology Transfer (MRC), or engage more widely with the broader KT agenda (AHRC). In some cases the broader KT activities such as informing policy development and engaging in the science in society agenda were conducted by a different group within the RC and not considered as an integrative KT function. We did find that whilst there is good understanding of the tactics to be employed in KT, many do not have a strategic view of KT's place in the overall objectives of their Council. Not being clear on strategic objectives made assessment of current and future plans less transparent and less easy. This led the Panel to often focus on strategy related issues in the Q&A session with Councils.

4.2 The Panel applauded some excellent examples of Technology Transfer which have been made including some high returns on royalty based products and the development of a portfolio of spin-out companies. Progress at this level had made a step change since the Baker Report of 2000. However the Panel were unable to form a view about the wider and current KT trajectories. Output 2 data will be reported in June 2006 which will put a marker down for 2004-06. Each Council briefed the Panel on their schemes and mechanisms to bring about KT yet we had concerns about the apparent lack of long term vision (and goals) for KT at the highest strategic level. The Panel were not shown how the RCs KT plans and programmes will impact on the Government's target to increase the UK's R&D levels to 2.5% of GDP by 2008 (although we recognise that the RCs are just one element of this target).

4.3 In almost every case of grant funding into Universities, Government policy is that the University will own and manage any emerging IP. Some RCs are using brokering to actively mobilise the transfer of IP to the user base but we were concerned that there appears to be little or no monitoring of projects, i.e. the investment made by the RC, emerging IP or how that IP is used or transferred to the user base. Given that this type of funding represents approx 1/3rd of the £2.2 billion annual RC budget, we believe some monitoring and reporting of IP generated by Universities from RC funding should take place on an annual (or 2yr) basis¹¹. Furthermore, in cases where significant levels of funding are made available (e.g. projects of £3M/yr and above) the Councils should have closer involvement¹² in the project management, and exploitation strategy, in order to help and provide best practice for the commercialisation of that IP, although we acknowledge this would place an extra resource burden on that RC.

4.4 Measurement of KT varies across the 8 Councils. AHRC's Impact Fellowships to measure KT in their sector for example, are at an early stage of development. It would be worthwhile to develop KT measures across the 8 Councils and design common benchmarks and Council specific measures to aid OST's evaluation of the RC's progress. Councils should work on increasing the level of detail in the Output 2 frameworks, and work together on the consistent development of indicators.

4.5 It was evident that there are instances where a reliance on key individuals or organisations to provide leadership or services exists. More could be done to make sure that skills and learning are brought on board for the benefit of the local teams, or that arrangements for skills transfer can be made thus reducing the risk to the RC's KT teams and long term abilities.

4.6 Each Council has a number of different KT schemes for interacting with their user base. As the user base often overlaps between different Councils this can make it complicated to make use of these schemes. RCUK should carry out a regular review of Council wide KT schemes to determine the degree to which common schemes could be introduced to reduce complexity, improve transparency and increase user uptake. It is acknowledged that *some* differences are necessary.

4.7 In an effort to improve communication between the RCs and the DTI's Technology Strategy Team, EPSRC, on behalf of all RCs, had placed a secondee into the DTI team. This has resulted in improved links

¹¹ Perhaps as part of the HEBI survey.

¹² This "involvement" could range from monitoring through to helping close a deal. It would not change IP ownership, but does introduce a degree of accountability by Universities for IP from RC funding.

between the RCs and DTI's team. Also BBSRC, EPSRC and PPARC are in direct communication with the Technology Strategy Team to try to address their user sector's issues (referred to in 6.24).

4.8 It was clear that although some RCs actively perform a role which encompasses the use of research and evidence in policy making in key areas, this was not a part of the intrinsic activities of the KT group. This function was provided by a separate team. The Panel saw value in combining key aspects of this under the wider KT definition given in Annex 3-

4.9 There have been many excellent examples of KT and TT given in the Council presentations. We believe it is important to celebrate this and to demonstrate an aspect of value for money for Government and the tax payer. It would be worth considering a publication which highlights RCs' KT examples (not just in technology transfer) and provide lessons learned for the KT community as a whole. This could be co-ordinated and produced by the RCUK KT group

5. Definition, Scope and Scale of Knowledge Transfer

5.1 Knowledge Transfer is a broad umbrella heading. Its interpretation is the source of considerable misunderstandings. We are good at some aspects of KT but it would put UK competitiveness at risk to assume that this is true for all aspects of KT. There are areas that are quite immature globally and addressing these could present a real opportunity to enhance UK competitiveness or present a real threat if we have to follow others. Underlying much of this is efficient transfer of research output into business capabilities to address market opportunities. Although this has to be approached through a range of measures and formulas, some generic features can be identified. A proper understanding of Knowledge Transfer, its parameters, its dimensions, its scope, its scales and its dependence on Knowledge Creation is fundamental to addressing the objectives of this exercise.

5.2 In this review it has become clear that the definition of Knowledge Transfer (KT) is subject to some debate and has been interpreted in different ways. At the inception of the RCUK KT group in 2002 a definition of KT was agreed after some discussion. Although RCUK provided the Panel with their definition of KT in advance this did not entirely fit with the debates the panel subsequently had with each Council and a variety of definitions are used across the Councils (see Annex 3).

5.3 Although a clearer definition of KT would be helpful, until its scope and scales are understood and agreed, there is the risk of establishing a definition that eliminates areas that could deliver value to the UK Economy.

5.4 The Panel emphasizes the importance of establishing a better understanding of the scope and scale of KT, leading to an appropriate benchmark definition before subsequent reviews. The definition needs to be agreed across an appropriate set of stakeholder, including the end-users. Limiting this to current 'KT practitioners' could lead to a definition with limited scope. Alternative definitions, including an option from some Panel members, are presented in Annex 3

5.5 In broad terms the Panel assessed a number of aspects of Knowledge Transfer (KT). Technology Transfer (TT) can be considered as part of KT and KT's wider scope can make it more difficult to measure. The impact of some aspects of TT and even more so, some aspects of KT, can be subtle and not apparent for many years. However, to address its markets, business also needs KT resulting from an appropriate element of planning rather than just serendipity. TT was the most advanced aspect and consequently prominent in most RC presentations. It is worth noting that in the Panel's view, the broad scope of KT will touch on education and science in society. Although considered by RCUK as outside the remit of this review, the Panel also sought to probe for wider aspects of KT such as societal benefits, impact on public policy and engagement of the public.

6. Research Council Diversity

6.1 It is important to recognise the differences between the Research Councils in terms of the nature of research funded and their user communities, although some commonalities exist. The definitions of KT used by the Councils vary as does their operational approaches. The needs of their user communities are diverse, which results in different Council structures and must be balanced against the need for the highest quality research. There is far more to KT than research excellence and dissemination of findings. Significant knowledge associated with the transfer and utilisation of knowledge often lies outside the RCs and can be different for different domains. Correspondingly, to address the diversity, the Panel found that the KT programmes and approaches varied across the Councils. However, the diversity should not be used as a reason to act independently. The KT measures used by Government (and others) are applied uniformly on each Council and the Panel's remit is predicated on a common starting point, supporting the need for an agreed understanding of KT (section 4).

6.2 All RCs have a grant awarding function to independent bodies, primarily Universities, and in nearly all cases it is Government policy that the grant holder's host institution owns and manages intellectual property (IP) resulting from RC funded research. Some RCs have used brokering effectively to help mobilise their research and researchers and assist the active exploitation of IP. To date RCs have played a limited role in the project management, or direct monitoring of any arising IP or exploitation of that IP¹³. For EPSRC, PPARC, ESRC and AHRC this position applies to the majority of their research budget. For MRC/NERC/BBSRC/CCLRC, who each have their own institutes and units, each Council has developed separate arrangements to manage the IP arising from their institutes. MRC, NERC and CCLRC each own and manage the IP centrally whilst BBSRC has delegated this to each of its 7 research institutes.

6.3 When comparing RCs the Panel recognises the differences in the potential market segments for each Council, particularly so for ESRC and AHRC. KT has to be based on both push from the generators of new knowledge and pull from users, the latter steered by the need for compatibility with the substantial continuous investments by business and industry into their products, processes and capabilities. At the moment the balance between push and pull is far too much towards 'push', where the business/industry perception sees a 90/10 split.¹⁴ Although there are notable exceptions and positive indications, to date, most RC investments fit with the needs of existing industry by serendipity. This concern is only partially reduced for Councils interfacing with industrial sectors that are R&D sophisticated, i.e. strong "pullers", characterised by employment of significant numbers of highly qualified research staff, new product dependency, and large R&D budgets. Those Councils interfacing with less innovation-dependent industrial sectors, i.e. weak "pullers", have a bigger challenge. MRC and BBSRC benefit from the R&D sophistication of the pharmaceutical and biosciences industries, whilst EPSRC and PPARC benefit when dealing with the aerospace, defence and instrumentation industries etc. BBSRC illustrate the role of industrial "pull" by their effective interface with pharmaceutical and biosciences companies but experience difficulty when engaging companies in the food sector.

6.4 All facets of research are covered by the eight RCs and therefore nearly all types of potential market could be addressed through different KT programmes and schemes. This requires an integrated approach to knowledge creation and transfer.

If knowledge is created without consideration of its later use, it may well be incompatible with many potential application areas without additional significant investment, often equalling the original research investment. The spectrum and variety is substantial including atomic scale, space research, anthropology, religion and many more. With such a complex and widely based product mix differences in approach are expected. *This backdrop makes a KT review of all 8 Research Councils in such a short time frame a considerable task (see Annex 4).*

6.5 The resource available to RCs to provide KT support has varied over time. The MRCT has built up to approximately 74 staff, but 10 years ago this was around 20. NERC and PPARC have tried to address support by linking with external providers (ISIS Consulting and Qi3, respectively) to provide expert and extra resource for KT activities. ESRC and AHRC have smaller groups with a different focus away from traditional

¹³ RCUK works with HEFCE on the HEBI survey which reports on the commercialisation of University IP

¹⁴ This point is the Panel's view (particularly from those currently in industry).

technology transfer embracing a wider definition of KT incorporating greater links with “Science into Society”, new end-user communities and impacting more strongly on policy making. However, it is emphasised that a ‘separate’ resource for KT in RCs and universities is not the way to address the KT challenges. For most KT the way knowledge is created is a critical factor for its later use.

7. The Role of RCUK

7.1 RCUK is a strategic partnership which encompasses all eight Research Councils. It enables the Councils to work together more effectively to enhance the overall impact and effectiveness of their research, training and innovation activities. RCUK activities are delivered across the Councils through a number of mechanisms including joint Council business units, RCUK cross-Council groups, joint Council projects and through day-to-day interactions between Council staff. One of the key cross-Council groups is the RCUK Knowledge Transfer Group (KTG). The role of KTG is to improve the visibility and impact of the Councils investments in knowledge transfer, at both strategic and operational levels. It provides a forum for pooling expertise and learning from developments in the UK and elsewhere. It provides the focus for KT activities with the Research Councils and the hub for interactions with the DTI Innovation Group, OST Exploitation Team and other external bodies in relation to innovation funding. In this context RCUK coordinated this activity but was not the direct subject of the review.

7.2 We asked whether the RCUK KT group¹⁵ was working effectively at a strategic level. Many of the presenters were not aware of the activities in other RCs, and cross-Council communication in our view appeared to be embryonic. RCUK could be swapping and developing best practice between the RCs and the community at large (PSREs, Universities and others). Through this, learning from one RC to another can be facilitated and lessons learned. Regardless of sector specialism, they are all trying to facilitate user take-up of products and services, some parts of the process are similar and some methodologies can be imported (e.g. BBSRC entrepreneurship to ESRC/AHRC, MRC negotiation with industry to EPSRC, ESRC understanding of the policy making agenda to other RCs). There are skills sets in one which do cross over and map on to another (e.g. discussing evidence generated by RC research with user community, developing schemes within public sector limits).

7.3 There are an increasing number of groups involved in KT (we note the recent establishment of KTNs). As these groupings develop, RCUK could play a role in delineating the responsibilities and specific expertise of these groups and establishing a means to work in partnership with them as part of the overall National Technology Strategy. In particular, it is very important that these KT groups and networks are very closely linked to those that create the knowledge. KT skills are an additional set of skills that need to be included in the skills set of multi-disciplinary teams.

7.4 The Panel had difficulty in obtaining one table on the amount of KT income & spend for each RC. This was measured in different ways by each Council. For future reviews RCUK should provide financial data on KT income and expenditure for each Council, and we suggest that RCUK take on the monitoring of such financial data for future OST needs.

7.5 RCUK could develop or manage:-

1. Impact and KT measures across all Councils including the evaluation of KT programmes
2. An appropriate set of KT schemes supplied across all Councils, with as many common to Councils as meet the needs of their users (as is done now with the Business Plan Competition)
3. A common KT portal for users (with a focus for business) interfacing with RCs
4. An agreed definition of KT to be used by all RCs.
5. A means of efficiently and effectively engaging with the broad range of stakeholders.
6. KT Financial data on income and expenditure.
7. KT surveys - RCs are requested to complete a variety of KT surveys and a co-ordinated response through RCUK KT group would be more efficient.

¹⁵ RCUK KT group have focussed on 4 activities: (i) co-operation in education and training at masters and doctoral level; (ii) people and knowledge flow; (iii) collaborative research with users, and (iv) commercialisation including IP exploitation and entrepreneurial activities. The role of KTG is to improve the visibility and impact of the Councils investments in knowledge transfer, at both strategic and operational levels. It provides a forum for pooling expertise and learning from developments in the UK and elsewhere. It provides the focus for KT activities with the Research Councils and the hub for interactions with the DTI Innovation Group, OST Exploitation Team and other external bodies in relation to innovation funding

8. Assessment: Delivery Plans, Best Practice and Development Areas

Note: Councils' web links to their delivery plans, scorecards and output frameworks can be found at:-

AHRC - http://www.ahrc.ac.uk/about/delivery_plan.asp

BBSRC - <http://www.bbsrc.ac.uk/about/pub/policy/delivery.html>

CCLRC - <http://www.cclrc.ac.uk/activity/deliveryplan>

EPSRC - <http://www.epsrc.ac.uk/Publications/Corporate/DeliveryPlan.htm>

ESRC - <http://www.esrcsocietytoday.ac.uk/ESRCInfoCentre/about/CI/CP/delivery%5Fplan/>

MRC - http://www.mrc.ac.uk/delivery_plan_2005

NERC - <http://www.nerc.ac.uk/aboutus/planning/deliveryplan/>

PPARC - <http://www.pparc.ac.uk/ap/dphome.asp>

8.1 The 8 RCs' delivery plans were developed from the performance management framework outlined in the 2004 science budget. Under this framework the RCs collect baseline data on Science (Output 1) and on Exploitation (Output 2). The first annual report on the deliverables from these plans will be published in June 2006. For this Independent External Challenge Panel, many of the deliverables from Output 2 still remain in their early stages of generation.

8.2 The RC's 3 year plans have only run for 12 months, so the Panel's assessment was more towards the anticipated achievements to each RC's KT agenda, rather than specific deliverables within that 12 month timescale. Each RC presented their data as a balanced scorecard measuring scale and quality against 5 parameters; interaction with business, collaborative research, commercialisation of research, cooperative training, and people exchanges between science & engineering base and users. The AHRC and ESRC have adapted these where appropriate to their areas of activity. The Panel felt that these parameters were mainly quantitative and did not allow a qualitative assessment of RC's KT impact. We understand however that these parameters were put forward by the RCs and subsequently agreed between each Council and OST prior to their use as Output 2 criteria.

8.3 It would be useful to develop an indicator in the scorecard to say how the assembled data will be used to (i) influence future KT resources, (ii) change any emphasis on KT schemes, (iii) feedback to policy makers, and (iv) the research allocations of mainstream Council business.

Best Practice and Proposed Development Areas

By Research Council

Note on Development Areas

Proposed development areas arose from discussions with members of each research council. A number of development areas have been listed under 'cross-council'. Others are listed under specific councils and reflect the discussions within which they arose but may be more widely applicable and should be considered by other research councils.

General Cross-council

Introductory Comments

8.4 Areas of best practice that had been adopted across all research councils were not identified but these are listed separately for each RC below. However, there were a number of enthusiasts / champions and concepts had been shared through the cross-council KT group but usually implemented in different ways within each RC. Although the needs for differences in implementation are understood this has to be balanced against a proliferation of schemes, clouding clarity and each only adding *a little to the overall objectives*. This is difficult for stakeholders that have to work across the research councils. **A particular strength, which came from some RCs, is that they recognise that far more could be done to deliver value to the UK economy from the large investment that they make in the university sector.** At the same time there are many university staff, at all levels, who would like to be given the opportunity to deliver value to the UK economy from their quality research.

8.5 It was difficult to establish an *overall picture* of delivery against the Innovation Report objectives

- Increased level of business interaction
- Increased rate of KT compatible with end-user requirements,

particularly in terms of end-user impact, from the number of *separate* initiatives presented by the RCs. Although some initiatives contain excellent best practice examples to build on, each makes a small contribution and questions remained about the appropriateness of the scale of the activities and the scale of buy-in across all RC employees. The RC representatives were keen to get feedback on their separate initiatives, whereas the panel were more concerned with the integrated picture to establish the degree of impact on the above objectives. There was little evidence of a coherent and structured approach to knowledge transfer or knowledge creation (research), which can rarely be considered in isolation. The coherent picture is needed not only for the Panel's assessment but also for the involvement of the stakeholder community.

8.6 The general impression is that a substantial challenge exists within the culture and inertia of the overall system, including other funding and assessment bodies. At the same time it is evident that far more could be achieved by aligning our best academic capabilities with the key requirements of the UK business and end-user community. At the moment it only appears that a small part of the budget delivers noticeable value to established business, occasionally planned but more often by serendipity.

8.7 Management is at the heart of this and the management plans to achieve the goals need to overcome the substantial inertia and culture embedded in the system. Management in its many forms needs careful consideration and application.

Development Areas

8.8 The degree of coverage of the areas listed here varied across the Councils. However, it was felt that they are sufficiently important to warrant consideration by all Councils. Where there are shared responsibilities the RCs could be pro-active in ensuring that they are covered by those responsible.

- Implementation of Mission Statements: Aspects of mission statements relating to quality and preserving skills in the university sector are well served but questions remain for those relating to delivering value to

business and the UK economy. Although this emphasis, particularly from the historical context, is understood, the balance of effort across all aspects of the mission statements should be reviewed in the context of achieving step changes in delivery of value to the UK economy.

- Visibility and packaging of a coherent KT approach targeted at all stakeholders, particularly the end-user community, within each RC and across RCs where possible.
- The small problem culture: This is still perceived as featuring strongly:
 - Strongly influenced by publication focus and RAE ratings
 - Encourages a highly granular use of budgets.
 - Insufficient coverage of the medium to large problem areas that can provide a higher probability of impacting the economy and business e.g. areas requiring multi-disciplinary skills teams
 - Responsibilities for this are far broader than the Research Councils but the RCs could have a major influence.
- Establishing and promoting best practice in the university sector to facilitate creation and transfer of knowledge that delivers value to the UK economy e.g. to address the development areas listed. The perception is a 'Hands-off' approach.
- Management of Knowledge Creation and Knowledge Transfer projects:
 - This means the management towards a desired goal that will deliver value
 - Generally left to grant recipients rather than addressed by RCs.
 - The balance of university push (e.g. responsive mode) projects to end-user pull / managed projects should be reviewed. The former, alongside RAE ratings, drives inertia whereas business needs to change at an increasing frequency, driven by markets.
 - For many sectors, it represents a gap in the UK compared to the US.
 - The research councils, as large investors in research and now with strong requirements to deliver value to the UK economy, could take a lead.
- The cycle 'from research initiation to application/exploitation': A thorough understanding of this is fundamental to achieving the objectives, establishing best practice, understanding which stakeholders to involve and when, which partnerships to form, who pays for what etc. Differences in approach are expected across RCs and across sectors. However, it is certainly not well understood by all RC staff and this should be reviewed. Within some sectors this is structured through Technology Readiness Levels 1 to 9 (see Annex 6). There are examples of good practice e.g. PPARC.
- Scale of activities to address the KT objectives: The scale of increase in, or changes to activities was unclear whether via new KT activities or, more importantly, through changes to the way knowledge is created, the latter being the major expenditure for the RCs and fundamental to its usefulness. Consequently, more reassurances are needed regarding step changes, particularly with respect to impact on the end-user community.
- Scale and duration of KT to provide the appropriate weight of relevant effort (quality assumed) to match specific needs. It was not clear that this has been properly considered i.e. is a 'one-off' two day course needed or a multi-year partnership providing continuity in the creation and transfer of knowledge between members of the team.
- Changes to the knowledge creation (research) process: The knowledge creation process can facilitate or inhibit knowledge transfer and is the primary investment area for the RCs. It was difficult to identify the degree to which changes had been made to the process to achieve greater impact on the UK economy. A range of best practice options needs to be established and made visible. A review of alternative approaches to the complete process 'from research initiation to exploitation' and the many factors that can influence it would be beneficial.
- Address perceived images and cultural issues in university and industrial sectors:
 - Delivering value is not in the mindset of many academics but there are many that would if it was a grant condition
 - Although research output with respect to KT is checked by some RCs, some academics still need convincing that the RCs have an interest after a research grant is awarded.
 - Whereas parts of industry recognise excellent skills in the university sector, other parts are difficult to convince. The *image of delivering value* is far from where it should be and the RCs could help address this.
- Consider mechanisms for establishing 'value-driven' priority areas with consideration to profile and impact on the UK economy. This could involve competition and peer review. Consider novel methods for addressing national and business grand challenges.
- Interfacing with the end-user community

- Review the effort allocated to interfacing with end-users
- Review methods for interacting with end-users and addressing their needs
- Distinguish between personal views of company employees and corporate priorities
- Establish opportunities, through partnership with other funding bodies as necessary, to allow researchers to see their research through to application i.e. delivering benefit and value.
- Address the perception of a prevailing academic culture in the RCs (noted by some RCs), which, for some RC staff, is reflected by a focus on quality, without sufficient recognition of the need to deliver value with quality.
- Staff recruitment: Significant knowledge and experience on a range of issues associated with knowledge transfer lies outside of the RCs and recruitment could bring that knowledge into the RCs. A number of issues arose: Salaries often restrict recruitment from industry to young people or retired industrialists and limited the RCs ability to attract the people with the knowledge and experience. As a result, some (but not all – EPSRC noted that only two of their 300 staff had been recruited from universities) RCs primarily recruited from universities.

8.9 AHRC was only established in 2005, and it could be considered too early to comment on their deliverables. However, they have already conducted three “sector interaction studies”¹⁶ to identify and characterise their users and their needs. AHRC have developed a 10 yr plan for KT, and have included an integrated strategy for research support for Museums and Galleries (M&G) with a strong focus on the Creative Industries (CI). AHRC has started cross-Council programmes of exchange which supports their longer term planning and strategic thinking. There are also plans to explore the potential for the development of a proof of concept fund over the next 2 years which is an important step in providing financial support to development projects, and they should scope in advance the size and criteria for delivering this type of funding. AHRC are developing a unique scheme to develop better short-term KT measures using Impact Fellowships; 2yr studies (using some HEIF support) to help map pathways where leverage to KT can be applied to help increase their outputs; the next review will see if this was successful.

8.10 The AHRC have achieved an enormous amount in their first year across many fronts. As the Council moves into a more mature phase of its development it will be important for the Council to continue to check that its KT activities reflect its high level objectives and priorities which themselves are evolving as the potential for research in the arts and humanities to assist becomes even more recognised

8.11 AHRC have established a task group with DCMS¹⁷ to help co-ordinate and develop stronger links with the CIs; seen as a key user group. We note that AHRC would like to sponsor a Knowledge Transfer Partnership (KTP) designed to encourage micro-enterprises and SMEs to engage in research-led KT with the arts and humanities research base. AHRC recognise that this sector (majority of which are small SMEs) may not have the financial capacity to take on such a scheme and will develop a pre-cursor KTP scheme to address the financial shortfall. We support this use of creative thinking to understand their user needs and adapt KT schemes accordingly, but they may wish to scope their user base more widely and bring in other groups and government departments as well as CI’s.

Areas of Best Practice

1. Targeted user communities (M&G, and CIs) as growing sectors with strategic plans to improve KT here.
2. Good cross-council working (ESRC) with DTI and some other Govt Depts to co-sponsor KT programmes, and leading on a cross-council initiative on global conflict.
3. Developed new programme with Home Office who now also sit on advisory committee to provide early policy awareness.
4. Reacted to user requirements; produced and adapted precursor KTPs to suit financial position of user group.
5. Concordats seen as documents to empower action rather than statement of intent
6. Increase in team size will focus on RDA and DA
7. Developing networks to provide best practice to user communities

Development Areas

1. AHRC user community lacks access to exemplars and best practice.
2. Have produced their own definition and version of KT.
3. Metrics are in development as current ones are unsuitable and do not capture AHRC’s user groups’ outputs.
4. The AHRC community has considerable skills that could be of use in policy making, and that they could usefully consider how to support this activity

¹⁶ Noted in their Output 2 data.

¹⁷ Department of Culture Media and Sport; DCMS sponsors 17 of the largest M&Gs

8.12 BBSRC made a strong commitment to its KT responsibilities from its creation in 1994. From the outset, scientific excellence and the interface with industry were treated as equals when creating two Council Boards.

8.13 BBSRC has demonstrated robust commitment to provide core funds in support of industrial partnerships and collaborative awards, and has developed its own Technology Strategy. BBSRC has many varied KT schemes but has indicated that it is reducing significantly its support to KTPs due to lack of market demand. A difficult decision in light of other RCs continuing to support of this scheme, but the Panel supports this action when schemes to serve a market need lose their market demand. This point illustrates a generic Panel recommendation that all Councils should regularly assess their KT schemes to determine whether the current schemes meet users' needs. BBSRC, for example, operates eight KT schemes including the SBRI scheme. Here it intends to increase funding to £2.5M/yr having already secured 33 contracts. Despite its prominence in the DTI Innovation Report, BBSRC was the only RC to comment on the SBRI scheme¹⁸.

8.14 BBSRC has 7 Institutes which manage IP generated from BBSRC research funds. The Institutes' KT outputs are reviewed every 4 yrs, most recently in 2005. Total BBSRC data (244 patents held, £2.1M income and 13 spin-out companies) was given as part of the presentation, but this was not represented on the Output 2 performance indicator, which could be overlooking an important measure for BBSRC¹⁹.

8.15 We acknowledge that engaging with small industries is problematic for many sectors and RCs, including the food sector for BBSRC. Although BBSRC have worked with and provided KT into that sector, some of the larger industries, who regularly work with universities, feel that more could be done.

Areas of Best Practice

1. Delivery plan and 10yr vision developed in discussion with stakeholders
2. Professional management of KT projects at BBSRC Institutes
3. Systemic approach to KT at BBSRC institutes; targets are set for industrial research income
4. Annual survey of exploitation activity of the 15 largest university bioscience departments
5. Sharing results with other RCs on a new pilot scheme to promote industrial interchange
6. On average BBSRC's Boards and committees have 20% user representation
7. Proof of concept fund of £1M available to pump-prime KT projects
8. Changes to Collaborative R&D activities in response to the evolving needs of the user community e.g. creation of the Bioprocessing Club
9. Clear evidence of successful initiatives (YES, Business plan competition etc.) and transfer of knowledge culminating in the creation of new companies

Development Areas

1. Continue to develop robust and effective links with RDA in order to ensure the SMEs community is fully engaged – not unique to BBSRC
2. Explore ways to engage academics/universities in order to influence change culture such that KT becomes embedded

¹⁸ This may be due to changes imposed from outside of the RCs. We understand that in answer to a Parliamentary Question in Feb/March 2006, the RCs will now be supporting a new Small Business Research scheme, committing £815M in 05/06 to University-SME collaborations.

¹⁹ Subsequent to this comment, we understand that these Institute performance indicators are included in Output 1 data which was not in the Panel's scope.

8.16 The exploitation vehicle for CCLRC is CLIK Ltd. CCLRC has spun-out 6 new companies over the last 2 years. Most of their technologies have been exploited via new companies and, in contrast to other technology-based Councils they have completed very few licence deals. CLIK are turning their focus to other CCLRC core strengths, e.g. the ISIS Neutron Spallation Source, the Central Laser Facility, and the potential to exploit more commercial use of beam-time at the Daresbury Synchrotron Radiation Source. The major mixed economy KT related campus developments at Daresbury and Rutherford Appleton were well presented to the Panel, and we believe that CLIK will be able to capitalise on these using its good access to commercial funds and strong commercial focus. They have expressed a concern about the challenges of maintaining a sustainable pipeline of new IP and the campus developments may provide new opportunities here.

8.17 Their Output 2 indicators mention increasing support to KT but do not say in what capacity or by how much. They have reviewed their KT programme with OST but do not mention the outcome of this. All the Output 2 measures are Technology Transfer related²⁰ and do not indicate measures of wider KT performance which could reflect perceptions of the specific and different nature of CCLRC.

8.18 CCLRC quotes²¹ that “the quality of their collaborative research is assessed through the income that arises from IPR generated licensing/royalty based agreements”. Whilst we accept that such royalties are a useful measure of KT activity, this does not relate to a measure of the quality of collaborative research – this would be better measured by a matrix of criteria (number of jobs created, products and services produced, type and size and industrial contribution to the research, new material produced which can advance CCLRC’s scientists’ research, and publications made).

Areas of Best Practice

1. Have used outside agencies to identify current benchmarks of best practice and matched these against CCLRC’s practices
2. Re-evaluating the value of CCLRC’s facilities and the “offering” to user base to include expert’s time in analysing user problems

Development Areas

1. Rather heavily focused on conventional Technology Transfer, spin outs and selling their own resources
2. Interfacing with industry; packaging and presenting their facilities, resources and associated knowledge transfer e.g. knowledge, best practice and utilisation associated with computing facilities – including knowledge on their optimal use, interfaces, visualisation etc.
3. Working to change culture at the level of the scientist/inventor.
4. Pipeline of opportunities undergoing audit
5. Consider gathering views of other organisations and similar funding bodies (and asset base) in other countries to inform KT strategy
6. Can appear competitive rather than supportive to the contract research industry and to some of the community of small high technology companies

²⁰ CCLRC have used the “hard” KT definition to focus on economic impact and creating wealth.

²¹ In Output 2 document

8.19 EPSRC is an exclusively grant giving RC²² and its KT is driven by providing skills for business, enhanced routes for business-University interaction and through partnerships. EPSRC use secondments of university staff, company staff and their own staff to support these interactions supplemented by various studies carried out to measure user uptake of KT schemes. Training, rightly, figures strongly in EPSRC's Output 2 measures and underlines this RC's emphasis on the people element of KT.

8.20 EPSRC is trying to increase the awareness of its role through a number of collaborative schemes and have established agreements with some major companies from different sectors. However, a more systematic and visible process for engagement would be welcomed. Although the need for a flexible approach is acknowledged this should be done within an open framework that enables equal opportunity and benefit to all companies. In many cases it is left to the universities to choose which companies to work with, facilitating comfort zones and leaving some companies with KC and KT challenges that are not addressed. Integrated Knowledge Centres (IKCs) planned in the next 2 years will foster research in emerging sectors. We would have liked to have seen more evidence of how the vision EPSRC had painted was going to be converted into practice, having said that, the long term desire to develop their own Technology Strategy will be a key measure in this regard and we would like to see Output 2 data on that element in the next review. It would have been useful to see more detail on how EPSRC proposes to interact with smaller companies. The SBRI scheme could be used to good effect in this respect (see footnote 12 earlier). However, the challenges of directly interacting with the smaller companies are well understood.

Areas of Best Practice

1. The vision statement is excellent but the challenge is implementation
2. Strategic partnerships with industry are establishing best practice with many university staff responding enthusiastically to the greater insight into industrial needs. Planned *industrially aligned* demonstrators²³, with flexibility to allow for an envelope of solutions, featured in some of these clarifying the research direction to all involved. This approach features strongly in many PPARC programmes.
3. Formation of internal working groups on 'Better Exploitation' and 'Health of the Science Base'. However, these activities are perceived as not sufficiently visible and open to exploitation stakeholders, particularly in the context of delivering value to an external UK community and tapping into their substantial knowledge. Consequently, the degree of consultation with these stakeholders should be reviewed. It is noted that there are consultations with the User Panel and Strategic Advisory Teams.
4. Working across councils in sector specific areas (energy, bio-processing, health care, e-learning)
5. Collaborative scheme take-up. The growth is excellent but it is not clear yet that these collaborations are delivering value. An area of concern is that the EPSRC (not unique to EPSRC) investment leaves a strong degree of freedom with the academics and they will be driven by publications and RAE ratings.
6. Raising the profile of KT in grant applications. Although the Panel would have preferred a more robust approach to this at an earlier stage it is noted that some monitoring of KT has been in place since ~ 1994 and further improvements are underway.
7. Recognition that university IP needs monitoring and provision of IP courses for new academics (via Oxford Innovation). However, a more pro-active approach in seeking solutions could be considered.

Proposed Development Areas

1. Breadth and degree of buy-in to KT across EPSRC: EPSRC indicated that KT is embedded in its activities, staff and programmes and that a dedicated KT team was not necessary. However it was difficult to assess the degree of change across the main research investment areas to enhance exploitation and the scale of buy-in across EPSRC is not clear.
2. Funding the complete process from research initiation to exploitation: EPSRC primarily target the lower 'Technology Readiness Levels' (see Annex 6). They see their role as knowledge creation and supporting its transfer to users but that they are a minority player at the exploitation and commercialisation stages i.e.

²² As is ESRC, AHRC

²³ There are many forms of demonstrator; the emphasis here is industrially aligned and industrially defined in consultation with research staff. A key issue is that demonstrators are planned and allow the university teams to see their work delivering value via a demonstrator providing a *clear but flexible research direction towards an end-user need*.

‘hands-off’ with respect to a number of issues relating to delivering value. In this context their KT vision statement can be misleading. Such an approach is fine in an ideal world with the funding sources joined up and with appropriate end-user involvement throughout. However, the complete process requires different sources of funding for different stages and opportunity for end-user influence is variable and constrained. This presents a number of potential failure points decreasing the probability of completing the process. Many businesses cannot justify involvement. This is not unique to EPSRC (see Cross-Council section).

3. Large scale block grants: Concerns exist around the value delivered from these multi-year grants (e.g. IMRCs, CTA’s) relating to how they are distributed within a university and monitored thereafter. In many cases the managed involvement of business is after key investment decisions are made decreasing their ability to influence.

8.21 ESRC KT team engage broadly in the KT agenda, and as part of its KT strategy this Council invests more effort into partnering arrangements such as concordats, primarily with policy users of ESRC output and with wider KT schemes. In its presentation to the Panel we heard a number of positive impact measures of ESRC schemes and their recognition that they had more knowledge than technology to transfer, although the team did appear under resourced²⁴.

8.22 ESRC has developed its own definition²⁵ of KT and this places an emphasis on social networks. ESRC works with Government Departments, through 14 strategic agreements (Concordats) to facilitate knowledge transfer. It is currently planning 15 policy seminars in 2006 on topics identified by these Depts. We support ESRC's placement schemes into Government Departments and business which will aid KT at a fundamental and human level. Whilst many Councils use concordats, we believe that this ESRC approach to foster working relationships and understand user needs²⁶ should be adopted more widely to provide an important link to understand policy needs and to complete the feedback loop in policy formulation.

8.23 While significant progress has been made on KT within the ESRC and with some users there is still a long way to go in embedding KT in both user communities and academics. Progress made to date reflects the energy and determination of a small pump priming team working across a very broad canvas. This can only take KT so far and there will be a need for a dedicated strategy to ensure continued efficiency and effectiveness.

8.24 The Panel is of the view²⁷ that barriers include the unwillingness of many academics in receipt of ESRC funds to appreciate the responsibilities they should hold for KT and to participate in constructive engagement; the varying ability of users to receive KT and to participate in the necessary two way relationship to articulate knowledge about their own requirements and organisation.

Areas of Best Practice

1. Interfacing with government - concordats based approach to relationship building, although its extension to industry would be more in line with the primary objectives in the 10yr plan
2. Using Troika style meetings to seek user views of grant investments
3. Developing a network of retired business professionals to develop them as intermediaries with users
4. Programme managers also have KT responsibilities
5. Role of the Communications and Information Committee in promoting interaction with user groups
6. A good example of best practice in engaging with policy, and adoption of knowledge transfer (versus technology) in the broader sense
7. Proactive in developing their KT strategy, and clearly had a good understanding of their end users and customers
8. A wide variety of measures implemented, and how the measures fed into an overall coherent KT strategy was demonstrated
9. A great deal of recent progress in new initiatives was demonstrated

Development Areas

1. Partnerships with industry
2. Taking a lead on establishing best practice in management of knowledge creation and transfer with a view to delivering value to the UK economy and industrial sector

²⁴ Subsequent to the December 2005 meeting, we understand that 4 staff in Research Training and Development Directorate are being allocated 33% of their time for KT activities

²⁵ "Involves process of generation and translation with interaction between creation and practice that occur in organisational settings in which social networks are important"

²⁶ ESRC has conducted surveys amongst stakeholders to assess their awareness of ESRC, the services it offers and areas for improvement. The ESRC has also coordinated other surveys e.g. attendees at the Social Science Week events; among concordat partners; among local authorities; among workshop and seminar attendees – all of which are designed to improve knowledge transfer pathways so that policy and practice can be enhanced

²⁷ This point has been checked and upheld with the Panel

3. Small KT team but less of a problem if KT is embraced across all staff and funded researchers
4. Recruitment of staff with business backgrounds to boost the KT activities. ESRC have been trying to do this but are experiencing a problem with respect to salaries.
5. Collaboration between ESRC and AHRC could be increased as the nature of their research has obvious linkages. AHRC could benefit a great deal from ESRC's more established expertise in KT.

8.25 MRC made an early start in active IP management and now has a strong record in Technology Transfer developed over the last 15 years. Creating jobs in spin-out companies and generating significant commercial income (more than £200 million since 1985); it is seen as a leader in its field and recognised internationally. The Panel recognise that, in addition to the royalty revenues, TT has facilitated the availability of key healthcare products, e.g. Herceptin²⁸, Humira²⁹, Synagis³⁰, and Xolar³¹ etc. The use of information derived from clinical trials that the MRC supports is an important form of KT. However, it can be difficult to measure the impact of these medicines in human terms, but measurement might be possible from patient benefit that the NHS regularly measures. Such a measure should be attempted in order to let policy makers see how the long term benefits of KT can eventually be translated into important benefits for the public.

8.26 The nature of the industrial sectors served by MRC means that industry has always pushed for scientific research excellence. The sophistication of the pharmaceutical and biosciences industries, with natural two-way recruitment between academe and industry, has facilitated the interface with the MRC although on occasion this interface has not been straightforward. In addition, the MRC has continued to support research in areas of un-met medical need such as orphan drug status diseases, and the needs of the developing world and MRC's TT activities also embrace this research.

8.27 MRCT (MRC's exploitation vehicle) has demonstrated good financial management of funds and developed creative funding vehicles to pursue KT targets. Wider cross RC working could be more proactive, but MRCT's support to Praxis (Technology Transfer courses) has been good for building relationships with bodies outside the RC environment.

8.28 The move to develop its own drug discovery group is a measured risk and in response to prevailing market conditions in the Pharma industry. By taking early stage compounds through further rounds of the drug development process and assembling a portfolio of potential lead compounds, MRCT hopes to better address the market needs and help novel compounds reach clinical development, in partnership with industry, earlier than would have otherwise been possible.

Areas of Best Practice

1. Regular meetings with University counterparts to discuss grant outputs.
2. MRC funding is streamlined into centres of excellence which reduces risk of lower attention to KT exploitation
3. Evidence of clear links from basic and applied clinical research through to KT/TT and patient benefit
4. Strong evidence of exemplary technology transfer
5. Taking managed risk in developing a drug discovery team.
6. Industrial consortium approach (Dundee) considered to be a useful model and may be replicated elsewhere

Development Areas

1. Consider the balance of KT and TT activities in order to determine whether there is scope to derive further benefit from KT
2. Could work more closely with other RCs to promulgate best practice and learning from partnership creation and management.
3. Focus on wider KT objectives including people transfer at fellowship level. Explore barriers and incentives when developing solutions to this
4. Translational research is an area in which the UK can be leading. The MRC is well placed to maintain cohesion of strategy with DOH. It will be important to ensure that clear delivery plans maximise the impact of the new funding

²⁸ FDA approved drug for HER2 protein over-expressing metastatic breast cancer

²⁹ First fully human monoclonal antibody approved for rheumatoid arthritis

³⁰ To prevent viral respiratory infection in premature babies

³¹ Treatment for severe Asthma

8.29 NERC has 4 research centres³² that generate IP owned by NERC. The director of each centre is responsible for driving this agenda and agreeing performance targets - the achievement of which are facilitated via a central hub team. In an effort to move more rapidly and import late stage commercial skills thought to be lacking, NERC have formed partially risk-reward based partnership with ISIS Consulting.³³ ISIS conducted a systems audit in the first 3 months of the relationship and we understand that ISIS is active at the NERC sites. However, NERC maintains its scouts and continues to lead on trawling for IP in its centres, assessing ideas and opportunities to bring to ISIS. The Panel's view is that NERC has still retained perhaps the most difficult part of the KT process. The relationship has yet to bear fruit, and we await the Output 2 data mid 2006 to see if after 1yr the relationship has made progress. NERC's ownership of the KT process was not clear to the Panel.

8.30 NERC considers informing policy development an important part of its work and it is currently recruiting a "science into policy" facilitator for this purpose. This however does not figure in its Output 2 measures and we believe highlights where Output 2 criteria are missing certain types of KT activity (for all RCs).

Areas of Best Practice

1. Awareness raising with one-to-one meetings with scientists and scouts
2. Branding of solutions through prediction model help users identify with type of KT approach offered by NERC
3. Science and Financial directorates overlap to cover KT activities
4. Developing cultural change at some institutes (British Antarctic Survey)
5. Partnership approach is strong with EPSRC and DEFRA

Development Areas

1. A more committed approach with a ramp up in the scale of activities should be considered.
2. User business community consists mainly of SMEs many of which do not conduct R&D; NERC could use greater engagement with RDAs to promote KT and develop better user links
3. Consider using commercial knowledge developed at BGS to help commercialisation at CEH and POL
4. Data sets are one of NERC's greatest assets. Explore ways to gain maximum value from this resource; consider making the data freely available or selling / licensing data.

³² Include 14 locations

³³ Part of ISIS Innovations, the exploitation arm of Oxford University

8.31 PPARC requires strong working relationships with its user base to provide for its researchers' needs and effective communication to industry at large to demonstrate the wider industrial relevance of its programmes. However the technology base in the UK for PPARC's science is fragmented and this is a key impediment to KT. PPARC have therefore identified that it is important that they support the development of leading edge technology, including their own specialist industrial suppliers, simultaneously helping to build the skills base and capabilities of relevant UK companies. This is a powerful means of transferring knowledge and the Panel applauded this approach. PPARC is also influencing the DTI's Technology Strategy team to address some of these issues. This includes working with instrumentation companies, which are not recognised as a sector in their own right and companies who specialize in specific applications of technology. DTI's strategy is aimed at more traditional sectors and such smaller specialist companies can often fall through the "gaps" (DTI Sector Groups). PPARC have developed KT schemes to address this particular problem (PIPSS), which can reach sectors not traditionally supported. Other RCs may wish to consider adapting aspects of PPARC's approach for the sectors that they deal with.

8.32 Like NERC, PPARC have contracted with a 3rd party (Qi3) to provide specialist commercialisation skills (marketing to these industries), but the contracted individuals are fully integrated into their team and there is learning and sharing and the relationship appears to be working well.

8.33 Many PPARC projects are large and long term with supporting Technology Roadmap. This allows for a well structured and carefully considered KT activity to be built in as a fundamental part of PPARC programmes. For example, sensor development has been identified as a core requirement and there has been a successful transfer of imaging device technology to wider applications, including medical.

8.34 The Panel felt that there was strong and well communicated integration between Council strategy and KT implementation programmes. The measures being taken by PPARC therefore seemed appropriate. This was exemplified by the new advanced instrumentation component of the Sensors KTN in development with BBSRC, CCLRC & UKAEA. The Panel supports this kind of greater cross-Council working (where appropriate) to further KT objectives and outputs.

Areas of Best Practice

1. Enable researchers to see the fruits of their labour through to application, delivering value and impact by providing funds for the development of advanced technologies to high technology readiness levels and integration into complex engineering systems and products
2. An understanding of the complete process from research initiation to application, demonstrated, in particular, through large and long term projects.
3. Direction and purpose for knowledge creation and transfer – high level drivers and goals with clarity of direction for all stakeholders – providing a significant incentive for the best academics to apply their intellect – profile and prestige are key human drivers, not just funding.
4. Culture – a good culture appears to prevail, driven by the areas noted above.
5. Utilising technologies and outputs for multiple applications. Although the scale of this was not clear it is an area which should be explored, grown and extended across other RCs to optimise the benefit from research investment.
6. Technology brokering – the KITE club – already demonstrating its potential for impact
7. Funding schemes for business-university partnering: Promotion of business opportunities to industry, particularly creating opportunities for academics and industrialists to work together, with no financial burden to industry. This is particularly important at the low TRLs (see annex 6) - usually no one is prepared for industry to be involved at this important stage.
8. Balanced approach to the industrial and academic stakeholders i.e. stands out amongst the research councils with respect to allocating their limited resource between universities and industry.
9. Future programmes will incorporate plans for KT and outreach
10. Track record of monitoring grants using oversight committees
11. Consider use of KT within peer review mechanism, this should improve the extent to which KT is embedded

Development Areas

1. Despite having one of the better cultures towards delivering benefit, the knowledge base within PPARC would benefit from a more balanced approach to recruitment from across the stakeholder base. In common with the other RCs, few industrially experienced staff are recruited.
2. Small FTE resource even including Qi3 help.
3. Indicated that they thought they had put in place mechanisms to deliver the step changes and needed time to make this happen. Therefore, now they need to ensure that they have a robust mechanism for gaining feedback during the implementation process and that key learning points are shared within PPARC and across the RCs and with RCUK.

9. Summary and Conclusions

The progress made by the RCs is acknowledged and best practice examples are described in section 6. There are examples which should be followed and *scaled up*. However, in the spirit of the ‘External Challenge’, the focus for this conclusions section is ‘How can we do better?’

9.1 Knowledge Transfer is a broad umbrella heading and, in its entirety, is not well understood. Knowledge Exploitation is broader requiring far more effort to address. The interpretation of KT is the source of considerable misunderstandings. Indeed, it is not surprising that knowledge transfer for Life Sciences is often quite different to KT for large engineering companies. We are good at some aspects of KT but it would put UK competitiveness at risk to assume that this is true for all aspects of KT. There are areas that are quite immature globally and addressing these could present a real opportunity to enhance UK competitiveness or present a real threat if we have to follow others. Underlying much of this is efficient transfer of research output into business capabilities to address market opportunities. Although this has to be approached through a range of measures and formulas, some generic features can be identified. A proper understanding of Knowledge Transfer, its parameters, its dimensions, its scope, its scales and its dependence on knowledge creation is of particular importance to UK competitiveness.

9.2 The RCs work in an environment influenced by many. Historically, assessment criteria and career progression have put far greater emphasis on quality and publications rather than relevance or economic impact. The latter requires *awareness of end-user requirements* so that academics can evolve and align their skills with the needs. If this is not readily available, the academics will simply focus on the next publication, relevant or not, driven by RAE ratings. The responsibilities to change this inertia in the system lie across a number of bodies, including UK businesses, many of whom need persuading to come to the table. However, the funding bodies are in a key position to influence change.

9.3 All Research Councils (RCs) have made real progress in Knowledge Transfer with some leading examples of best practice and KT champions in each RC. *Best practice examples are described in section 8.*

9.4 There is little doubt regarding the strength of capabilities in our universities and that they could bring far greater economic value to the UK.

9.5 The inertia of the system - the peer review process and the RAE assessment make it difficult to plug gaps in our university skills base and to evolve university skills to meet business needs. This has also led to continued funding of mature areas at the expense of poor funding of immature areas. It is difficult to find reviewers for new areas and the RAE pressures university staff to publish, which is most easily done in the areas that they are most familiar with. *Business has no choice but to evolve to meet market needs whereas the UK system supports inertia in universities.*

9.6 Understanding the complete process from research initiation to application – Particularly in view of the focus on KT, an enhanced understanding of this process needs to be more widespread across RC staff. The process itself varies in maturity across disciplines and sectors and is worthy of study in its own right to enable adaptation and optimal management of the process for different circumstances. More detail is given in Annex 6.

9.7 Funding the complete process from research to application – Funding the early stages of research, historically the territory for the RCs, appears to be well served. Funding of the intermediate and later stages, moving towards exploitation, is less clear. The full process usually involves a number of funding sources (e.g. RCs, HEFCE, DTI, RDAs, EU, and industry) as depicted in some RC presentations. It is no surprise that the cycle is rarely completed and that many businesses cannot justify the effort to get involved with universities and join up the different stages involving a number of proposals to different bodies. See Annex 6 for further discussion.

9.8 Far better alignment between end-user needs and the research directions of universities is needed if business is to increase its investment into universities. The RCs could help break this ‘chicken and egg’ situation. There is a strong perception in the end-user community that the percentage of funding steered by end-user needs is far too small with beneficial impact too dependent on serendipity.

9.9 Profile and presentation – Although diversity has to be accommodated, more coherence and packaging of the KT initiatives would aid the presentation not only for the end-user community but also for the universities. The perception is that there is not strong visibility of this focus on KT either in universities or the end-user community. Many are simply unaware. Emphasis on KT and KE could be achieved in a number of ways. This could include:

- Changing the name of the RCs e.g. Knowledge Processing and Innovation Councils
- Coordination through a central unit with sufficient independence to drive the agenda and set the infrastructure e.g. introduction of a Knowledge Exploitation Department in government or a Knowledge Exploitation Council.

9.10 Whether progress to date is sufficient to deliver a *step change in economic impact* is a matter of judgement. This is strongly influenced by the scale of the activities and the buy-in from sufficient numbers of RC staff, many involved in Knowledge Creation (Research) activities, the main investment area for the RCs. A key indicator for this judgement is acknowledgement from the end-user community (e.g. business and industry). More has to be done to get more consistent end-user acknowledgement of real impact. End-user perception needs to be addressed. This should be through greater buy-in from all RC staff, building on and enhancing the best practice examples and developing new approaches.

9.11 Research Project Management – Although this should not be applied universally to all research projects and investments it is a fundamental requirement to steer research towards goals associated with end-user requirements and delivering value to the UK economy. The prevailing culture of working towards the next publication does not require project management. Its relative absence does not encourage industry to invest in universities or align with RCs. For some sectors and disciplines this is an area of distinct difference between the US and the UK. The RCs could take a lead in this area by establishing and promoting best practice in project management, which has many facets e.g. by teaming and funding some of the UK's best Management Schools in collaboration with business, where much of the knowledge exists.

9.12 Step changes in people flow should be considered. People flow between organisations through a variety of mechanisms, encompassing both permanent and temporary appointments (secondments) is a key mechanism for knowledge transfer and effecting change on cultures. However, it is noted that the RAE assessment often presents a significant barrier for the flow of high calibre industrialists into permanent university positions. Universities often want to recruit people who can immediately boost their RAE ratings and the industry focus is somewhat different.

9.13 The balance of investments across small, medium and large problem areas should be reviewed. The perception is that it defaults to the 'small problem culture', which drives granularity in investment and limits resources available for medium to large challenges that could impact on the economy

9.14 Business/industry-aligned demonstrators – The type and characteristics of the demonstrators are important. There are many forms of useful demonstrator. However the emphasis here is on alignment with business or industry and delivering beneficial impact. These are relatively few in numbers. Demonstrators have many advantages including adding clarity to the end goal, providing incentives to the academics in terms of seeing the benefit derived from their efforts and raising the profile in the public sector.

9.15 The panel's tasks included assessment of the progress that RCs are making in their individual KT activities. There are examples of excellent TT, for example in new medicines which could have major impact on public health. Some Councils are taking measured risk in developing their KT abilities in association with other parties like ISIS and Qi3. These are good examples of using skills from outside of the RCs and reflect a desire to progress the route of commercialisation. However, this is only a small part of the overall picture.

9.16 Government has indicated the importance of KT as part of each Council's mission and accordingly set Departmental PSA³⁴ targets. However, we have not seen the parameters and criteria used by each Council to set its strategy, nor how this will be subsequently managed to provide deliverable benefits to the user community or the country's economy and quality of life. The impact of KT back onto research strategies was

³⁴ Public Services Agreement

unclear e.g. such that results can be quickly transferred to industry and into products and services, or into government and its policies. For the future it is important that each Council clearly articulates its vision.

9.17 For the RCs to support the UK business and economy to compete more successfully in today's world, KT strategy must be integrated into the body of a Council's research plan and overall objectives, and this must be articulated to users. KT is a two way process and although the remit of this review was to look at the RC KT work, the Panel emphasizes the importance of end-user requirements, explicitly referenced in the objectives from the DTI Innovation Report. The user's needs are critical to the successful transfer of knowledge. There is a strong perception in the end-user community that the percentage of funding steered by end-user needs is far too small.

9.18 KT can occur in unexpected ways through interaction between people. The more interaction, the more likely it is to occur and simultaneously stimulate innovative thinking. This interaction requires time. It can be hard to make it happen and there is no single formulaic approach that is guaranteed to work. What is needed is encouragement, permission and funding to support people spending time engaging in KT activities, both transmitting what is available for transfer and listening to what others are saying. This will increase the likelihood of useful KT happening and it is very much a question of doing things that will increase the probability of success. Unfortunately, this kind of activity is usually squeezed out in drives for efficiency! We must get away from KT being seen mainly as a 'laying out your wares on a stall' activity.

9.19 Feedback from the user communities should be incorporated into Output 2 assessments of the respective RC's KT activities.

9.20 The RCs should regularly review their current KT programmes to assess their user needs. Where there is clear evidence that a scheme is no longer needed, cancellation should be viewed as a strength and not recognition of failure.

10. Annexes

Annex 1: Panel Membership

Panel members were nominated by the Research Councils to RCUK as having the necessary expertise in their sector and a good understanding of Council activities.

External Challenge Panel membership:-

1. Prof Richard Brook OBE, President of SIRA Ltd
2. Ms Hilary Chilton, Advantage West Midlands
3. Ms Barbara Doig, Chief Researcher, Scottish Executive
4. Prof Brigid Heywood, Pro Vice Chancellor, The Open University
5. Dr Stephen Hill, DEFRA
6. Dr Adam Kowalski, R&D, Unilever Ltd. (Panel Co-Chair)
7. Prof John Murphy³⁵, BAE Systems Ltd., Chairman of CBI's ICARG (Inter-Company Academic Relations Group), (Panel Chair)
8. Dr David Owen³⁶ OBE, ex CEO MRCT (1990-2001), Chairman Ploughshare Innovations Ltd
9. Dr Bruce Smith CBE, Rainbow Seed Fund, and previous Chairman of ESRC (1994-2001)
10. Ms Julie Tam, Economic Advisor, DTI
11. Mrs Jackie Wilbraham, Director R&D Science Policy, AstraZeneca Ltd. (Panel Co-Chair)

Rapporteur: Mr. Alan Driver, Partnerships UK

³⁵ John Murphy was unable to attend the initial two day set of presentations in December, 2005 and these sessions were chaired by the Adam Kowalski and Jackie Wilbraham.

³⁶ Dr David Owen contributed to the early stages of the activities but decided to withdraw from the Panel, confirming this on 24 Mar 2006.

Annex 2

Terms of Reference for the Research Councils UK External Challenge Panel

The aim of the External Challenge Activity

- i Provide Research Councils and OST with an independent, external assessment of the strength and breadth of each Council's current portfolio of knowledge transfer activities and their plans to increase their rate of knowledge transfer and the level of interaction with business – taking account of the history and evolution of knowledge transfer activities and the resources available to Councils.
- ii Establish a baseline for future assessments.
- iii Identify best practice and opportunities for improving the effectiveness and efficient delivery of Research Council knowledge transfer activities, both individually and collectively.
- i Inform future Spending Reviews.

Duties of the External Challenge Panel

- i The panel will consider the knowledge transfer and business interactions activities of each Research Council in the context of Recommendation 3.16 of the DTI *Innovation Report (2003)* and *Science and Innovation Investment Framework 2004-14* (chapter 5, paragraphs 5.32-38)
 - The Innovation Report can be found at: <http://www.dti.gov.uk/innovationreport/innovation-report-full.pdf>.
 - The Science and Innovation Investment Framework 2004-2014 can be found at: http://news.bbc.co.uk/1/hi/shared/bsp/hi/pdfs/science_innovation_120704.pdf
- ii In assessing the activities of each Research Council and making recommendations it is important that the Panel recognises the diversity within Councils' knowledge transfer portfolios. This should take account of:
 - breadth of science and research supported;
 - particular characteristics of each Council's user communities;
 - size of Research Council budgets;
 - resources available to undertake the knowledge transfer activities;
 - history of each Council's involvement in knowledge transfer
- iii The Panel is asked to provide a critique of individual Research Council's current and planned knowledge transfer and business interaction activities. The Panel is specifically requested to:
 - Consider, in the light of (i) and (ii) above, whether current and planned knowledge transfer activities (including interaction with users) are appropriate and on course to deliver Councils and Government's objectives for knowledge transfer and innovation;
 - consider the efficiency and effectiveness of the current and planned knowledge transfer activities and the extent that they achieve value for money;
 - comment on those areas where performance is particularly good;
 - identify those areas where there is scope for development/improvement;
 - identify any remaining barriers to innovation practice appropriate for Research Council intervention.
- iv When considering the knowledge transfer activities of each Research Council, the Panel is asked to be mindful of suitable opportunities for adopting a more 'joined up' approach cross-Council. The Panel is requested to consider:
 - generic themes which emerge cross-Council;
 - areas of best practice and the processes and procedures for sharing knowledge cross-Council. The panel should critique the extent that these exist and where there is scope for improvement;
 - the current cross-Council schemes and comment on the extent that these are considered to work well and identify areas where there is room for further improvement;
 - the extent that there is scope for additional cross-Council collaboration.

Annex 3: Definitions of Knowledge Transfer

Although it is recommended that a more thorough understanding of KT in its entirety is needed before settling on a definition the Panel suggested the following definition as an interim:-

“Knowledge Transfer means the two-way transfer of ideas, research results, expertise or skills between one party and another that enables the creation of new knowledge and its use in:
→ The development of innovative new products, processes and/or services;
→ The development and implementation of public policy.
Knowledge transfer will encourage the dissemination and assimilation of knowledge and stimulate engagement between wider society (including business, government and public) and the research community.”

The above definition makes the generators and users of knowledge more generic (parties) and emphasises the use of “new”.

Included are: inherent is the idea that it is new and not old; technology, ideas, mathematical theorems, devices, equipment, know-how, designs,

Ramifications are: influencing policy decisions which can take into consideration science into society (medicines use), development of novel programmes of research,

Not included are: previously known information or that has been in the public domain; communications policy, ethics policy

RCUK’s KT definition

Knowledge Transfer encompasses the system and processes by which knowledge, expertise and skilled people transfer between the research environment (universities, centres and institutes) and its user communities in industry, commerce, public and service sectors.

NERC’s KT definition

For the purposes of the Knowledge Transfer Fund, the term knowledge transfer covers the processes by which knowledge, expertise and skilled people transfer between the NERC science base and its user communities to contribute to the economic competitiveness of the UK, effectiveness of public services and policy, and quality of life.

OST’s definition:

KT is about transferring good ideas, research results and skills between universities, other research organisations [PSREs], business and the wider community to enable innovative new products and services to be developed.

PPARC’s view

For academics - this is about using your skills and knowledge to enhance your research opportunities and business potential. For example, this could be to collaborate with industry on a project that underpins PPARC core sciences, or you may have developed a technology which, with the help of industry could be further refined not only for your benefit but to help another sector as well.

For industry - this is about using your skills and resources to maximise your business potential and gain valuable access to the wealth of knowledge within academia. For example, this could be developing partnerships with academics in order to bid for valuable contracts available through core science projects. Alternatively, it could be joint working with an academic to develop mutually beneficial technologies.

Alberta public service definition (by way of an international comparator)

Knowledge transfer is a systematic approach to capture, collect and share tacit knowledge in order for it to become explicit knowledge. By doing so, this process allows for individuals and/or organizations to access and utilize essential information, which previously was known intrinsically to only one or a small group of people.

Annex 4: Panel's Views on this Process

A4.1 Comment

This review was run for the first time. The External Panel, which provided voluntary unfunded effort, believes that the RCs had unrealistic expectations of what could be achieved from such a rapid review. Following the presentations on 1st, 2nd Dec 2005, the RCs expected a report to be written including an analysis of their schemes and delivery plans. However, the Panel's terms of reference were very broad and the Panel had only one hour to interview each Council. Consequently it was not feasible to provide an in-depth assessment of each scheme. Also, it was considered more valuable to direct the limited effort towards higher level strategic issues such as strategic planning and scale of impact on business / end-user requirements, which would be more in line with assessing the progress against the government objectives

- Increased level of business interaction
- Increased rate of KT compatible with end-user requirements.

Even so, the Panel had to accommodate a significant amount of effort within fairly short timescales and a number of useful suggestions have evolved.

Reviewing eight different bodies under one banner has highlighted the difficulties for the Panel in providing a single view about KT without these becoming eight separate reviews. We spent time discussing mechanisms when we wanted to discuss strategy and where KT needed to be in the future.

Driven by the DTI Innovation Report and the 10 year Science and Innovation Framework document, this review of the Research Councils was organised and run by RCUK, a secretariat primarily staffed by the RCs. Despite this the Panel has taken a robust independent line through the extended interactions with the Research Councils and some valuable suggestions have evolved. However, future reviews might wish to establish more transparent independent process e.g. responsibility placed with an independent body and findings reported to the relevant government department (DTI/HMT/DfES).

A4.2 Procedure

- The Chairman and rapporteur meet with RCUK in November 05 to discuss RCUK's requirement to conduct an independent challenge review of the RC's KT activities.
- The Panel was assembled by RCUK; Panel members were nominated by RCs.
- Dr Kowalski and Dr Wilbraham shared the role of Chairman for the December 05 meetings as Prof Murphy was unable to attend for personal reasons
- The Panel was given the delivery plans, and 6 page reviews (Annex 7) of supporting data three weeks before the 15 minute presentations by RCs followed by 45 minute Q&A session with each.
- A summary note of the Q&A was provided to the Chairs by the rapporteur by 4 December followed by draft version 1.0 of the report to the Panel (with the amended Q&A) on 12th December 05.
- A draft report was given to RCUK on 12 January 2006 for comment. A presentation of the Panel's findings (thus far) was given to Sir Keith O'Nions (OST Director General of the Research Councils) on 23rd January 06 by Prof Murphy, Dr Kowalski, and Mrs Wilbraham (rapporteur was in attendance), at the request of OST.
- A second meeting with the 8 RCs' KT members was offered to enhance the degree of interaction and the content of the report. The timescale pressures made it difficult to establish a full Panel follow-on meeting and RCUK welcomed the suggestion that the Panel Co-Chairs (Prof Murphy, Dr Kowalski and Mrs Wilbraham) meet with RC representatives. Even then, Dr Kowalski was unable to attend and Prof Brigid Heywood attended instead. The meeting, on 3rd February 2006, was structured around a set of questions provided in advance. All Panel members were asked to contribute questions and the RCs had the option of providing verbal or written responses.
- A revised draft, which incorporated some feedback from the 1st draft, was issued to RCUK on 20 February. Councils provided further comment.
- A 'close to final' version of the report was made available to RCUK on 22nd March 2006 with the final version being targeted for end of March 2006.
- Prof Murphy, Prof Brook, and Dr Doig attended a House of Commons S&T Committee meeting on 29th March 06 to give formal evidence from the report.

A4.3 Panel composition

Noting the objectives (see A4.1 above) members of the Panel should be drawn from the business / end-user and knowledge creation and transfer community to appropriately reflect the stakeholder base. Although KT experts should be involved it is emphasized that KT in its entirety is not well understood and the experts may only cover some aspects of KT. In particular it is the evolving and weaker areas that need attention. Although international members should also be considered, it is noted that some aspects are weak globally and addressing the weaker areas could aid UK competitiveness.

A4.4 Panel size

For this approach the panel size was considered to be right (at around 12 members). However an alternative approach would be to establish small panels for each Research Council with an agreed process across these panels and pulling the outputs together at the end of the process.

A4.5 Frequency of External Challenge meetings

There were different views on this. One body of opinion was that every two years was enough to measure changes in KT objectives and performance and that the next and subsequent External Challenges, should take place prior to the OST's Spending Reviews in order that any recommendations from the Panel might be taken into consideration for that spending round. Another body of opinion was that, in view of the importance of this and the size of budgets involved, some form of ongoing monitoring is needed rather than continue to use the budget ineffectively. A combination of the two should also be considered – some form of continuous monitoring will improve the probability of successful reviews.

A4.6 Engaging with RCs

In consideration of the high importance given to KT by OST and HMT, and that KT is part of a Council's mission statement and also part of the job description of the CEO, it was considered that for future External Challenge meetings the Council's CEO should present the Council's KT progress to the Panel. They should be accompanied by their Director's of KT.

A4.7 The process

A format for consideration for future meetings is:

- The review's terms of reference would be agreed in advance, and the scope of the final report agreed in advance;
- KT Progress reports would be submitted to RCUK and on to the independent body responsible for the review in advance of the Panel meeting;
- In advance of the meeting, the Panel should agree a core group of questions to be posed to each RC (which they see in advance) which are based on the supporting information and delivery plans;
- Stage 1: Council CEO to meet and discuss with the Panel the Council's KT progress against plan with particular attention to the Council's KT strategy;
- Stage 2 (same, or another day): Council's KT Team to meet and discuss with the Panel operational progress against the KT plan;
- Pre-agreed panel members would lead discussion on pre-agreed RCs, and the panel member would draft that Council's part of the report;
- No presentations, just a Q&A format of an hour in duration
- An independent body should manage, and be responsible for conducting the review; and,
- The Panel's final report would be made public, and subject to FoI.

Annex 5: A Vision for the Future

A5.1: As part of this External Challenge on the Research Councils' progress in KT against the objectives of the Innovation Report, some *initial* thoughts on a vision for the future are provided. The responsibility to *mature* and move towards such a vision is shared between the RCs and other bodies. Although it is recognised by both business and universities that the RCs are in a key position to influence the agenda, there are other key funding bodies in the UK who have a key part to play. Although this vision may not present many surprises, it is included because it is not unrealistic but we have some way to go to achieve it. The details of implementation could be the subject of a follow on exercise *but first the key stakeholders should debate and refine the Vision*. It was not possible to do this within the External Challenge exercise because of the constraints on the timescales and resource. Such an important topic needs careful consideration with appropriate resourcing.

A5.2: The **Primary Goals** for the **Vision** are:

- Far higher degree of integration of end-users, funding body staff (e.g. research council staff) and university teams i.e. directly aligned with the 10yr plan objective 'Increased level of business interaction'
- Enhanced delivery of impact and value to the UK end-user community i.e. directly aligned with the DTI Innovation Report objective 'Increased rate of KT compatible with end-user requirements'

This can be achieved through the aligned goals of producing step changes in the following areas.

A5.3: Strategic Considerations

- The scope, scales and continuity of KT required for different needs
 - Schemes need to be in place to accommodate the spectrum of needs. The range in scale and continuity of KT activities should reflect the range of needs and should come in many formats including short courses and long term partnerships to facilitate continuous transfer of knowledge to maintain a global company's competitive advantage.*
- Utilising the knowledge created - putting it where it is needed
- Balance of investment between knowledge creation and knowledge transfer, including greater consideration of KT throughout the knowledge creation process which also requires funding i.e. research could cost more to get the output better tuned for utilisation
 - The existing system is perceived as producing a substantial quantity of research deliverables that are not used and we are continually adding to this with our mode of investment. With a different approach more research investments could be headed in directions that will result in KT and create value.*
- Skills development by RC schemes through universities via linkage to leading edge projects
- Balance between high profile leading edge projects and responsive mode
- Integrated approach to the needs of users
- Coverage and management
- Major RC activities that need to change to influence the KT goals
 - Ownership, staff awareness / involvement / buy-in

A5.4 Culture, Environment and Staff

- Unambiguous to the complete stakeholder community that the Research Councils care about impact and value
 - The current perception amongst many university staff and end-users is that the RCs allow recipients of their contracts sufficient flexibility to side-step delivery of impact and value or address it superficially. Although it is in most mission statements its implementation is secondary leaving the 'nice to have but not essential' perception. The perspective from a number of universities is that Research Councils have little interest after awarding grants.*
- *Joint appointments* to senior levels across any of RCs, universities, industry, DTI, MOD etc to initiate and drive partnerships

- Step change in *people movement / secondment schemes* between RCs, universities, industry, DTI, MOD etc at all levels
- Balanced RC staff recruitment to a senior level - more end-user community
- ‘Research Council’ - change name to reflect delivery of ‘impact and value’ as well as quality research e.g. Knowledge Processing and Innovation Councils. An alternative approach would be to introduce another body to address exploitation of RC output e.g. Knowledge Exploitation Council or Department³⁷ (in government).

A5.5 Knowledge Base and Skills within the Research Council Staff

- Balanced to understand how to deliver impact as well as quality
- Balanced recruitment from the entire stakeholder community.

A5.6 Visibility, Awareness and Openness across the stakeholder community

- Awareness within the RCs and Universities of the requirements of UK industry and Economy
Addressing this is fundamental to aligning our best university capabilities with some of the key problems for the UK and ensuring that the knowledge is fit for purpose. The RCs would benefit from knowing these and could play a key role in promoting them across the university sector, even offering calls for proposals to address them.
- Stakeholder Enhanced RC / University awareness of and delivery against - Priority consultation, bandwidth of communications, available resource
 - To inform before key decisions
- Awareness within the stakeholder community of a coherent package of measures from the RCs to ‘deliver value to the UK’
- Involvement and consultation with the appropriate stakeholders before key investment decisions are taken

A5.7 Funding Opportunities / Mechanisms

- For academic staff that want to work on challenges that will deliver **value / benefit** as well as **quality**
Feedback from many universities that partner with industry shows real enthusiasm to deliver relevance and value as well as quality. The minimum requirement here is the balanced pairing of the knowledge creator and receiver with the latter being somewhat more than the token local industry. The pairing is usually needed at the beginning
- Funding opportunities for people movement – integration of teams
This provides a more integrated approach to iterate towards a ‘fit for purpose’ solution. The solution comes from the team not just the university component of the team.
- Knowledge Initiation *catalyzed* for later take-up – involvement of end-users from the start
Most research is started with little consideration to the use or value of the knowledge created and when consideration is given it is often superficial or inadequate. This is when the primary direction of the knowledge creation is set, but industry, both large and small, cannot see the value at this stage and it is difficult to justify involvement and effort at this critical stage
- RC - end-user partnering to allow end-users greater influence to decide on which university teams are best equipped to address their needs
EPSRC industrial CASE awards are examples of how industry decides which university team is invested in.

A5.8 Incentives and Recognition

- For those delivering value as well as quality
As well as incentives and recognition it is important that barriers are overcome e.g. RAE assessments associated with moving out of comfort zones.

A5.9 Management

³⁷ Although this approach would provide the opportunity to put Knowledge Exploitation, with a strong infrastructure, understanding and associated best practice on the map, it would need to be joined up (see Annex 6).

- More directed / managed research programmes
Examples show that many knowledge creators welcome programmes directed towards end goals so that there is sufficient clarity of vision to direct the application of their know-how. Once these programmes are up and running they are able to spin off innovative new concepts within the relevance envelope.
- Use of skilled programme managers knowledgeable in the project area
CMI highlighted this as one of the main differences between research in the UK and North America for many key areas of research
- Management of ‘Knowledge Creation and Transfer’
 - What’s involved to optimise it - individual agendas, teams, stakeholders, psychology, objectives, incentives, finance etc?

A5.10 Although some of these areas are already partly addressed we need to take a more integrated approach with step changes that raise the level of activities and delivery and move towards a situation where it is considered unusual for industry not to be working with universities. Further debate around potential implementation mechanisms is needed and some members of the Panel would welcome involvement. A potential structure for the debate is:-

- What knowledge is needed?
- Enhanced relevance of output from the UK university sector via
- Delivery / transfer of the relevant output to where it is needed.

The vision does not assume an increase in budget but better use of existing funding. We have to be smarter than countries that have more resource than us for these activities, whether in the form of people or funding.

Annex 6: Frameworks – Structuring the Process from Research Initiation to Exploitation

The path from research initiation to exploitation can take a number of routes but it usually involves a complex process that is not sufficiently well understood by all involved. Understanding and optimising this process for different situations is at the heart of delivering greater value to the UK Economy and Business. The process can be (and usually is) split into a number of stages. Although this is useful to manage the more complex paths, the breakdown can also introduce major disconnects between the different stages. Different sets of stakeholders take responsibility for executing different stages and different funding sources have to be approached for different stages. The chances of failing to complete the process and exploit are high.

To help address this some industry sectors have introduced frameworks to provide some structure across the process. Examples include

- Technology Readiness Levels (TRLs),
- System Readiness Levels and
- Exploitation Maturity Levels³⁸.

These are also complemented by approaches such as Technology Road Mapping³⁹. TRLs, for example, are used extensively in some industry sectors, providing levels 1 to 9 with a definition of each level. They are also used extensively by PPARC. Although they add considerable clarity in certain circumstances, it is limited. The coverage of the complete process and applicability of these frameworks are strongly dependent on the definitions of the levels.

There are a number of variations on these indices or levels and alternatives can be conceived such as ‘Exploitation Readiness’ and ‘Research Maturity’, the latter being useful in the context of continued high funding of mature areas compared to low funding of immature areas.

With the emphasis on step changes in scale of impact on the UK economy from our research investments the timing is right to establish far greater clarity of the overall process ‘from Research Initiation to Exploitation’. – it is worthy of study in its own right to understand the different stages, which stakeholders should be involved when, who funds what, with the overall objective of optimising exploitation from the process.

³⁸ Examples of TRLs, SRLs and EMLs can be made available but are used in some of the RCs.

³⁹ Consult Institute for Manufacturing, University of Cambridge, for example.

Annex 7: RCs Initial 6-page Reports

This information was provided to the Panel in advance of the December 2005 meeting. It is a separate document of ~ 40 pages that is available on request.

Annex 8: Written RC responses to Panel Questions

Written responses from the Research Councils to supplementary questions posed on 3rd February 2006.

The additional session on 3rd February was structured by the Panel providing questions to the RCs in advance of the meeting. Some Research Councils provided written responses to these questions. AHRC, EPSRC and PPARC are willing to make their responses available. A copy of this report with these responses is available upon request.