

**LAMBERT REVIEW OF BUSINESS-UNIVERSITY
COLLABORATIONS**

RESPONSE FROM BNFL-17 APRIL 2003

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GENERAL INTRODUCTION

BNFL has a long established tradition of working with Universities, and we wish to fully participate in the Lambert Review. Our current main focus is developing and strengthening our links with our University Research Alliances (URAs), and we have already provided background information on these to the Review Team. However more detailed information can be provided, if the Review Team would find this useful. We have structured our response around the questions posed by the Review, and attempted to provide a useful response on all the questions.

BUSINESS-UNIVERSITY COLLABORATIONS

We would like to identify best practice and examples of excellence in business-university collaboration in the UK and abroad. Some examples of the types of collaboration that we would be interested in hearing about include:

- **Industry's use of the information contained in academic publications, and academia's use of industry patents and prototypes or vice versa.**

Because of our long-standing links with the UK Universities, we find that most of our contacts are direct and first hand. It would be surprising if we came across a new development unexpectedly in a UK based scientific journal. However, reorganisations and routine staff changes do sever established links, and the published articles are a useful fall-back. We also receive large numbers of mail-shots, including information on new courses, seminars etc, and whilst these are occasionally useful, they very often end up on the wrong desk. A balance needs to be struck between mailing direct to the specialist and experts, but who might have moved, and mailing to a central location, but creating a bottle-neck.

We find that our strong links with our URAs gives us a good intelligence network into the other Universities (both UK and abroad), and our URAs are effectively our eyes and ears into the broader academic community.

Our patents tend to relate to large scale industrial processes, and have not traditionally been of much interest or value to the Universities. Our business is fairly specialised, and we have not found much of interest in the existing University based patents.

However, on the broader front, we find the knowledge base and expertise in our Universities extremely valuable, and although we typically sub-contract 10% of our R&D into the Universities, the benefit is substantial and strategically vital to our business success.

- **Joint ventures between universities and business, for example, personnel exchange or collaborative research and development projects.**

This is by far the most important aspect of our response, and centres around setting up our four University Research Alliances. We have tried to briefly summarise the main points below, but would welcome the opportunity to discuss these in more detail in your follow-up consultations. A visit to one of the URAs is also strongly recommended.

It's worth providing a perspective on the historical background to the decision by BNFL to set up the URAs.

First, the privatisation and fragmentation of the electricity and nuclear industry that began in 1990 resulted in a rapid run-down of the nuclear R&D programmes in the UK. All the UK's nationally funded nuclear R&D facilities are in the process of being closed down, and the UK's universities have gradually removed nuclear topics from their teaching courses.

BNFL's historical relationship with the UK's Universities was also fragmented and uncoordinated. The research portfolio was a list of over 150 unrelated projects with 50 different Universities that required significant cumulative administrative and managerial effort. Although this approach was successful in addressing specific project needs, there was clearly a great opportunity for improving the gearing and leverage on BNFL's annual expenditure of £10M, and to improve cross-fertilisation between the projects, thereby achieving a much greater influence and stability from its investment.

A major rethink on BNFL's university arrangements resulted in the strategy to establish a limited number of University Research Alliances. These Alliances would cluster research around the key technical capabilities needed to run BNFL's businesses. The vision was that the Alliances would become world-class research and teaching centres, be long-term, secure knowledge bases that would support BNFL, and would create added value through collaboration between universities and industry. BNFL wanted a long-term strategic partnership, and was willing to invest both time and money to achieve its goals.

Four Alliances have now been established.

The first URA to be set up by BNFL was in Radiochemistry at the University of Manchester in 1999. This was a priority since several decades of decline in government funding (via the Research Councils) for radiochemistry meant there was a real danger that the subject would disappear completely from UK universities. The second URA was established in 2000 at the University of Leeds in the area of Particle Science and Technology. Unlike radiochemistry, which is something of a niche subject particle technology is broad based and impacts on a wide range of industries not just nuclear. The URA covers the measurement and manufacture of a range of particulate systems such as dry powders, sludges and slurries, all of which are relevant to BNFL's processes. The third URA was established at the University of Sheffield in 2001 in Immobilisation Science. This covers glass and cement technologies as well as looking at other potential immobilisation matrices such as ceramics. In 2002 the most recent URA was established at UMIST/University of Manchester in Materials Performance that will cover both the corrosion and the structural integrity of materials performing in nuclear environments, including materials such as stainless steels, zircalloy and graphite.

These four topics were selected on the basis of a thorough review that identified the technical and scientific topics, which whilst being of major importance to BNFL, would best flourish in the long-term in an externally based university alliance. Part of the strategy is that academic staff from the Universities will work and use the facilities at the new £200M BNFL Technology Centre at Sellafield, much as medical students use a teaching hospital. Staff from BNFL will also attend training courses at the Universities.

The five key criteria on which the success of the URAs are evaluated are

Leverage. The financial target is 400%. For each £1 that BNFL invests, the URA must attract £4 from other research fund-holders, including the University itself. For an annual spend of £500k per Alliance, BNFL will have the support of a total of 140 research staff, in modern research facilities established from a range of grants. It will retain all the IPR for nuclear global exploitation. And BNFL will benefit from multi-disciplinary collaborations between the URAs and other departments within the Universities.

Solutions and Knowledge. BNFL will use the URAs to carry out both fundamental research and applied R&D to solve plant operational problems, to create product improvements and assist with new plant and process design. This is probably the 'bottom line', the URAs must demonstrate their success at solving major technical challenges, and becoming an informed knowledge base for day to day consultancies.

Recruitment. The URAs will create a growing pool of graduates with nuclear training that the nuclear industry can potentially recruit from.

Stability. The URAs will be funded by 5-year rolling contracts, renewed every 2years. This will provide continuity and stability, allowing for long-term investment in both training and facilities. Other research fund holders will be attracted to the build-up of a strong research base, particularly at a time of rapid change.

Image, Reputation and Culture. The URAs are already attracting world-wide attention, being the host for international conferences, and receiving international Peer Review panels who have confirmed the research quality levels as 'world-class'. They already feature in many technical journal and publications, and have been praised in recent Government sponsored reviews into the nation's skill base. Both the Universities and BNFL have worked hard to understand each other's drivers and stakeholders.

The Alliances have already played a key part in generating solutions to BNFL's technical challenges, developing a strong image for BNFL in science and technology, and bringing nuclear subjects back onto the national agenda.

BNFL also has a Fellowship Scheme, whereby post-doctorals are seconded from Universities into BNFL for typically three years. The purpose is to implant international experts into in BNFL to strengthen the in-house R&D capability.

- **Informal contacts, for example, meetings and conferences, use of science parks, business-university liaison, industry sponsored university posts or studentships, work experience for students, business contributions to curriculum development, academic secondments in industry and provision of continuing professional development training by universities for business.**

1) We recently held the first joint BNFL-URA Conference at Sellafield. The high level objectives were

- To improve the interaction between the Alliances and their customers in the BNFL Business Units and R&T.
- To identify and strengthen synergies between the Alliances.
- To provide a forum for the Alliances to present selected research activities, both current and future plans, and to obtain feedback.

A decision was also made to limit the conference attendance to BNFL and the URA's. Although there would have been some benefit in inviting external groups, such as DTI, OST, NII and the regional development agencies to learn more about the URA's it was also important to hold a conference at which the URA's could discuss their latest achievements in a commercially private forum.

The conference was designed to be student focussed with many of the presentations being made by PhD and post-doctoral researchers. In addition a popular session of poster presentations was also held on both days of the conference. In these sessions students who had posters on display at lunchtime, gave a two minute résumé of their work to whet the appetite of the audience. A total of 44 PhD and post-doctoral students from the four URA's attended and presented work at the conference. This was a significant proportion (estimate 90%) of the total number of students active on nuclear related R&D in UK Universities and is an indication of the very rapid growth of the URA programme. And that growth is set to continue since the most recently formed URA's are still at an early stage in building up their numbers. In 2-3 years time it is estimated that there will be 140 researchers active in the URA's. This represents an important source of nuclear scientists as potential recruits both into the industry and into academia. The poster sessions were held in the Atrium of the BNFL Technology Centre (BTC) and allowed for a more informal atmosphere for people to discuss their work. Prizes were awarded to the best two posters.

2) Attendance at conferences obeys the maxim-the more you put in, the more you get out. They can be useful, or a complete waste of time. We have found that we benefit from attending conferences on a joint BNFL-URA manner, we can then exploit our Industry-Academia networks to mutual benefit.

3) All the forms of student sponsorship and exchanges are extremely useful. However they can be costly, mainly in the effort required for the organisation, and the initial familiarisation required. We are able to target the more able students for recruitment, and they gain early insights into business processes.

4) We are beginning to explore the possibilities of our URAs providing CPD training for BNFL staff, but these discussions are at an early stage.

- **Formal contracts, for example, the use of licensing, research contracts, consulting projects, establishment of spinout companies, product testing, or business support.**

We have a single over-arching contract with each URA, which sets the main business targets and the commercial and IPR arrangements. Each work package is then implemented by a simple instruction. In these early stages, a minimum funding level

is committed, but the aim is to exceed this through emerging work. The contract has a rolling 5 year timeframe to give stability and encourage long-term investments in the facilities and infrastructure.

We also maintain a centrally co-ordinated process for the contracts with all other Universities. This ensures we place the work with the most appropriate University, have a single point of enquiry for all contractual queries, and it provides background information and continuity when a new package of work is initiated.

We do not need or use Universities for business support, but believe this was a useful initiative for small companies in the HE White Paper. We do not promote spin-out companies via Universities, and have some misgivings on the long term desirability of such initiatives. A simple view would be that Universities create knowledge, and business/industry create wealth by utilising this knowledge. Universities can easily find themselves in competition with business that will certainly damage long term alliances. Are the American spinouts a joint venture between Universities and business?

- **We would also be interested to learn how the relationship came about. Were your local Regional Development Agency or Sector Skills Council involved? What more could be done to facilitate successful partnerships?**

The URAs were established after a prolonged series of discussions with potential Universities, followed by a process of competitive tender. The extended time-scales for these initial discussions were judged to be essential to help overcome the wide culture or ethos gap between business and Universities. The essential ingredients were to find business drivers and technical programmes that benefits both parties.

We did not involve the RDAs or SSCs in these early discussions. However we find that the NWDA is a helpful partner in ensuring our URAs are integrated into national initiatives such as the UK Energy research Centre, and the School of Nuclear Science and Technology.

What more could be done?

The essential factor is to have joined-up thinking between Business, Universities and Government/Government Agencies. Early discussion between all stakeholders is essential, to ensure there is a shared view on future developments. Too often there is criticism that industry has invested in a University department, only to find it's RAE rating has slipped, and it's funding via HEFCE cut.

The collaboration must be a tri-partite one between the Government funding Agencies, Business and Universities, not a series of bi-partite arrangements. Also, long term Business-University Collaborations need long term funding arrangements to create the financial infrastructure for commitment and stability. To be fair, the Research Councils are moving in this direction (eg, the EPSRC's Partnerships), but more initiatives of this type are needed.

BARRIERS TO COLLABORATIONS

If you do not have, or would like to strengthen such relationships, what are the main barriers to doing so?

- **These might include:**
- **Management and organisational issues. How can businesses and universities best organise themselves in order to benefit from each other's resources? Do the present mechanisms for priority setting, decision-making and funding in the university sector help or hinder business-university collaboration? What changes might encourage collaboration?**

We find that most Universities have formed Business Development Teams and on balance they are a helpful initiative. They do create an additional interface, but they are a single point of contact, and the staff do have the time and resources to ensure the necessary commercial arrangements are put into place. The majority of academic staff have neither the inclination, nor the aptitude to become involved in commercial matters, and dedicated business support is currently an essential input. Ideally future academic staff will have the training and incentives to acknowledge that commercial processes are important.

We also find that many Universities have a range of contractual arrangements which allows the academic staff to benefit financially from their 'external' work. Whilst we support this in principle, the current arrangements are complex and create confusion and delay.

Most Universities have management and organisational arrangements in place which clearly pre-date the current priority given to business collaborations. At best, Business Support is an 'add-on'. However we need to be very careful in proposing radical initiatives for them to become more 'business friendly'. The UK's Universities are held in high regard for the high quality of their scholarship and research, and any new proposals must be carefully thought through to ensure these are not degraded in the process. Creating new knowledge is a risky and time-consuming activity that sits uneasily with the short term nature of our business culture.

The Research Councils and HEFCE rightly give high priority to academic excellence in their funding decisions, however they must also increasingly acknowledge a factor that is difficult to define simply, but which could be termed 'business usefulness'. As mentioned earlier, the support from the Funding Agencies must be better aligned with investment from Business to make the most of the UK's assets.

- **Technology transfer. What are the barriers? How can it be made more effective?**

Technology transfer must be built into the project, not considered as an add-on near to completion. Our URAs are very familiar with our business processes, and knowledgeable about how our R&D is targeted to overcome our technology challenges. If the University Business collaboration is fully integrated into the Company's investment and innovation programmes, technology transfer ceases to be an issue.

However Technology Transfer is now acknowledged to be a scientific discipline, and we would certainly benefit from improved training arrangements, and a greater availability of trained experts.

- **Intellectual property. Are the present arrangements understood and appropriate?**

We have a simple arrangement with our URAs, BNFL owns the rights for nuclear exploitation, and the Universities own the non-nuclear rights.

However we still spend considerable time and effort debating IPR issues, and we would not claim to fully understand the arrangements, or consider them appropriate. As soon as the traditional boundaries of knowledge and wealth creation are breached, IPR will inevitably become a contentious issue. Unfortunately this is another example of the UK becoming a more litigation based society.

RECRUITMENT

A third set of questions relates to how business can attract the best graduates and postgraduates with the skills that they require, especially in technology.

Questions include:

- **Is the quality of graduate recruits satisfactory? Are there any obvious gaps in terms of skills and disciplines?**

Much of the evidence on quality is anecdotal. However there are many accounts of interview panels being disappointed with the basic or fundamental scientific and technical knowledge of applicants over the past 5 years. Courses are increasingly being broadened to cover business skills such as project management and financial management, but we appear to inevitably be losing some of the depth. The broadening of the FE Curriculum (the AS/A2 initiative) may provide Universities with students of a broader background, but again it gives them the task of developing the depth. Perhaps the solution is for Universities to offer more courses with a degree of specialist bias, Physics with Radiation Modelling, Materials with Irradiation Embrittlement etc.

Graduates with numerate skills are clearly attracted to the high salaries in the City, and this creates an obvious shortage for Industry.

There is a well-acknowledged trend of reducing applicants and students for SET (Science, Engineering Technology) courses at the majority of our Universities. There are also widespread reports that much of the Industrial business sector has great difficulty in recruiting sufficient numbers of SET graduate and post-graduates. The causes are many and diverse, and include the unpopularity of these subjects at schools, the inherent difficulty of the subjects, the increasing selection of subjects perceived to be more enjoyable (media studies etc), and perhaps the relatively low starting salaries in Industry. Some of these problems can undoubtedly be overcome by Business, Schools and Universities working together to improve the attractiveness of SET courses, and indeed such initiatives are probably already underway. However the magnitude of the problem requires a major new initiative with clearly allocated funding.

- **How do businesses, individually or collectively, communicate their needs for specific scientific or technical skills and for the development of relevant courses in universities?**

It's interesting to see the question phrased with the term 'skills' rather than knowledge, with Universities traditionally orientated towards knowledge.

However in our experience the best approach is with local Universities. This facilitates a broad spectrum of interactions, from the shared use of facilities to secondments and day-release. We are already in discussion with the NWDA and Manchester University to establish a School of Nuclear Science and Technology that should provide courses and graduates for the entire nuclear industry. We anticipate that Universities will become increasingly orientated to particular Business or Industrial sectors, and again this will facilitate the development of courses with specific scientific or technical skills. A particular challenge for the future will be the distinction between 'Research' and 'Teaching' Universities, which will distance R&D and teaching, and create additional interfaces and stakeholders.

The development of 'tailored' courses is probably best achieved on the back of a long-term collaboration, where both sides have a well-established working-level understanding. The development of courses for the proposed 2-year Foundation Degrees will certainly require close Business involvement if they are to achieve their stated aim of becoming a 'Work-based' qualification. The HE White Paper did not provide details of encouraging such input.

- **How could more attractive career paths for science and technology graduates and postgraduates be developed?**

We feel this question could better be answered by direct discussions with our HR Department. But important elements would be:

- The opportunity for secondments and working between Business locations and Universities/Research Institutes
 - Rapid progress to Chartered Engineer status, via Accreditation Schemes
 - A clearly defined development programme, with staged increases for responsibility
 - The opportunity for medium term secondments within different Business Units within the Company.
- **What plans does business have to attract the best talent in the future and are the universities made aware of them? If not, what more could be done to facilitate such a dialogue?**

One purpose in establishing our URAs was to facilitate and target our recruitment of the more able graduates. We also find that all the work experience, YII, and sandwich type schemes provide an excellent basis for students to acquaint themselves with potential employers, and employers to target students for future employment.

FINANCIAL CONSIDERATIONS

The review team will also want to understand whether financial considerations currently help or hinder the relationships between business and universities.

Questions include:

- **Are there ways in which the present financing arrangements could be made more effective?**

Longer term funding from the Government Agencies would better underwrite investment decisions from Business.

- **Has the introduction of R&D tax credits influenced business demand for research and skills, and if so, how? Are there other means to the same end?**

We have not found the R&D tax credit scheme particularly helpful, either to understand or implement. We understand the recent budget simplified the eligibility criteria to claim refunds, but have not yet obtained the details.