

CIA/SET Board/AHK/Lambert Review 2003/1

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Dear Niki,

CIA response to the Lambert Review of Business-University Collaboration

I have pleasure in enclosing the Chemical Industries Association (CIA) response to your important consultation on business-university collaboration.

The CIA is the leading trade body representing the UK chemical industry. With gross output valued at around £49 billion, and a trade surplus of over £5 billion, the UK chemical sector is manufacturing industry's number one export earner. We spend over £3 billion on research and development annually, and we have a long-standing tradition of working with universities in order to maintain, and retain, a thriving and innovative Chemical Industry in the United Kingdom.

Furthermore, the strong collaborative ventures with academe (in a time of immense structural change within the industry) is deemed vital if we are to have access to creative developments in science, engineering and technology as well as to ensure a continued supply of well trained and educated scientists and engineers.

We believe that research and development is not just the beginning and end of the innovation process, but is almost the foundation for radical, step-change improvement in a product, process, technology platform or even business activity. Our collaborative relationships with academe are therefore crucial if UK-based companies are to take to leading position in their business portfolios on both a national and global basis.

The CIA warmly welcomes the main focus of the review, and we hope that your consultation will lead to the development of a coordinated and integrated series of policies across Government to help promote business-academe interaction.

This in turn will help to promote research and development/innovation that is vital for the economic success of the UK, and more importantly, positively impact on the UK Chemical Industry's ability to remain an innovative knowledge-driven entity rather than one which is purely asset based.



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The CIA undertook a wide consultation amongst our membership, including companies belonging to the Specialised Organics Chemical Sector Association (SOCSA), on the issues outlined in your consultation paper, and our key points on the consultation are presented below:

- © Although the consultation paper has been positively received in many quarters for the reasons outlined above, there is a strong and prevalent view that review is concentrating primarily on current business-university collaborative issues rather than looking forward.

The review also needs to distinguish between skills and knowledge as well as between scholarship and training when considering issues on attraction of graduates and postgraduates to a science-based career.

- © Effective and efficient mechanisms of communication are crucial to developing robust and substantial collaborations between industry and academe as well as technology transfer activities.

These may include secondments of staff from industry to academe and vice versa, participation in conferences, seminars and Technology Car Boot Sales, sponsorship of university posts, infrastructure investment by industry, development and delivery of university modules by industrialists, and the use of academics as consultants.

Further support should be targeted at bridging the divide between the transfer of knowledge and skills across the business-university interface.

- © RDA's and Sector Skills Council do not feature prominently in helping to improve business-university collaborations. However, this is likely to change with time once the activities of these organisations filter through, and impact upon, the industrial and academic landscapes.

- © Universities should focus on creativity (converting money into ideas) whilst industry should concentrate on innovation (converting ideas into money). However, there has to be a clear and strong link between both these parties in order to generate ideas and benefit from any financial gains.

- © Special emphasis should be placed on developing a database or a 'one-stop-shop' - a repository of information on research activities, including service facilities in Higher Education Institutions - for use by industry.

Conversely, a similar database outlining who is doing what in industry also needs to be created for use by academe. Trade Association's, like the CIA, and Regional Development Agencies can play a major role in this regard.

For example, the North West Chemical Initiative has recently developed a web-based portal that contains information about expertise and resources available in North West Universities. A national database, which is kept constantly up-to-date, is required.

There is a strong feeling in the Chemical Industry that there is a large pool of chemistry talent in universities that remains untapped. This resource should be deployed on elucidating answers to some of the technical challenges that industry and its customers face.



- © Research and Funding Councils such as EPSRC and HEFCE correctly emphasise and reward academic excellence in their funding decisions. However, what they must factor into this assessment is the business usefulness of a research project. This is vital if the UK is to extract the most value from its investments in science and technology.
- © The funding of demonstrator projects, which industry and academe sometimes find difficult to do, should be considered as a way to enhance and promote innovation.
- © IPR is still a problem but getting better in this country.
There is still a tendency for universities to be inflexible and unprepared to adopt a pragmatic approach to negotiations on IP. This has resulted in the fact that companies will no longer work with such institutions.
IPR between business and university should always be agreed at the outset of any collaborative activity between industry and academe.
- © Research undertaken by the CIA indicates a decline in the overall quality of graduates in science, engineering and technology (SET).
This is especially the case in disciplines such as Chemical Engineering, Bio-processing and Bio-Chemical Engineering, Separation Science, Analytical Science, Physical Chemistry and Physical Organic Chemistry from both a quantity and quality perspective.
- © Businesses tend to communicate their needs and image to universities through their research alliances with specific universities.
However, the majority of businesses are not particularly good at this exercise. In fact, universities never ask what businesses want and companies rarely volunteer the information. This requires a cultural change in the UK for business to be more open, and academe to continue to be more receptive to industrial needs
- © An improvement in the reward and remuneration structure/level for a career path in research is paramount if graduates and postgraduates are to be excited by the diversity of prospects that are available to them in a science-based organisation.
- © The Research Assessment Exercise (RAE) needs to be properly reformed so it rewards universities for teaching, research and/or technology transfer (and not just research).
The RAE needs to promote interdisciplinarity, properly reward academe for its collaborative ventures with industry and focus on the assessment at research group level rather than at departmental level.
- © Funding changes by the DfES should not impact on centres of excellence that happen to be located in universities that did not obtain high assessment ratings.
- © The myriad of Government studies and reviews on competitiveness, productivity, skills and technology should be better communicated to the user community (in both business and academe).
- © It is still too early to say what the actual impact of R&D tax credits might be in industry, and whether this incentive will



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catalyse greater investment in R&D amongst the UK Chemical Industry.

- © The Government to consider is rewarding the gifting of technology and IPR from industry to academe (in the United Kingdom) through the use of a tax credit.

I have attached some additional comments on the questions which your consultation document seeks answers to, namely, examples of excellence in business-university collaborations, barriers to collaboration, including technology transfer and Intellectual Property Rights issues, attraction of graduates and postgraduates and financial considerations.

I have also included a copy of CIA's response to Sir Gareth Roberts Review of the Supply of Scientists and Engineers for your perusal since I believe that this complements your review and will also answer many of the questions to which you seek answers.

Finally, the CIA welcomes the chance to work closely with Government on business-university collaboration issues since these will have a major impact on the future health, sustainability and success of the UK Chemical Industry.

I trust that this submission will prove useful to your needs. Please do not hesitate to contact me if I can elaborate further on any matter raised.

With best wishes,
Yours sincerely,

Amit Khandelwal

Dr Amit Khandelwal
Head of Research & Innovation



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Comments on the 'Lambert Review of Business-University Collaboration'

Business-University Collaborations

1. 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.
- Joint ventures between universities and business, for example, personnel exchange or collaborative research and development projects.
- 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.
- Formal contracts, for example, the use of licensing, research contracts, consulting projects, establishment of spinout companies, product testing, or business support.

The Chemical Industry uses a wide variety of methodologies to foster strong business-university collaborations. These include:

- ◆ Access to scientific literature, patents and prototypes, and the use of standard search procedures and engines

Most companies find the information contained in the literature and the know-how held within universities extremely valuable. The benefits of accessing information contained in academic publications, patents and prototypes are strategically vital to business success.

R&D functions within companies would not be able to extract value or function effectively without the ability to search the academic literature.

Overall, this represents an extremely important component for undertaking R&D activities in industry, and interacting with academe.

- ◆ Participation in a variety of Collaborative Research Programmes

Collaborative Research Programmes such as CASE Awards, LINK, European 5th and 6th Framework Community Programmes, University Research Alliances and Technology Links are an important component of fostering strong industry-academe links.

For example, Industrial CASE Awards are favoured by many companies because it allows them to choose projects which

are relevant to the business but nevertheless involve basic research.

Companies use these awards to provide them with access to the underpinning science for a key business area or to provide an insight into a new area of science and technology. They consider it vital to appoint industrial project supervisors and to have regular project reviews. Patents tend not be expected from such work, and if they come, they are an unexpected bonus.

The Chemical Industry also funds post-doctorate work, where they expect to be able to set more demanding and shorter-term targets. Ownership from Intellectual Property Rights (IPR) that may be generated is expected to be retained by the company.

A large number of companies who sponsor studentships and post-doctorates also encourage them to spend a period of time each year in the company. This is an excellent way of 'fingering' prospective recruits as well as getting good research done. They also review their research projects on a regular basis, and each project has an industrial project supervisor.

Some companies such as Avecia and Johnson Matthey plc host annual events where CASE students and their supervisors can review project and network with peers and industry partners.

More recently, businesses are also partnering with university spin-outs as well as start-up companies to harness their intellectual capital and enhance overall profitability.

- ◆ Participation in Industry-led collaborative research programmes and networks

A number of companies participate and provide industrial leadership for several programmes designed to enhance the industrial relevance of university research and make it more broadly available to industry.

Specific examples include, BRITEST (a consortium now incorporated as a limited company to develop technologies and methodologies for 'natural rate' chemical processing), CPACT (Centre for Process Analysis and Control Technology) QUILL (established for ionic liquids) and UKAP (established for analytical sciences)

- ◆ Exploitation of IP developed in academe

A wide variety of chemical companies have benefited from technology developments/inventions generated within universities. A good example is the acquisition of the licence for oligonucleotide and chiral technologies from Kings College, London by Avecia.

- ◆ Involvement in academic networks and meetings, participation in conferences at national, regional and international level, and at Technology Car Boot Sales

Companies tend to get involved by making contributions themselves and helping to make an industry input on the organising committees of an event.

- ◆ Sponsorship of university posts

A number of companies sponsor individual university posts such as a Chair in Organic Chemistry whilst others have sponsored large sections of university departments or undertaken a joint-venture type association (e.g., Unilever Research Centre at the Department of Chemistry, Cambridge University) to enhance partnerships with academe.

- ◆ Use of academics as consultants and departmental facilities such as analytical services

Academic consultants are widely used as business technical needs arise. Some companies have established special funds to help maintain an open approach to establishing links with consultants in new areas of expertise.

For example, Avecia has a 'pump priming shared fund' which is allocated to Avecia scientists to cover for the first engagement with a consultant new to the company.

Many companies also make extensive use of analytical services provided by universities in areas where there is a critical mass requirement for facilities and skills. This often occurs when new techniques are developed and their full industrial application is not yet apparent.

- ◆ Active participation in Industrial Advisory Boards which are operated by a number of chemistry departments in the UK

- ◆ Involvement in EPSRC Peer Review College

- ◆ Secondments of staff between universities and businesses for development of skills/knowledge, technology transfer, networking and recruitment

Many companies deploy their industrial staff in university laboratories for a limited period of time in order to refresh their knowledge base and to develop new networks.

A number of courses have resulted to cater to the demand for specific industrial training needs. These include courses run by the Bristol Colloid Centre, polymer centres in Manchester and environmental sustainability at Surrey University.

Such developments are not only beneficial to companies from a strategic perspective (transfer of knowledge and technology, networking) but also to researchers from industry who see it as part of their continuing professional development.

Some companies actively encourage the movement of staff from academe to industry (and vice versa though on a more limited scale). For example, the recruitment of Marie Curie Fellows by companies such as Avecia and GSK to their research centres in the United Kingdom.

Targeted strategic recruitment is also carried out by companies on an annual basis as they seek high quality graduates and PhD's to sustain their science base and develop the skills needed for the future.

Recruitment also occurs at school leaver levels who then are encouraged to gain degree qualifications through day release at local universities. As a consequence companies tend to become involved in the industrial steering groups for these part-time degree schemes.

- ◆ Delivery and assessment of university modules at both undergraduate and graduate level

The development of courses specific to the needs of industry has been undertaken by a number of companies in critical areas of technology where there is likely to be a shortfall of skilled manpower and knowledge.

Specific examples include the MSc in Safety Engineering at Lancaster and the MSc in Physics and Technology of Nuclear Reactors at Birmingham.

In general,

- ◆ Most university business relationships come about because either the business wants some work done or goes to the university (often because someone in the company went there, sometimes because it is the best in the field) or the university feels that there is a gap in the market for either research or a post-graduate course and goes to industry.
- ◆ Industrial money underpins research that is a little broader than the immediate needs of the company thus providing a gene pool to dip into in the future and underpinning technology areas in the UK. Personnel exchange is usually an aspect of these alliances.
- ◆ There are some isolated examples of Regional Chemical Initiatives (such as the North West Chemical Initiative) which have begun to establish networks and collaborative activities to help improve business-university collaboration.

However, currently RDA's and Sector Skills Council do not feature prominently in helping to improve business-university collaborations. This is likely to change with time once the activities of these organisations filter through and impact upon the industrial and academic landscapes.

- ◆ A crucial factor in enhancing business-university collaborations is close cooperation, communication and

joint-up thinking between industry, academe and Government on this area. This in turn will ensure the translations of any future strategies developed to support this area will have a real and practical benefit to all concerned parties.

Barriers to Collaboration

2. 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?

There is still a lot of scope to improve general academic understanding of industrial needs, project management issues (e.g., failure to meet deadlines set by industry).

The Chemical Industry already has numerous successful relationships with academe, and it is open to new collaborative approaches. However, there do not appear to be very efficient mechanism to support this.

For example, companies tend to receive numerous CASE proposals every year, many of which are technically superb but are not relevant to industrial needs. It would be far better to explore ideas first with industry before drafting a formal proposal. A mechanism to improve this would be helpful to both parties.

Another issue concerns the difficulty in finding the right quality students to carry out challenging industrial research in academe.

This is especially the case for industrial CASE studentships which may be allocated too late. Consequently, finding high calibre students can be problematic as they have already been snapped up elsewhere.

Many companies value the participation in EPSRC and other grant funding review processes. They believe that this is an important channel of communication of their needs to the Research Councils and Funding Bodies such as HEFCE.

Recently Faraday Partnerships such as CRYSTAL and IMPACT have been an extremely valuable mechanism for sharing information on technologies such as Green Chemistry and Colloid Science respectively. What is crucial is that these groups find effective and efficient ways to gather and share information across a diverse range of stakeholders in academe and industry.

They also need to find ways of working such that there is a visible and measurable benefit from the contribution made by the contributors. This is particularly an issue for small companies who do not possess a large corporate infrastructure to participate in open-ended discussions.

In general, business and academe get together because there is a pressing need by one party, sometimes a coincidence of interest by two parties, to develop a molecule, product, process or technology.

Whilst third party involvement such as a Faraday Partnership or a RDA can be very helpful in fostering industry-academe links, there is a strong and prevalent view that third party advocacy will need to deliver tangible benefits to 'the collaboration game'.

Otherwise they will be strong on 'spin' and 'overheads' and will only be tolerated because they are a cash cow with money to spend on research activities between academe and industry.

Finally, Research and Funding Councils such as EPSRC and HEFCE correctly emphasise and reward academic excellence in their funding decisions. However, what they must factor into this assessment is the business usefulness of a research project. This is vital if the UK is to extract the most value from its investments in science and technology. The Chemical Industry is willing to help support such a process in an impartial manner.

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

Technology Transfer

Technology transfer agreements are now automatically being built into projects undertaken with universities. They are no longer considered an 'add-on' near to the completion of a project.

However, Government departments appear to have the view that technology that is transferred from academe to industry is ready to use in products. This is rarely the case and considerably more development is usually required, often involving the combination of several technologies.

The CIA believes that the key issue is often the funding of a demonstrator project, which industry sometimes finds difficult to do, and which the DTI terminated funding for several years ago.

Outside the UK, companies have had positive experience with collaborative programmes and technology transfer. For example, in Germany regional bodies have supported innovative developmental programmes in material technology in line with industrial needs.

Instruments to aid Technology Transfer

Although industry clearly knows about the projects it is funding, it is often more difficult to find out about what else is going on within academe and other publicly funded research institutions. There is a real need to develop instruments to aid networking and technology transfer activities.

A number of databases exist to support this activity. However, many of them are now somewhat out-of-date (e.g., BEST), and those developed by consultants (such as US-based Technology Commercialisation Group and Prosavvy) can be prohibitively expensive to access by both industry and academe.

The Royal Society of Chemistry has run a number of 'Technology Car Boot Sales' whereby academics can market their work to industry with the eventual possibility of collaborative

ventures, or even licensing of technology. These have proven quite successful, and are not expensive to run.

A number of companies have mentioned the useful nature of the European Marie Curie Fellowship Scheme which has been an effective vehicle for bringing in new skills into the organization. This is in contrast to schemes run by the EPSRC which have proven less favourable in recent times.

Overall, there is a strong feeling in the Chemical Industry that there is a large pool of chemistry talent in universities which remains untapped. We feel that it could, and should be deployed on elucidating answers to some of the technical challenges that industry and its customers face.

Intellectual property. Are the present arrangements understood and appropriate?

This area is a minefield and can be a contentious issue. It is certainly the subject of more argument with universities than anything else. Overall, companies mention a general increase in bureaucracy on IP.

Most damagingly, a tendency for universities is to be inflexible and unprepared to adopt a pragmatic approach to negotiations on IP has resulted in the fact that companies will no longer work with such institutions.

A recent decision by the Research Councils to make universities responsible for IPR generated, e.g., in CASE Awards, is a dangerous development. Industry regards IPR protection as its bread and butter, where most universities have little experience.

Furthermore, there are a lot of poor patents being written by universities which result in wasted IPR, or raised expectation from the licensing of the technology when none can be realistically realised.

A number of companies are now increasing contemplating donating their non-core IPR portfolio (that they cannot use and see as too expensive to keep) to universities with a view to building stronger industry-academe relationships.

In summary,

- ◆ It is clearly important to achieve a balanced perspective on the issues surrounding commercialization of inventions and the risk and reward from investment when dealing with IPR arrangements between industry and academe.
- ◆ The failure to understand the differences and similarities between academe and industry, long-time timescales versus short-term timescales, intellectual prowess versus profit can cause an immense amount of confusion and frustration.

Both academe and industry are businesses which have to make a profit to survive. Whilst there needs to be a convergence of driving forces that generate knowledge and develop know-how, the CIA believes that there needs to be

a proper understanding and appreciation of the various factors that underpin value extraction from technology developments and its associated IPR. Industry is best placed to undertake this task rather than academe, especially in terms of delivery to the markets it serves.

- ◆ IPR is still a problem but getting better in this country.

In fact, in comparison with US universities, where IPR negotiations can be tedious and difficult - an issue compounded by the Bayhe-Doyle Act, UK universities are much more flexible in their approach on this issue.

Consequently, companies can still undertake the sort of open research collaborations that would be difficult in the US. This is perhaps a significant factor in encouraging US companies to undertake research in the UK.

Attraction of Graduates & Post-graduates

3. 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?

Although much of the evidence on quality is anecdotal, research undertaken by the CIA indicates a decline in the overall quality of graduates in the science, engineering and technology (SET).

Whilst many of the large chemical companies have been able to attract the calibre and skills of graduates they require, a number of them have cited shortages in disciplines such as Chemical Engineering, Bio-processing and Bio-chemical Engineering, Separation Science, Analytical Science Physical Chemistry and Physical Organic Chemistry.

There is already a well-acknowledged trend of a reduction in applicants for SET courses. Physics and Maths are two obvious areas but chemistry is also now facing severe pressures in terms of maintaining student numbers at undergraduate level.

It seems that universities put on courses that are popular with students but not those that industry necessarily needs. An exception to this is the development and delivery of postgraduate short taught courses. It is rather worrying that there is a mismatch between the desires of the individual and the needs of the economy especially since young individuals are uninformed customers.

Widening access to university has a lowest common denominator effect to it with the result that there are probably too many graduates with less valuable degrees from poor quality universities, and not enough technician and craftspeople that industry requires.

Until the image of science and technology is improved it will remain a struggle to get young individuals to display an interest in, and take up of, SET subjects.

This is where the school system lets the economy down (poor introduction to SET at primary school level, easy GCSEs and A-levels in the natural sciences followed by having to do remedial work in the first year of many SET courses at university).

The CIA believes that this country still suffers from what Churchill said "Scientists should be on tap not on top".

See copy of CIA's response to Sir Gareth Roberts Review of the Supply of Scientists and Engineers for further details in this area.

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

Businesses tend to communicate their needs and image to universities through their research alliances with specific universities. For example, some (like BP) have a small network of favoured universities where there is a 'link individual' to each university.

Companies also often pay for postgraduate courses at local universities to ensure that they can access at least some of the knowledge they need.

In general,

- ◆ It has to be said that the majority of businesses are not particularly good at this exercise. In fact, universities never ask what businesses want and companies rarely volunteer the information.
- ◆ Information on scientific and technical skills and for the development of relevant courses in universities is often gathered by Trade and Professional Bodies like the CIA and RSC and is transmitted 'en masse'. Companies only communicate their needs on an informal basis with the academics they fund.
- ◆ The CIA strongly feels that it is crucial for the Lambert Review to distinguish between skills and knowledge as well as between scholarship and training when considering responses to this and the previous question.

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

Many companies within the Chemical Industry feel that they do offer attractive and diverse career pathways in science and other allied areas such as marketing.

Individuals are also able to move readily into other careers, for example, a scientist/engineer moving into the legal department to train as a patent attorney or into sales). Those who show good management potential are 'fast-tracked' into senior positions within the business.

Some companies also possess a dual ladder system to ensure the same reward structure exists irrespective of whether one is pursuing science career or a non-scientific one (e.g., in finance).

However, one key issue is that of scientific salaries. They are generally too low in the UK, and many scientists move straight into more lucrative occupations, e.g., in the City, rather than coming into science-based industries.

Hence in order to provide attractive career paths for science and technology graduates and postgraduates, we believe that the following aspects need to be considered:

- ◆ An improvement in the reward and remuneration structure/level (compared to other career pathways).

◆ A clear, defined, demonstrable and managed development programme that is responsive to individual needs within a business or an academic environment.

◆ A real commitment to training and development of skills and knowledge, for example, rapid progress to Chartered Status as a Chemist or an Engineer.

In fact, continuing professional development is considered vital for ones survival in this day and age.

◆ Increased opportunity for both short and long term secondments between industry and academe and vice versa. Exposure to different business units would also act as an important catalyst in this area.

◆ Increased involvement of industrialists in delivering components of natural science, engineering and career development modules at both undergraduate and postgraduate levels

◆ Free academe from bureaucracy and allow them to be creative within their institution.

Easy access to funds is equally important to allow academe to be creative (converting money into ideas) and then for UK industry to be innovative (converting ideas into money)

◆ The marketing of R&D is crucial.

R&D should be seen as a demanding, creative and rewarding career proposition. This needs to be aggressively marketed if one is to convince young scientists and engineers that attractive career paths in the SET arena awaits them.

◆ The creation of a dedicated support mechanism (within natural science and engineering departments at universities) to promote careers in a science-based environment and manage secondments from academe into industry.

This is very much in a similar fashion to that found in the majority of good Business Schools.

Industrial Advisory Boards can play a crucial role in this endeavour.

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?

See comments above

Financial Considerations

4. 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?

In a climate where universities are under immense financial pressure (because the Government has pursued a policy of widening access without adequately funding it), schools are screaming to recruit and retain qualified science teachers (especially at primary school level), and the UK Chemical Industry is struggling to make headway in a competitive (and perhaps teetering) world economy, the CIA believes that it is vital to make better use of the limited resources available to enhance business-university collaborations. For example:

- ◆ Limit intake to universities, and reward Higher Education Institutions for excellence in teaching, research, and technology transfer rather than research.

The Research Assessment Exercise (RAE) needs to be properly reformed so that it promotes interdisciplinarity, properly rewards academe for its collaborative ventures with industry and focuses the assessment at research group level rather than at departmental level.

We hope that HEFCE's Review of Research Assessment will result in a funding mechanism where Higher Education Institutions are rewarded for partnering with industry. This will catalyse more business and university collaborations.

Another noteworthy point is the potential impact of the recent DfES White Paper on Higher Education Strategy. Whilst welcome, it is likely to have a detrimental effect on some centres of excellence that are situated in universities (and their departments) that did not score highly in the Research Assessment Exercise.

One such case is that of the Wolfson Centre for Bulk Solids Handling Technology at the University of Greenwich). This has delivered immense benefit to a wide variety of industrial sectors, including the Chemical Industry, through its underpinning and fundamental scientific projects and collaborative programmes with industry.

However, recent funding developments may mean that the Centre will face a substantial financial shortfall which could result in its closure. These types of centres of excellence need to be retained and properly funded since they deliver immense benefit to industry.

- ◆ Merge universities/university departments so that funding can be focused on high quality, well-funded institutions

rather than spreading the funds across a wide range of institutions or reducing the overall level of funding.

A number of companies have advocated bringing back Polytechnics since they served the needs of (local) industry from both training, supply of technicians, and by undertaking applied research in a results oriented manner.

- ◆ Focus on teaching not testing in schools so that teachers can concentrate educating children (especially in subjects such as the natural sciences which are deemed to be difficult) rather than their sole objective being to ensure that their student pass exams.

- ◆ Rationalise the Foresight programme so that it is of direct relevance value to industry by identifying and supporting current and future business needs.

Currently, there is a strong feeling within industry that the Foresight programme seems to have lost its way by funding abstract projects such as flood and coastal defence rather than providing information such as intelligence of value to business and academe.

- ◆ Public sector research institutions need to be more actively engaged with supporting business-academe collaborations.

- ◆ The myriad of Government studies and reviews on competitiveness, productivity, skills and technology should be better communicated to the user community (in both business and academe).

This type of activity generates an immense amount knowledge and intellectual capital which could be better deployed directly amongst industry and universities to promote increased collaboration rather than being used by consultants as a source of income generation.

Trade Associations such as the CIA, Professional Bodies such as the Royal Society of Chemistry, Regional Development Agencies and Business Link could be used as an effective delivery mechanism to industry and academe in order to initiate knowledge transfer and collaborative activities for both these parties.

- ◆ Better coordination of all the initiatives that promote science, R&D and innovation across Government.

Specific financial arrangements such as CASE Awards, LINK and the Innovative Manufacturing Initiative have been very successful in promoting relationships between business and universities. In fact, some companies have made extensive use of such initiatives.

However, in order to make any financing arrangement effective, it is absolutely vital not to make them too bureaucratic and administratively burdensome. This is the downside of many European programmes.

In general, schemes and initiatives developed by Government need to be simple and properly funded (over a long time horizon not a short one, and with limited associated bureaucracy) if they are to deliver real tangible benefit to business and academe in their R&D efforts.

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?

Initial assessments tend to suggest that many companies are still in the process of obtaining details on how the tax credit regime will work in practice.

Some companies have increased, or are looking to increase, their investment in R&D as a consequence of this incentive.

However, many have commented that they feel the current regime is still complex and bureaucratic involving a substantial compliance burden for a relatively small financial benefit. Hence, they are unlikely to use this incentive.

Although the picture in this area is mixed, the CIA feels that that it is still too early to say what the actual impact of R&D tax credits might be in industry, and whether this incentive will catalyse greater investment in R&D amongst the UK Chemical Industry.

One area which we would urge the Government to consider is rewarding the gifting of technology and IPR from industry to academe (in the United Kingdom) through the use of a tax credit.

This type of incentive is available to, and actively pursued by, companies in the United States of America. The benefit to the business is that it is rewarded financially for the transfer of its 'intellectual capital' to academe and promotes industry-academe partnerships; and allows industrial technology to be utilized/enhanced further by universities in existing or new research ventures.

We believe that the introduction of such a scheme in the United Kingdom will deliver similar benefits to those gained in the United States of America. It would certainly bring industry and academe closer together and strengthen collaboration; reward industry through a tax efficient scheme; and enhance the UK science base. Ultimately, innovation in this country will be overall winner!