LAMBERT REVIEW: Business – University Collaboration

Response from ARUP

Summary

Arup is a global firm of consulting engineers with over 7000 staff, providing engineering design, planning and project management services in all areas of the built environment. We aim to help our clients meet their business needs by adding value through technical excellence, efficient organisation and personal service. In order to deliver the best possible technical advice we have a strong commitment to maintaining and strengthening our position at the leading edge of technical development. This is done through external links with the academic world and internal investment.

Arup has many and varied collaborations with UK Universities, ranging from supervision of undergraduate and graduate student teaching and projects, to collaborative research projects. The collaborations have largely arisen through enthusiastic and committed individuals. The benefits are manifold: increased technical expertise, contributions to training needed in our business sector and access to good graduates. In addition, these collaborations help reinforce connections between Arup and local community.

We have identified a number of specific recommendations that would facilitate collaborations:

- Research Councils should open funding to business and industry, when they are part of a University-led bid
- Successful industrial work within Universities needs to be recognised, for example in Research Assessment Exercises and University staff promotion
- R&D tax credits have no current impact within Arup, but offer good opportunities and incentive for future collaborative activities

1. Introduction

Formed in 1946, Arup now has over 7000 staff based in 70 offices in 32 countries and our projects have taken us to more than 100 countries. The firm, which is wholly owned in trust, enjoys total financial independence and has an annual turnover in excess of £400 million.

Arup provide engineering and related consultancy services to the built environment industry and beyond. Arup provides skills necessary for every stage of the project, from inception to completion and after. We aim to help our clients meet their business needs by adding value through technical excellence, efficient organisation and personal service.

Throughout the world we aim to provide a consistently excellent multi-disciplinary service that incorporates our concern for the environment. Arup is committed to sustainable design, to its increasing incorporation in our projects and to industry-wide sustainability initiatives.

In order to deliver the best possible technical advice we have a strong commitment to maintaining and strengthening our position at the leading edge of technical development. This is done through both external links with the academic world, and others, which are described below and internal investment – a substantial proportion of the firm's income is devoted to improving its technical standards through the continuing professional development of its members and by developing new techniques of engineering design and management.

Arup Research + Development

Arup has an unparalleled range of expertise in construction and is one of the few engineering consultants with a research and development capability in-house, namely Arup Research + Development. This resource, and those of other specialist groups within the firm, provide skills in support of projects, and ensure effective dissemination of feedback from one operating group to another. In addition, a substantial contribution is made to the work of the British Standards Institution, professional institutions, research associations and other national and international organisations in both the public and private sector, in the drafting of guidance documents for circulation within the industry. Among the benefits of these in-house facilities are the ability to support innovative thinking within the firm and empathise with researchers in general. However, R&D activity is not limited to our in-house group but is infused and integrated to all parts of the firm.

Research and Development within Arup is enhanced by a vast range of collaborative activities. Many of our staff hold key teaching roles within Universities where they share their enthusiasm, knowledge and expertise with future construction professionals. In addition, the Ove Arup Foundation has contributed to shaping many construction courses in Universities throughout the world. We benefit as a firm by the diversity of student that chose to join us, whether it be for a short time through a student placement or studentship award, or on a long-term basis through our recruitment process. New people bring with them new ideas and a diversity of experience that contributes to the service we provide.

2. R & D: Best Practice

Can you provide examples of excellence in business – university collaboration in the UK or abroad? Please provide specific examples

Arup demonstrates a wide range of interactions across the whole range of academic activities (i.e. teaching, research, and development). Relationships are formed over time, driven by enthusiastic individuals and often lead to commensurate rewards. Arup offices worldwide are making strong efforts to contribute to universities as a part of efforts to establish connections in the local community. Furthermore, many of Arup's offices, both in the UK and abroad, are located near universities with reputations as centres of excellence for specific disciplines.

It became evident in compiling this review that the range of interactions between Arup staff and Universities is not well recorded corporately or centrally within Arup: the devolved and fluid nature of Arup encourages this. For the purpose of this review we have tried to record the essence, however, it is quite probable that the range of collaboration and interaction is greater than is demonstrated here.

Specific examples of Arup-University collaboration:

- Numerous Arup staff hold university positions, leading to teaching and steering of taught courses and joint supervision of project students. Specific examples include: a member of staff who is visiting professor at Loughborough; Arup provide a series of technical lectures as part of the design course at the Bartlett School of Architecture, UCL; Arup R+D teach a new materials course at the Architectural Association.
- University faculty staff hold positions within Arup. For example a member the Department of Meteorology, University of Reading, is seconded for one day per week to help develop technical expertise and business in environmental modelling and climate change.
- Arup supports students at all levels of study, including Pre-university placements, summer placements, industrial experience placements and support for post-graduate research students via:
- Arup are currently supporting 5 PhD research students, and have supported 25 students over the past 12 years, all through the CASE schemes. Four students having completed their doctorate have gone on to join Arup in key roles.
- Several members of staff are currently undertaking an industry based Engineering Doctorates at Loughborough University focusing on the use of IT for construction projects and the appropriate application of visualisation techniques to engineering data.
- The Ove Arup Foundation is a registered charity that provides investment to aid 'the advancement of education directed towards the promotion, furtherance and dissemination of knowledge of matters associated with the built environment'. In addition to supporting research projects, activities have included: establishing a Chair of Civil Engineering Design within the Department of Civil and Environmental Engineering at Imperial College of Science & Technology, London; development of a Masters Course in Interdisciplinary Design for the Built Environment, University of Cambridge,

an MSc in City Design & Social Science at the London School of Economics, and an MSc in Interdisciplinary Management (MIDM) at Hong Kong University.

- Arup are participating in the Society of Building Science Educators (SBSE) visiting scholar project, which aims to enrich interaction between industrial and the academic communities throughout the world. With the help of the SBSE network, Arup projects were chosen for an educational CD series of exemplary buildings for teaching design and technology topics in architecture schools.
- Collaborative research projects: e.g. Partners in Innovation (PII), and other ventures where our support is provided by offers of 'contributions in kind'.
- EPRSC Peer Review College: Arup Research + Development currently provide four members of EPSRC Peer Review College. Their contribution is through practical knowledge and experience to assessment of research proposals.
- There have been a variety of joint ventures on development and live projects. A small sample:
    - Arup's Advanced Technology Group (ATG) in London collaborated with Imperial College and University of Cambridge on finding solutions to the wobble on the Millennium Bridge. Imperial has also been used for impact testing of concrete. ATG has strong links with Sheffield University in the fields of structural vibration, non-linear analysis and biomechanics. ATG also provides visiting lecturers to UMIST Impact and Blast Analysis short courses.
    - Academic facilities have been used to test and develop a product under simulated or real conditions. E.g. Arup Lighting work with University College London to develop and test lighting solutions.
    - Universities of Leeds and Durham are doing work supported by the EPRSC that will help update Arup's state-of-the-art design software. This work will ultimately lead to changes in the European Codes of Practice.
- Oasys Limited, the software house of Arup, now provides all of its structural, geotechnical and CAD software free-of-charge to all educational establishments for academic use in both teaching and research. Almost 30 UK universities now have the free network licences installed on their systems and we are now looking to increase worldwide participation. This development is aimed at creating mutually beneficial relationships with academic establishments - true industry/academia links. In return, Oasys hope that academia will contribute their ideas to ongoing development of the programs so that these continue to be the definitive state-of-the-art leaders in their particular fields.
- Several of Arup's regional offices are purposely located close to academic centres of excellence. E.g. Cambridge office.
- Arup Newcastle Office has strong links with Universities of Newcastle and Northumberia, where University staff have been seconded to Arup. Arup staff have lectured and tutored students (paid by Universities) leading to published papers, knowledge transfer, etc. Arup office has participated in 'Taster Days' when lower sixth form students visit Newcastle University to help encourage enrolment onto engineering. Links are also developing with Durham University.

- Arup Manchester Office has made a strong effort to develop links with local universities as a part of a desire to contribute to the local fabric. This has led to very strong links with UMIST, Manchester University, Manchester Metropolitan University and Salford University. This was initiated by Arup gathering 12 Heads of Departments within UMIST with 12 Arup people. Specific projects include
    - Arup gathered artists from MMU and Engineers from UMIST to develop a monument for the Manchester celebrations of St Petersburg's tercentenary
    - Arup participated in a 3-year research project with UMIST on knowledge management.
    - Arup Manchester Office has an art gallery containing works from MMU artists
    - Arup helped develop an MSc course on Electrical building services

How did the relationship arise?
Arup is proactive in forging relationships with universities and other research bodies, mainly through the development of personal contacts by individual staff. These personal contacts are developed by

- Teaching roles of our staff, initiated through their professional standing
- Relationships formed through externally funded research work
- Sitting on committees, e.g. Building Standards, or through membership of professional bodies (e.g. Institution of Civil Engineers). Clearly it is important to involve academics and industry in these processes (and to recognise their contribution). These bodies may also be instrumental in co-ordinating collaborations.

3. R & D: Benefits and barriers to collaboration

What benefits do you perceive can be achieved from greater interaction with higher education?
Arup sees interaction with higher education as essential for effective research and development. Key benefits are perceived to be:

- The opportunity to work together to achieve pioneering advances and innovation.
- Development of technical skills.
- Peer review of Arup work by specialists.
- The ability to tap into expertise of academics, the accessibility of analytical thinking contributing to extending the company's comfort zones.
- Increasing understanding of the fundamentals of science and technology.
- Value of extending formal and informal networking.
- Promotion of Arup increasing accessibility to the best students for recruitment.
- Higher education is seen to benefit from industrial academics who are able to project an insight of the real needs of the industry (issues such as client

awareness) through their teaching. Conversely, industry benefits from remembering the importance of teaching and sharing knowledge.

What are the barriers constraining demand for universities knowledge and skills? How could these be addressed?

The prevailing view within Arup is that the research should be mutually beneficial to the parties involved. Nevertheless a number of barriers are perceived to constrain the demand for university knowledge and skills:

- Timescales: Some research needs are required within short time scales; Universities tend to work to longer time scales.
- Funding:
    - Limited number of funding routes: DTI's Partners in Innovation scheme has led to important joint projects, but Research Councils will not fund research within companies, often requiring companies to offer funding in kind.
    - Experience at Newcastle and UCL shows that even a nominal payment to Arup staff for lecturing helped to oil the financial wheels.
    - Within universities there is a growing emphasis on commercialisation of research outputs and primary funding of research facilities by industry. This trend is less apparent in the construction industry perhaps because of the more fragmented industry structure.
- Communication:
    - Knowledge and skills presented by universities were not always in a form the business could identify with. The language of common interest between academia and industry requires improvement.
    - Need for more strategic view of Research Council funded research, better dissemination routes.
- IP was not perceived to be a strong issue: once academic work is published it is in public domain. It was observed that some university activities are spreading into consultancy and subsequently they may become our competitors.
- More recognition needs to be given to use of academic work by practising engineers, in for example Research Assessment Exercise, which does recognise patents but does not recognise the use of academic findings in industrial practice.

4. Recruitment

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

Arup is fortunate in recruiting good graduates at all levels: BSc, MSc, PhD but mainly MEng. However, we recognise that the falling number of quality graduates is an industry wide problem. Universities face a challenge to train graduates with skills appropriate to rapidly developing technology and a broadening of topics. Arup responds by providing training to employees, which in turn makes Arup an attractive employer to good graduates. Nevertheless, we recognise that the skills required have

changed over the last decade and will continue to change significantly in the future. Universities must continue to respond to these changes. We note the following particular issues:

- The expansion on Masters level training in the last 10 years has helped recruitment in specialist areas. It is in this sector that Arup has contributed most to course content.
- Presentation skills (written and oral) are essential; Science and Engineering degrees must train students at all levels in these skills.

How well does Arup communicate their skills requirements to the university sector? How could we improve?

Our ability to communicate our skills requirements to the University sector varies. Arup has representation on the Joint Board of Moderators (JBM) and has many links with universities worldwide. We believe that we are more successful in communicating the requirements of our core skills than our specialist skills.

Specific activities have been undertaken to improve communication such as communicating our skills requirement to universities through collaboration with individual courses - e.g. Mechanical Building Services course at Cardiff.

Arup is involved with a number of initiatives promoting careers in construction to school children (Engineering Education), including the Young Engineers for Britain Scheme and the provision of work experience placements. This area was perceived as a real challenge that would have the greatest impact.

How can we improve the attractiveness of career paths to graduates and post graduates?

The firm conveys strong values and beliefs that were established over 50 years ago. For many, these are compelling reasons for joining Arup and for staying with us. Furthermore many are attracted by the opportunity to learn alongside talented people.

The following observations were made with regard to career paths:

- Changes to the requirements and routes to professional qualifications made by the Engineering Council (UK) are frequent and not widely understood. They need to be stable and clear. Universities need to be aware and involved in with the Engineering Council(UK)'s changing requirements and be able to provide students with appropriate advice.

1. Within Arup, our commitment to training to chartered status was seen to be attractive in recruiting and retaining the best graduates, particularly in the technical disciplines.
2. The attractiveness of our career paths was seen to be more relevant to retention than for initial recruitment. However, we are noticing a generational shift. The most common question we are now asked by graduates at the recruitment stage is about prospects (salary and/or development opportunities) showing that although attractive career paths are important for retention, they do also contribute to the initial recruitment decision.

5. Financial Considerations

How could financing arrangements be made more effective?

Arup perceives the benefit and value of the collaborative activity to be fundamental. If the collaborative activity is likely to provide value to the firm and to academia then the financing arrangements become less of a constraint.

Funding for R&D activities across the whole construction industry needs the framework of a strategic plan. Furthermore, the research initiated and carried out by universities is often driven by academic interests and may form part of a two to three year academic study. This lengthy timeframe can give rise to financial barriers when business requires more rapid problem solving capabilities and is required to demonstrate the financial return of R&D work. However, in Arup we also recognise the long-term benefits of research.

There is a culture within government and academia that if industry is interested then it will pay. Industry can invest time and funding but the margins within construction sector from normal commercial activity are often too small to allow large funding for research.

We suggest the following mechanisms for improving Business-University collaboration:

- Opening further routes to fund business working with Universities. For example business should be eligible to bid for Research Council funding but only with a University partner. DTI Partners in Innovation scheme is a good model
- Some payment (even nominal) to business from Universities for e.g. lecturing can significantly help internal funding and engenders good will. For example, EPSRC funding to launch new MSc courses has helped pay Arup staff contribute to development and teaching of new courses
- Businesses and universities seem to have a different view of what constitutes 'cost'. For businesses, time is money, whereas universities appear to see time as a 'free' resource.
- There have been discussions over the years within Government of an R&D levy. The Act of Parliament of 1946 stated that if the construction industry collectively agreed they could have an R&D levy however, the majority of contractors have been opposed to it. We support the idea of a levy for R&D in construction to increase collaborative activities.
- There are excellent opportunities for academics to work in industry and visa versa, for example Royal Society Industrial Fellowships.

What impact has R&D tax credits had on business demand for research and skills?

R&D tax credits are having no impact as yet on our business. However, they open up strong opportunities and should provide strong incentives to collaborate more. They will be a very strong incentive for companies like ours that have systems in place to monitor and identify R&D work.

However, the definition of R&D and its use in defining tax credits can be vague. A member of staff had experience working in the Far East where similar tax credits operated meant that many manufacturing companies called their design departments “R&D” just to gain tax credits. This leads to countries like Japan and Korea having an unusually high R&D spend compared to the UK and distorts the figures.

Politicians and civil servants should understand this potential for distortion when comparing statistics.

This response has been based upon interviews, discussions and comments from a selected number of Arup staff from around the UK. The views expressed in this document are those of the contributors and are not necessarily those of the firm as a whole.