The Engineering Professors' Council is the representative body for engineering academics in higher education with 79 institutional members representing c. 6,000 staff.

The Dowling Review was publicised amongst the membership and responses were received from the following members:

University of Bristol
University of Birmingham
University of Chester
University of Huddersfield
Imperial College London
London South Bank University
Queen Mary University of London
University of Manchester
University College London
University of Exeter
Loughborough University
University of Cambridge
University of Nottingham
City University London
University of Sheffield
University of Strathclyde
Liverpool John Moores University
Harper Adams University
Aston University
Coventry University

The responses have been summarised to allow ease of reading. One or two universities have provided "case study" examples which have been appended. All of the respondents have outlined personal extensive/significant experience in university-industry collaboration/partnership.

Contact names at individual institutions can be provided if depth interview follow-up is required.

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1. What are the key success factors for building productive, long-term research partnerships between business and academia and how do these vary across sectors and disciplines?

1. Building a trusting and open relationship

- A commitment on both sides to openness and confidentiality when needed.
- Academics must see things from the industrial perspective. Companies exist to make money, not to fund elegant research. So one must always bear in mind what they are looking to achieve and then try and meet it as well as possible. This will mean taking actions from time to time that you wouldn't normally do when doing academic research, e.g. cutting corners a bit and making 'best guesses'. Costs and the pragmatism must also be constant bedfellows; there is no point in recommending an approach that will deliver a Rolls Royce if it has to sell for the price of a 2CV! Having said all of this, as an academic you are being involved because you bring skills and knowledge that the company doesn't have, so these must not be ignored.
- Long term relationships can be extremely fruitful but usually take time to develop - particularly with big companies. Patience is required; trying to push through the trust-building phase too fast (it can last a few years with some companies) usually results in a breakdown of the relationship. Understanding too that key staff in the company can change is important but if it happens too often it is probably a sign that there is a lack of commitment at the top of the company and it may be best to move on.
- Acquire a reputation for delivery…
- Be flexible and responsive to change - experiment, adapt and learn from experience, and encourage creativity
- Ensure you recruit the right (high quality) people for the project
- In summary: "*they depend 100% on individual personal relationships. It's utterly misleading to describe these as industry-university collaborations. They are person-to-person collaborations, and in my experience build up over years of incremental trust building: they attend my workshops; I go and give speeches at their outreach events; they support a CASE award and it goes well; I make strategic suggestions to them; they provide cash funding for a PhD studentship and so on. The whole thing is extremely fragile - if the key contact leaves or changes role, the relationship with the "company" can quickly disappear. It's a one-to-one connection".*

2. Connected to trust building, is the need for clear, relevant and regular communication…

- Clear unambiguous and relevant communication, close teamwork and well understood and shared objectives. This applies to all sectors and disciplines.
- Regular communication between the partners ensures that the project can progress along agreed lines with minimal misunderstanding. For a collaborative project to be truly successful, there should be no "them and us" within the group, the participants must act as

a single team, whether they are from business or academia. The objectives of the project should be clearly defined, and understood by all before commencement. Any changes during the life of the project should be discussed and agreed before implementation.

- Frequent interactions enhanced by the sharing of facilities and the co-location/exchange of staff
- In summary: "*Strong relationships are developed by creating common levels of understanding. As we face different realities and pressures, industry and academia need to develop mutual understanding and this can only be achieved by participating in different activities and situations. To improve communication with the industry I have created an academy where both industry and academia can exchange ideas and learn from each other. The world's problems are identified to be increasingly of an interdisciplinary nature, which can only be resolved by interacting not only within but also outside our disciplines. "*

3. Contracts and intellectual property (IP) ownership

- Communicate and agree the arrangements regarding IP ownership and rights to publish in advance. Universities shouldn't be too protective on IP ownership but companies need to understand that universities must have the right to publish unless there are exceptional circumstances.
- Leave the contract negotiations to the specialists.

4. Shared vision and plans

- Establish a compelling but realistic picture of what the partnership can achieve. Industrial partnerships work best when university research is embedded in company research plans and is not just an *ad hoc* extra.
- A shared understanding of industry needs and academic performance indicators.
- A shared long-term view of where industry should be.
- A focus on the shared delivery of tangible results to the customer
- A need to follow different strategies for different sizes of the business (i.e, large industry or SME) and whether the funding is public or private.
- Identify common areas of interest.

5. Time and money

- In order to engage more directly with current business problems, universities need to be able to react on shorter timescales. (But recruiting staff to undertake short intensive business driven projects is very hard).
- Academics need to understand and fit with business imperatives– time is money – and ways around academic processes, approvals, regulations etc. need to be found.
- Time to develop the partnership – and the financial help appropriate to the partnership is important, particularly in finding the necessary investment for SMEs.
- Willingness to commit to a long-term funding strategy is key.
- Long term funding (>3 years) is necessary for universities to hire high quality research staff. Committing to more than 12 months can sometimes prove to be problematic owing to company accounting conventions.

- Unless the company has the funding to pay for everything (increasingly rare these days), multiple funding sources are needed (e.g. EPSRC and TSB/BIS) AND luck to tie them together. It is so difficult to get continuous funding, just when you need it, from Government-based sources. A willingness to put the effort in on both sides, with minimal funding, to get thing moving is sometimes necessary.
- The project must be costed realistically – and differently from pure Research Council funded projects – see also Barriers (and industry view of Full Economic Costing…)
- Do the research which business needs doing , instead of viewing business as a source of funding.

6. High level support and dedicated leadership

- There needs to be support from high level within the company, ideally close to Executive Board level. This is particularly important when working with SMEs.
- The establishment of strong governance and professional structures is necessary, with joint decision making across all levels of the partnership (both strategic and operational)

7. Be prepared to work in multi-institutional collaborations and other partnerships

- Companies will wish to engage with several universities to acquire expertise required. There will be a large range of factors that determine whether a company will wish to work with any institution; force fitting a match in a range of topics areas with one "partner" institution is not often successful.
- Many companies want to engage with universities in order to maintain an understanding of future research trends and opportunities, to talent scout amongst graduates and researchers and as a public duty.
- Understand that a company may not need or require access to the same research base for long periods from one academic institution. Businesses are not normally able to accommodate speculative development in advance of it being seen as immediate need or concern.
- Companies may be encouraged to seek advice on knowledge that has already been understood and de-risked by academia. The term "research partnership" itself does not encourage some companies to work with universities – research is seen as unknown, exploratory, unbounded and risky. The key issue is mutual understanding but not necessarily mutual involvement. Having said that, the better academics understand the business world and needs, the better the relationship will usually become, but this takes time and effort on both sides – time and resources that are often not available or anticipated.

8. Use your students…

- All engineering students undertake a 12-month work placement. This gives students the opportunity to work in a professional company and put into practice the theory and applied skills they have developed. In return, the company gains access to what the students have learned about the latest research and techniques. ("*We have a well-established placement*

network across all sectors which has helped bring about valuable collaborative research with industry".

9. Some specifics…

- Keep the technology as simple as possible, understand that every complexity added increases the costs for the company;
- Avoid introducing a new product AND a new process at the same time;
- Consider the final manufacture from the beginning; the last thing that anybody needs is to get halfway through the development and realise that a major step has to be completely redeveloped because the existing approach is simply not economically viable.

Some references cited:

Getting Partnering Right: How Market Leaders Are Creating Long-Term Competitive Advantage

Neil Rackham, Lawrence Friedman, and Richard Ruff, McGraw Hill, 1996 ("Vision, Intimacy, Impact")

Industrial Strategy (Government & Industry in Partnership); Progress Report, April 2011

2. What barriers do academics and universities face in developing long-term research collaborations with businesses and how can these be overcome?

1. Time

- "*Increasingly in the modern academic world, time to focus on the research. Most academics work 50 - 60 hrs per week these days and many work far longer hours pretty much constantly. Teaching, research and administration all vie for attention and all need doing to a very high standard."*
- *"The academic needs to expect to do just about all of the legwork, filling in forms and writing draft letters for the industrial partner when external funding is sought. Though occasionally you find an industrialist who is willing to do it, by and large the view is still prevalent that academics have more time than industrialists, even though this hasn't been true for at least 20 years…"*
- *"Time... it takes time and effort to set up collaborations with business. This can be very difficult to find if you are a relatively new academic as you will already be stretched."*
- Long term research partnerships may blossom after collaborations get together for more short term reasons. Short term projects occur when industry needs help and these are difficult to establish for two reasons:
    - Industry needs help now, and most university assistance cannot be set up in a timely manner. Small projects might be started with project students or placements, but these can only start at certain times of year, and it is never the right time.
    - Projects that carry staff involvement such as Knowledge Transfer Partnership (KTP) or research projects have to undergo a lengthy and difficult application process with low rates of success.

2. Money

- Funding and costs can be an issue. Full economic costing (FEC) is simply not understood by industry and viewed as a skimming mechanism by universities to cover high cost of facilities.
- Industry is reluctant to pay for researchers (RAs PhDs). Industry tends to be organised on year-by-year basis while the PhD theses are typically delivered over 3 years. UK industry needs to be able to fund longer-term projects.
- Universities tend not to be able to access the finance required to mature research to the stage that it would be of interest to businesses.

3. Mutual understanding and conflicts of interest

- The value of exploratory, long-term research deliverables needs to be understood by industry, government and the public at large. In some areas, there can be a perception that universities should be providing fully subsidised or free services to business. By establishing clear and open communication between the collaborating organisations, the benefits of joint investment and funding (and added value to both partners) can be demonstrated.
- There are different driving forces for business and academia, and an agreed compromise needs to be reached before a project starts. Business requires rapid deliverables, but academia needs the time to consider issues thoroughly, hence both need to understand the timescales of the other. Equally, business is looking for the return on their investment in terms of short term financial benefit whereas the academic view may well give a long term benefit which is more difficult to quantify on a balance sheet. These need to be discussed to find middle ground where each side can benefit.
- There are often unrealistic expectations on behalf of university contracts managers on the value of the IP. This can lead to very protracted negotiations, delaying work and in some cases causing the project to not get started at all. There needs to be a realization that (at least for large companies) almost all critical research is done in-house. University research supplements this work and allows relationships to be built leading to a greater level of understanding of the underlying research and the possibility of recruiting high-calibre staff.
- Industrial requirement to protect IP versus universities' need to publicise/produce papers. Working with businesses often reduces or eliminates the scope to publish and is hence seen as a career limiting move. Often it conflicts with teaching and other academic commitments eg PhDs graduated and supervised. There needs to be better mechanisms and career paths to reward university staff who pursue work with businesses. As publications are international currency in academia, this is a very important consideration for individual academics – it effectively ends the academic career.
- Without significant dialogue between both organisations at the start of a potential project or relationship, IP rights and ownership can be a significant barrier to progress. The use of clear framework agreements (covering multiple projects), open dialogue, and evidence of demonstrable returns to both organisations can potentially address this issue.(Coventry University mentioned that they typically look for an open license back to

the institution for teaching and future research, clear lines of agreement on publication to avoid disclosure of confidential/competitive information (whilst not limiting academic career development), options on exploitation in other markets, and clear routes to commercialisation (with associated "fair and reasonable" royalty payments back to the collaborating institution)).

- Universities need to understand that staff changes in the private sector tend to occur at a higher rate and incidence (due to organisational restructures, promotions, role changes, and departures) – impacting on personal contacts with universities and the overall relationship and that this needs to be managed. (Establishment of "multi-touch" relationships over time, which are less dependent on single, individual contacts).

4. Incentives and rankings…

- UK rankings and league tables do not incentivise universities to work with businesses.
- "*Projects such as KTP in which industry is helped by academics are currently assessed on the basis of original research value to the institution. Most companies looking for projects need help from someone who has the requisite knowledge but very often this does not lead to original research and is therefore rejected by the KTP assessors and not valued by the university because it does not contribute to research outputs for REF. "*

5. Bureaucracy

- Legal agreements and the process of agreeing IP ownership are often protracted and overly complicated;
- Complicated processes related to public funding for collaboration such as Technology Strategy Board.

7. How effective are current incentives, policies and funding streams for promoting this type of collaboration? How could these be improved in order to scale up the range and impact of collaborations being undertaken nationally?

1. Effectiveness of incentives

- Impact case studies in the Research Excellence Framework (REF) are an excellent way for researchers to gain recognition of non-academic impact of their work.
- The current Higher Education Innovation Fund (HEIF) funding for industrial research is good but needs to be bigger.
- The current increasing concentration of funding by the Research Councils mean that only a limited number of players can benefit which limits innovation.
- Incentives and funding streams work reasonably well for larger companies where there is resource available to dedicate to understanding how to apply for funding and to put bids together. Smaller companies often struggle with this, as they do not have the time or resource available. The timescales for application for funding are often too short for

companies to be able to put the relevant bid together, especially for matched funding bids where the matching funding from the company needs to be incorporated into an annual budget which may have been set the previous year.

- Universities have little incentive to pursue activities with industry that do not obviously carry large research value. Projects that could be immediately helpful to industry, and interesting to students are unlikely to contribute to REF.
- REF 2014 requirements had very precise constraints on what was eligible – if repeated in 2020, these may constrain what exploitation / collaboration will occur. For example, academics will only wish to exploit "REF compliant" research, not wider knowledge and expertise.
- Generally the funds for initial work together are quite good (at least in Scotland). There are also good (competitive) funds available for large projects. Normally the problem is getting the funding for something in between.
- Incentives for academic staff are obvious when jointly seeking external funding but less so for some commercial contracts if not directly leading to REF impact case studies.
- KTPs are good and effective but just too small scale.
- RPIF (the Research Partnerships Investment Fund), and the Catalyst Fund are helpful.

2. How to improve incentives to scale-up range and impact

- There are some good incentives in place but consistency in policy and assurance of the schemes being in place for the long term (cross-party support) would be welcomed.
- More should be done to include industry collaboration in university performance indicators and rankings.
- Research Council responsive-mode type programmes are a good model as there is no need to wait for a Call on a particular topic. The reverse is true for funding aimed at higher technology readiness levels (TRL) for which there is very little, if any, responsive-mode funding. This means that one can have an idea, perhaps developed with RCUK funding, all ready to transfer to industry but there is no relevant Call within the critical time frame needed. By and large, industry will have a window of interest and if this is exceeded then even if a Call does come along the money will have been committed elsewhere (or the key industrial protagonist will have moved on). Having a 'responsive-mode' source of high TRL funding would be very useful.
- Some sort of support mechanism for smaller companies would be of benefit. This gap has been filled in some areas by entrepreneurial companies set up to advise on available funding, but is then an added overhead to the budget of those companies, especially where bids are unsuccessful but fees are still charged.
- For larger matched funding projects, some way of companies being able to spread the cost of the research across the period of the project, especially where the project has a very "front end" loaded budget (with initial capital investment for example) would allow them to be more reactive with commitment.
- If EPSRC offered some fraction of funding for PhD students - say 50-50 with industrial partners, we could do a fantastic job of engaging broad industrial support. Doctoral Training Centres are no proxy for supporting PhDs through projects.

- Currently most funding streams require industry to be the principal applicant and academics to take part to support initiatives. This could be improved if collaborative schemes such as those offered by the EU framework programmes are implemented.
- Different models may be needed for different sized companies and also for different levels of research, from short-term proof of concept through to bespoke product development and eventually commercial deployment.
- The bureaucratic nature of some funding programmes (and the speed and timeliness of the application evaluation process) can have a significant impact on research collaboration – effectively eliminating this as a route to support some time-critical activities. More investment into streamlining the approach to funding approval (and greater transparency over research project selection) would go some way to alleviating some of these issues.
- The perceived emphasis on the provision of greater funding support to a select group of institutions (by some funding organisations) can be a barrier to engagement with the "newer" universities (many of whom have long and established relationships with business). A consistent and transparent approach in this area would scale-up the range and impact of collaborations being undertaken nationally.

8. How can progress under the Industrial Strategy be harnessed to stimulate collaboration between businesses and researchers in the UK?

- Universities should create Industrial Advisory Boards and hold conference days showcasing their work to industrial partners. HEFCE could earmarks funds to make this happen (e.g. through HEIF).
- Incentivising academics to spend time in industry (without adversely impacting their academic career progress)
- Better communication of the academic workload and pressures to industry
- The Strategy could be used to promote more three way collaboration whereby Government funding could be used to encourage business and academia to work together in a more collaborative way. Businesses look on Government funding as a way to minimise what they need to spend on R&D, rather than as a way of extending what they are doing. They are also reluctant in many cases to "outsource" this work to universities, citing a number of reasons which may or may not be valid, but nevertheless are perceived - lack of control over timescales, leakage of IP to competitors and "not invented here syndrome" to name but a few.
- The academic stigma of industrial funding as being second class compared with RCUK research funding has to be overcome through appropriate recognition and incentives.
- *"Creating general information about who is who and what competencies exist can be a starting point. Meaningful collaborations usually start when there is a real problem and through a medium they can locate the expertise and competency required. Therefore, I suggest that a forum whereby those facing problems can identify and contact those who can offer potential solutions; the role of government funding here can be to develop the framework and facilitate this process until the time that collaborations can stand one their own feet. "*
- Provide a mechanism for universities and SMEs to jointly bid for new LEP funding.
- Provide a range of schemes addressing different bands of Technology Readiness Levels

- Align the REF requirements with the needs of the Industrial Strategy. "*Even with the new Impact case studies the emphasis is on turning curiosity-driven research assets into business/social impact*. "
- *"The growing centralisation of RCUK income has severely curtailed the impact of many Universities on the regional economy. There is a need to revisit the balance between targeted and responsive mode funding from Research Councils. The gap between basic research, proof of concept demonstration and commercial validation has gradually been closed by different types of funding notably from TSB. This needs to be at least maintained if not grown further".*
- Support the award of industrial research fellowships and have industrial visitors working in universities.
- UK Government must commit to increasing overall government spending on R&D (to at least 3% of GDP in line with other industrialised nations), understanding that this catalyses industrial R&D spend. Industry must play its part by recognising innovation as a vital driver of future revenue growth, and develop or expand collaborative supply chain innovation schemes.
- UK Government must incentivise both the uptake of STEM-based degrees and the uptake of STEM related jobs for these graduates, and ensure skills funding/tuition fee support is better aligned with the UK's Industrial Strategy.
- Supported by the Higher Education sector, industry must expand business-led skills training schemes and supplier mentoring programmes
- UK Government should continue to improve access to capital for medium sized companies, and encourage collaborative investment in R&D

Other publications cited:

- The opportunity to harness progress under the Industrial Strategy to stimulate collaboration between businesses and researchers in the UK, has been well described by the CBI in "Pulling together: strengthening the UK's supply chains", CBI Publication, October 2014

9. Which models of collaboration have proved most successful for stimulating SME engagement with the research base in the UK? What additional action needs to be taken to strengthen UK performance in this area?

1. Successful stimulants of SME engagement

- The Faraday scheme (before it was turned into Knowledge Transfer Networks) showed that having a cadre of technology translators who understood SMEs' needs and did the filtering ensured that only opportunities that were really relevant to the SME were put forward and was very successful.
- Knowledge Transfer Partnerships have been a successful model in terms of sustainable engagement (although the 2006/7 changes requiring guaranteed research outcomes made them less attractive to the university partner)
- Example of how SMEs can be encouraged to engage with the research base : University of Huddersfield 3M Buckley Innovation Centre. This university owned organisation has been set

up to be the interface between the university and business, a "one stop shop" to allow business people to explore how they might work with the university without needing to have an "inside contact" or to know who to approach. Similar centres at universities would make the research base more accessible to business, particularly to SMEs.

- The Small Business Research Initiative (SBRI) is a good model
- The scheme that allowed SMEs to bid for iCASE awards was excellent.
- The Advanced Manufacturing Research Centre (AMRC) is an excellent model as is the International Automotive Research Centre in Warwick. A way of getting large companies to support their SME supply chains.
- Innovation vouchers
- CASE awards

2. Additional actions

- Innovate UK should fund 100% of such work undertaken at universities which is SME focused.
- Providing funding for Master's students to conduct their final project within SMEs would be helpful (common in Germany and France).
- If KTPs could be made simpler to apply for, and their assessment made relevant to fostering collaboration rather than achieving research outputs, the number of schemes might increase again.
- KTPs are a good model for SMEs although not great value for Universities. Mechanisms could be put in place to link more basic research e.g. CASE studentships with successful KTPs, as a way of continuing R&D beyond the immediate funding period, to consolidate the impact on the company and possibly to complete the quality of research that is needed for a REF impact Case Study.
- Mid-size companies need support – they have more flexibility that the massive companies, and more critical mass than SMEs.

"The most significant models of collaboration for SME engagement at a national level, have been stimulated by the multiple programmes and range of options developed and delivered by Innovate UK (including Innovation Vouchers, Knowledge Transfer Partnerships, SMART, the Small Business Research Initiative, Collaborative R&D, Launchpads, and Eurostars). Some universities have leveraged both EU Structural Funds and the HEFCE Higher Education Innovation Fund (HEIF) to initiate SME research collaboration through the Knowledge Exchange Enterprise Network (KEEN) programme.

The challenge of working with SMEs is that there can be a focus on lower levels of innovation, or on business improvement - particularly with regards to local/regional funding. Research collaborations with SMEs can be purely transactional, with one-off projects typically not progressing through to longer-term partnerships. This is largely down to cash-flow, susceptibility to market fluctuations, and available time/resource within the individual SMEs. Additional action is therefore required to allow SMEs to transition to larger-scale, more "impactful" projects."

10. Which approaches/sectors/organisations – in the UK or internationally – would you identify as examples of good practice in business-university collaboration with the potential to be applied more widely?

- Rolls Royce UTCs are a success story for the UK. Other companies have tried but have taken too short term a view ie less than 5 years. Rolls-Royce has made longer term commitments.
- Hub and spoke research centres with co-location of TRl 1-3 and TRl 3-5 work, as done in the Catapult centres.
- Rolls Royce and the University of Birmingham for jet engine alloys and with Loughborough University for engine design.
- See description of the 3M Buckley Innovation Centre above.
- Business Improvement District (BID) companies have been effective in industry academia knowledge exchange and can be an example of good practice.
- The German BMBF projects. The funding of PhD students by industries, the German / French automotive and aerospace companies have often their own research programmes for PhD students. For these they are forced to look for partner universities. Often, this is supported by framework agreements between a special university and a company.
- DARPA grants and similar in the US have certainly worked in some cases. The US also funds centres of excellent e.g. MSEC's or specific industry focussed activities. Here the model is the business contribute a "subscription" usually ~$250k and then have strategic input as to the direction of the research undertaken. Effectively, this allows pre-competitive research to be done in areas that are likely/possible to be future products. In the UK this model is may be less effective due to a lack of leading edge critical mass in our businesses.
- The FUTURE Vehicle project (collaboration of 6 universities and 10 companies)
- The iCASE scheme
- EU Framework programmes.
- The Scottish Interface system works reasonably well.
- Sensor City initiative in Liverpool (collaboration of LJMU with the University of Liverpool and Liverpool City Council).

Appendix

Some examples and case studies

Coventry University Case Study 1:-

Unipart Group (The Institute for Advanced Manufacturing & Engineering)

Supported by £7.9m from the HEFCE Catalyst Fund, and direct investment by both Coventry University and the Unipart Group, the new 1700m2 Institute for Advanced Manufacturing & Engineering (AME) was opened on the 3rd November 2014. This is a new approach of co-locating academics and industry-based engineers to address the skills shortage in the UK manufacturing sector, stimulate innovation, and the need to accelerate research commercialisation. Based on an existing Unipart manufacturing site:-

- Undergraduates apply classroom theory on real “live” projects on the Unipart shop floor
- The co-located team work together in AME on research projects aligned to Unipart's technology roadmaps
- (this also includes working with OEMs (Ford, Aston Martin, JLR, etc) and smaller supply chain businesses)
- Over £2.5m investment in state-of-the-art equipment in AME will accelerate new technology through the Technology Readiness Levels (TRLs), and deliver new products and high quality research outputs that allows both Unipart and the University to position themselves amongst their world class peers

"I am very pleased with the progress to date. There is a real buzz in our new facility, with researchers, engineers and students working alongside one another. This will be central to driving change, developing my employees and creating growth in the business through innovation and new technology. Several customers have visited AME and I am delighted with the feedback. We have taken a very novel approach to bringing Industry and Academia together. The team is focused and well-motivated, already delivering in all three key areas: research, skills & education and business development."

(Carol Burke, Managing Director, Unipart Manufacturing Group)

Coventry University Case Study 2:-

MIRA Ltd (Sponsored PhD Studentships)

As one of the UK’s largest transport systems R&D companies, MIRA deliver customer solutions with a technical team of >500 staff; including dedicated resource focused on intelligent vehicles and mobility, controls and electronics, and functional safety. This technical expertise is underpinned by over 35 highly specialist facilities ranging from electro-magnetic compatibility laboratories, components and structures test laboratories, simulation and modelling facilities, to climatic wind tunnels. MIRA has been at the forefront of R&D programmes developing leading solutions in the area of intelligent vehicles, and determining their system performance for more than a decade.

In 2014, as part of a long-term collaboration, MIRA Ltd and Coventry University commenced joint sponsorship of a portfolio of PhD programmes which will focus on a range of topics (including cyber security, future vehicle design, human factors, and vehicle dynamics). The PhD's directly support long term R&D priorities at MIRA as well as development of the core business. The students will spend at least 50% of their time at MIRA throughout the programme, with expert supervision provided by both the technical leads at MIRA and transport R&D specialists at Coventry University - advancing current thinking in the critical area of intelligent mobility.

"We are delighted to be collaborating with Coventry University on a portfolio of PhD's linked to our core R&D themes. The universities emphasis on undertaking more PhD's with a strong focus on impact is a good fit with our own internal research model"

(Dr Anthony Baxendale, Head of Future Transport Technologies, MIRA)

Coventry University Case Study 3:-

Jaguar Land Rover (Technical Accreditation Scheme)

The Jaguar Land Rover Technical Accreditation Scheme (TAS) brings together eight university organisations (Coventry University, Loughborough University, University of Warwick, Warwick Manufacturing Group, Cranfield University, University of York, University of Bradford, University of Southampton) to deliver skills development in specific key technical disciplines which are needed to support future product strategy and low-carbon technologies. Since the scheme was launched in 2010 (and endorsed by the Institution of Mechanical Engineers (IMechE), over 50% of the R&D engineers at Jaguar Land Rover have undertaken TAS modules. Coventry University are the provider of vehicle engineering and control systems modules within the TAS programme, which saw 169 delegates attend 10 modules during the 2013/14. The schedule for 14/15 academic year is underway with a projection for 300 students over 12 modules.

"This is a significant investment by the business in not only monetary cost but time out of the office and private study by the individual, but the return on investment is huge, with the programme paying for itself twice over in money and in time saved."

(Jo Lopes, Head of Technical Excellence, Jaguar Land Rover)

Other examples of good-practice in business-university collaboration include:-

• The University of Durham and Proctor & Gamble (P&G)

Bioscience, surface science, and manufacturing innovation – R&D partnership

http://www.pg.com/en_UK/news-views/Inside_PG-Quarterly_Newsletter/issue3/community-matters.html

• Brighton Fuse (Innovation in the Arts, Humanities, Design, Digital, and ICT)

National Centre for Universities and Business, University of Sussex, University of Brighton, Wired Sussex

http://www.brightonfuse.com/

• Tekes, Finland

Publicly funded expert organisation - financing research, development and innovation in Finland

http://www.tekes.fi/en/

• Chalmers University of Technology, Sweden

Education, research, and innovation

http://www.chalmers.se/en/Pages/default.aspx

• Steinbeis, Germany

Specialist knowledge transfer

http://www.steinbeis.de/en.html