

Technology Transfer a Partnership between Research and Industry

In this technological world, the economic well-being and health of a nation's citizens, increasingly depends on access to new technologies, that deliver greater and greater efficiencies. New technology arises out of researcher's quest for new knowledge, and is delivered by companies in the form of new or better industrial products to consumers. The distance between new knowledge and new product is called the Technology Transfer (TT) 'gap', which needs a 'bridge' if economic development is to happen.

Therein lies the problem :

- Researchers are specifically trained and experienced in the very demanding disciplines required to search for new knowledge,
- Industrial managers are specifically experienced in the equally demanding disciplines required to deliver industrial products to customers.
- Very few people have a work experience which spans these two disciplines.

Therefore, the bridge between research and industrial application requires effective **collaboration** between academia and industry. While the search for knowledge (research) and delivery of products to customers (industry) are both very well understood within their own fields, the two activities are almost mutually exclusive, requires fundamentally different skills and are motivated by entirely different forces.

Large companies address this of course by managing their own research facilities and academics can find themselves interacting with a wide range of research expertise in the industry sector. The technology transfer gap is therefore more acute in industries dominated by SMEs, including agriculture.

The different motivations driving each activity have to be recognised, made explicit and accepted before true, effective and sustainable collaboration can take place. A successful technology transfer project has to provide sufficient incentive and be free of dis-incentives, to motivate each partner to complete their respective tasks in the technology transfer process.

Funding agencies in particular have lately recognised the need to bridge the technology transfer gap when commissioning research. Increasingly reflected in the calls for proposals, the technology transfer elements aim to provide incentives to motivate the academic and industrial partners into collaboration. These pages hope to go some way to explaining the rationale behind the technology transfer elements in such proposals :

The core question is : what actually motivates researchers, and alternatively, industrial managers, to which the incentives have to address ?

Incentives common to both partners :

There is of course, only one incentive that will motivate a collaboration : each has to provide something that the other is missing. Most often that 'something' is access to funding but there are other motivations that can at times assume greater importance:

- § **Funding** – all of us are only allowed to carry out activities that are explicitly funded : either externally (public research or education funds) or from profits generated from previous activities (industry)
- § **Joint interest** – unless the academic partner has some interest in the impact of their research after it is published, and the industry partner has some interest in the science underlying their activity, it is unlikely TT will happen.
- § **Self interest** – otherwise called 'job satisfaction' – individuals tend to exercise some choice about what interests us, enjoy a perspective wider than our day-to-day problems and appreciate recognition outside our usual circle of activity. Researchers are expected to have job satisfaction already, industry staff usually have to work hard to get it, but both will go to some lengths to achieve it.

Academics are motivated by :

- § anything which enhances an individual's career or a department's reputation, through published papers, leading to access to further funds, etc. (- this is a necessity, not a luxury, something not always appreciated by industry managers)
- § the strategic plan of the public funders, explicitly stated in the 'calls for projects' – researchers will develop an interest in new areas (eg TT) they know will be funded.
- § direct public funding for technology transfer, even if restrictions are placed on the exposure allowed to accrue (published papers, presentations etc)
- § funding conditional on industry co-funding – there is implicit access to additional industry resources.
- § direct industry funding, even if it comes with strings attached (eg Industry supported Chairs in Universities, confidential projects etc)
- § explicit access to breeding populations, biological material, phenotype and genotype data on an industrial scale, extreme phenotypes, sample collection, etc., that would otherwise be impossible to generate within academic resources.
- § enhancement to funding applications, research plans and access to relevant industry knowledge through input from the industry partner.

- § some sense of satisfaction that their results might 'make a difference' somewhere downstream, further justifying the public research spend.

Industry managers are motivated by :

- § anything that addresses the strategic development plans of the company, that results in increased competitiveness of the company, allows delivery of a new product that will draw a revenue, or otherwise reduce costs and increase profits. (- this is a necessity, not a luxury, something not always appreciated by academics)
- § access to research infrastructure, (basic knowledge, staff, tools and skills) avoiding the need to set up your own research departments within the industry – 'outsourcing' of research.
- § access to public research funding that would otherwise require in-house investment.
- § ability to access a wider range of research and development that cannot be otherwise accommodated within the company's priorities.
- § anything which provides a deeper insight into the breeding populations forming the basis of the company's business.
- § anything which motivates academic research to be directed at addressing specific questions and conditions applicable in the industry.

It is clear that the technology 'gap' can be bridged by building confidence and trust between both communities. This means recognising and accepting the differences outlined above. Distinctions between the layers of fundamental, strategic and applied research, technology transfer and industrial development are functional realities that are starting to be recognised and it is essential to use them to best advantage.

The funding agencies are starting to make this clear through the calls for research projects with industrial participation now often required (part or fully funded within the project) wherever downstream application is one of the outcomes. National and Community funding agencies have an increasing duty to demonstrate benefit to its citizens and this trend can only increase. Livestock breeding, genomics and health, must surely be the one sector with the most to offer and most to gain from this greater integration between research and industry.

In summary, the benefits of collaboration are :

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| To academia : | <ul style="list-style-type: none">* Access to industry-scale populations and data* Increased relevance of research outputs* Access to public and private technology transfer funds |
| To industry | <ul style="list-style-type: none">* Access to large-scale research infrastructures* Opportunity to influence the direction of research* Access to public funding to aid industry development |

These are not so different after all

FAQs - Frequently Asked Questions :

'Recognising and accepting the differences' is the key message in the text above, but various comments are often made as partners try to come to terms with the different cultures involved. So – this final section is a collection of 'Frequently Asked Questions' FAQs, that might be asked by either the Research (RES) or Industry (IND) partner and what might be considered as suitable answers (ANS) or not – its for you to decide :

Proposing the Project :

IND : How can I be expected to read 150 pages of proposal in two days / hours etc?

ANS: This is a common one - funders could be encouraged to spend no more time on designing forms than they expect proposers to spend filling them in – however, until then, form filling could be regarded as a small price to pay for access to what may be millions of Euros of research. The research partner is more familiar with such things and can go a long way to point the industrial partner to what is or is not relevant.

RES : Why can we never get a response from the Industry partner ?

ANS : SMEs in particular have days filled with 'do this now or the business goes under' type activities, and reading long, complicated and involved requests for ever increasing detail necessarily drops down in priority. Staff will not have been allocated responsibility to the project until at least the funding is approved. It is the project co-ordinator's responsibility (almost always a researcher) to keep everybody's attention to deliver the proposal on time.

IND : Why are the Researchers always away at conferences / meetings etc ?

ANS : Researchers are mostly funded by the public purse, and are not allowed to work in isolation. Because this is a legitimate and necessary activity, researchers generally expect to remain in communication while away.

IND : This is not our core priority - why should we get involved ?

ANS : A very large mainframe computer manufacturer famously said much the same about the emerging microcomputer industry just a few years ago. In modern business, it is said that 'change is the only constant' and a business has to run fast to stop the world passing it by. Good judgement is required, but there is no mistake worse than doing nothing.

RES : *Why does the industrial partner not recognise the need for the academic partner to publish ?*

ANS : Researchers must share their results in order to demonstrate any impact and more importantly to legitimise their results through peer review. Alternatively, Industry has to be very careful not to hand over the results of what may be over a million Euros investment to competitors who have not so invested. For both, it is a matter of survival. It is perfectly possible to reach a compromise (many successful examples now exist) where the project is publicised in papers and conferences but accepted that critically sensitive details have been withheld.

RES/IND : *Why are negotiations on publishing and dissemination of results becoming so difficult and protracted ?*

ANS : Usually because partners are not in agreement in to which of three stages the project falls : (i) fundamental science in pursuit of basic knowledge, funded from the public purse, (ii) pre-competitive applied science intending to provide tools to industry and (iii) direct development of industrial products and services. The answer is for funding agencies and project staff to be very clear about which stage the project is intended to address, and how the funding is apportioned. If the framework is clear, the partners on both sides can decide whether it is appropriate to get involved or not.

RES/IND : *Why are negotiations on Intellectual Property becoming difficult and protracted ?*

ANS : Usually because many public academic institutions now have a remit to protect their intellectual output – at some surprise to the industrial partners. There is some justification for this – the availability of national and international funds for research is now often justified in terms of increasing the industrial competitiveness of an economic area, which could be undermined if results were altruistically made available globally. Also the academic partner may often be better placed to manage the IP arising from a project than the SMEs contributing to it. Various strategies are now available to steer a path through this minefield (see for example the *Lambert Protocols*)

IND : *Why do researchers not understand the need for the company to make a profit ?*

ANS : You have to have worked in industry to understand that, without underpinning by company profits, your chosen activity will soon come to an end. It's the same as the researcher's need to publish papers, it is just a different currency.

RES : *Why is the industrial partner not willing to make its populations / staff / resources available until the funds are paid over ?*

ANS : Quite simply, the industrial partner could go out of business if it wastes resources on a project that does not ultimately get funded. Researchers on the other hand, are familiar with the long lead-in time to get project approval and can juggle departmental resources over short periods to make sure they are in place by the time the project starts.

Operating the Project :

RES : Why don't industry partners understand the need for scientific rigour and detail etc ?

ANS : Generally, with some exceptions, you cannot expect them to. Many industry managers will have had only a cursory experience of statistics. It is up to the research partners to be clear as to what is required and why.

RES : Why did the industrial partner suddenly cull all the trial animals ?

ANS : An extreme example this, but not unknown and highlights the main culture difference to address : management in traditional companies, SMEs in particular, is vertical, 'top-down' ie, staff are given management responsibility and allowed to take their own actions. In academia, collaboration is more the norm and indeed, essential. The answer is for the research partner to take responsibility for maintaining the highest level of communication and keeping everyone 'in the loop'. A good principle is never to assume an action is trivial and understood just because it is standard practice – always check with everyone who may be affected.

RES : Why do the industrial partners never answer their emails ?

ANS : Emails were established a long time ago in academic circles to enable the widest and most efficient communications. Related to the previous FAQ, many senior managers in industry still find email too impersonal, prefer to pick up the phone or visit in person, and as a result use email facilities inefficiently. Again, the solution lies in the hands of the research project co-ordinator to recognise and accommodate these differences.

IND : Wasn't this sorted out yesterday over the phone ?

ANS : an industry partner will often assume that because he has spoken on the phone to one person, everybody now knows. The research coordinator will need to pick this up and make sure it is properly circulated to all those who might be affected, however remotely.

RES / IND : OK – so how can we make the collaboration run as smoothly as possible ?

ANS : To avoid many of these problems, each partner needs to be able to see things from the other partners perspective – the best way to ensure this is through an initial series of exchanges where each can see the other's working practices first hand. It then becomes the main function of the appointed project manager (often 'self-appointed' at the project proposal stage) to maintain a flow of information and agreed actions across all participants.