

Global R&D: Where to place the bets?

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The old model of R&D is quickly morphing into something completely different as centralised R&D functions are replaced by global cooperation across the board. The new model draws on knowledge, skills, technology and research from a wide variety of sources. In this article the authors describe how global firms can set up R&D networks that provide maximum benefit in their endless search for innovation.

Back in the mists of time, companies conducted their research and development in well staffed and well funded corporate laboratories, their secrets closely guarded from those outside. In fact, Arthur D. Little was instrumental in the creation of the first such lab, for General Motors in 1911, and for many years the corporate labs worked well. Technologies and products were conceived that helped build the multinational companies that dominated the economy of the 20th century, creating wealth and providing secure long-term employment on a phenomenal scale while applying science and engineering in ways that enhanced the quality of life for much of the world.

But the old model has changed. Many of the corporate laboratories have disappeared; others, much reduced in size, are focused on a narrower range of medium-term business priorities. Business investment in R&D remains as vital as it ever was, but the new model is one of “open innovation”, drawing on knowledge, skills, technology and research outputs from a wide variety of different places and sources, and deploying them through a multiplicity of exploitation mechanisms – product and service creation, spin-outs and start-ups, joint ventures, licensing and so on. Where substantial in-house R&D laboratories remain, they are likely to see themselves not as ivory towers but as nodes in global networks of knowledge.

In a globalised world, those knowledge sources, and the output routes by which they can be exploited, are distributed across the globe. So for global firms there is a need to place R&D activity in different international locations and to enter into collaboration with partners in an even wider range of places. Sometimes the aim is to tailor products and services to local markets and technical requirements, helping to enhance the value that can be generated in those markets by companies based elsewhere. Sometimes – increasingly – the aim is to tap into local sources of expertise and research to augment what is available at the home base of the organisation. Often, both elements can be combined to good effect.

Arthur D Little

Danisco: Global and local R&D

Danisco is a Danish company which has become one of the world's leading players in the food ingredients industry. With activities in more than 40 countries and over 10,000 employees worldwide, globalisation comes naturally to Danisco and to its R&D.

The company has R&D facilities in many countries, some planned and built for Danisco and others the results of acquisitions, and it finds many advantages in having R&D facilities located in several countries. For example, Danisco has a health and nutrition R&D centre in Finland. "The Finnish research environment within the area of nutrition is excellent," says Dr Leif Kjaergaard, Chief Technology Officer of Danisco. "This means that in Finland there is critical mass in the education of nutritional scientists, enabling us to recruit from top-class nutritional scientists as well as to establish valuable collaborations."

Starter cultures for fermented dairy products are an important R&D area for products such as cheese and yoghurt. Danisco has placed its R&D centre for dairy cultures in France. Knowledge of cheese is tremendous in France, and being close to the market and some of the world's largest dairy companies in France is the main determining factor for the location of the cultures R&D centre, according to Dr Kjaergaard.

Danisco has R&D facilities in Asia, mainly in Singapore and China. R&D facilities in China allow Danisco to be close to the world's fastest-growing food market. The main advantages of placing R&D in China are access to a fast-growing customer base and a high degree of insight into a market which is very different from Europe or America - enabling the targeted development of ingredients to suit these different needs. Knowledge about global, regional and local food trends and preferences is vitally important to Danisco as a global food company.

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But all this is a costly business, and choosing where to make a play, and with whom to link, involves making tough decisions. The growth of Asian economies means that R&D investments in emerging countries, particularly India and China but with countries such as Brazil and Malaysia in their wake, are high on the agenda with many CEOs and Chief Technology Officers. Here, the decisions are especially tough because although countries such as India and China offer formidable and fast-developing knowledge and technology bases, the sheer scale of the countries and the cultural issues that face investors from elsewhere pose real challenges. These make it hard to see how to determine the best course of action and harder still to get maximum business value from the investments made or the collaborations entered into. Smart Innovation demands that companies make objective choices, drawing on the most appropriate skills and technologies from wherever they can be found, and translating them cost-effectively into products and services for a wide variety of markets across the world. Sometimes, acquisitions open up the chance to do that – for instance, when Swiss-based Nestlé acquired competitor Rowntree Mackintosh, the latter’s R&D centre was transformed into a global confectionery centre of excellence for the new parent. At other times, the combination of research and engineering excellence with a flexible, responsive management approach secures strategic partnerships with companies for R&D providers, such as BAE Systems’ alliances with Loughborough and Cranfield universities in the UK.

For companies looking to undertake R&D internationally, whether through direct investment of facilities and people or through collaboration with local partner companies, R&D institutions or universities, it is essential to understand how to make these difficult choices. At Arthur D. Little, we have advised many of the companies that find themselves addressing this sort of challenge, as well as national, regional and city authorities that want to ensure their locations are as attractive as possible to inward R&D investors. All need to understand the costs and benefits involved, such as those in the table below, derived from a recent study for the UK government.

Exhibit 1 Costs and benefits of internationalisation of R&D	
Potential benefits: Why do firms do R&D at affiliate level?	Potential costs: Why do firms keep R&D at home?
<ul style="list-style-type: none">■ Closer to 'lead' markets■ Better integration with local production■ More responsive to local regulations■ Access to foreign centres of excellence■ Greater efficiency in production and innovation (not only for the foreign subsidiary but for the rest of the company through intra-firm transfers)	<ul style="list-style-type: none">■ Reduced economies of scale and scope■ Disadvantage of being outsider in the host country innovation system■ Increased barriers to internal knowledge transfer due to inter-unit geographical and technological distance■ Leakage of key technology to foreign competitors
Source: Thuriaux, Veugelers, Brown, ADL report: Internationalisation of R&D for the UK Office of Science and Innovation	

So how do companies make location decisions?

Two recent studies have thrown light on this critical question.

The first took a European perspective. Under the auspices of EIRMA, the European Industrial Research Management Association, several of us surveyed companies across a broad selection of industries. A total of 56 companies, predominantly large multinationals, responded to the survey, with nearly all respondents based in Europe. All companies employed at least 100 people and over 70 percent

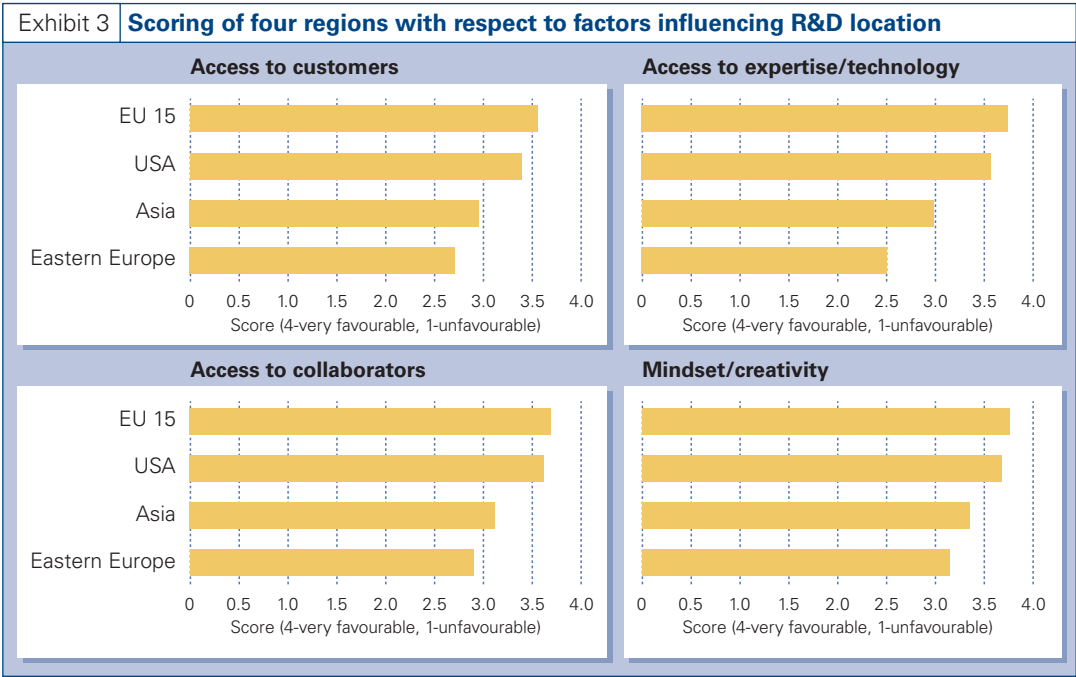
Exhibit 2 Determining factors for location of R&D		
Rank	Factors	Weight
1	Access to customers	4.5
2	Access to expertise/technology	4.4
3	Access to collaborators	4.0
4	Mindset/creativity	3.9
5	Innovativeness of customers	3.9
6	Entrepreneurial spirit	3.6
7	IP systems	3.5
8	Regulatory systems	3.2
9	Culture	3.1
10	Tax systems	3.0
11	Availability of funding	2.8
12	Employment law	2.8
13	Language barriers	2.7
14	Internal differences in the region	2.6
15	Cost of labour	2.6
16	Protectionism	2.5

more than 5,000 people. Virtually every respondent company performs R&D on several continents. Eighty-seven percent of the respondents considered the location where R&D is carried out to be important.

Exhibit 2 shows an overview of the factors determining R&D location and the weight assigned to them by the respondents.

It's clear from the results that factors connected with people, innovativeness and creativity, and the ability to engage and network with customers, collaborators and sources of technology are more important in location decisions than tax, labour costs or the availability of funding. That's important news for Western economies, where costs are a lot higher than in Asia (though the difference is narrowing as Indian and Chinese scientists and technologists are increasingly in demand). Intellectual property and regulatory systems are of intermediate importance to the respondents.

Looking at the table in more detail, the top-ranking factors are access to customers and access to expertise/technology. On both of these factors, the EU15 was rated most

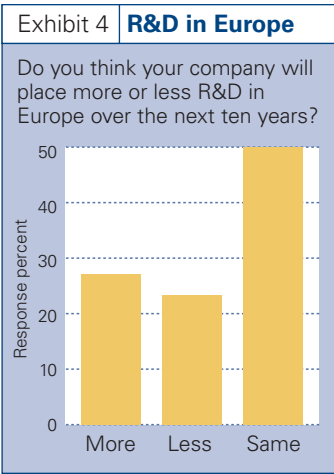


highly, closely followed by the US. Asia and Eastern Europe follow at some distance. The EU15 and US also score substantially higher than the other regions on the factors ranking 3, 4 and 5 (access to collaborators, mind-set/creativity, and innovativeness of customers).

So Europe is actually in pretty good shape when it comes to its competitiveness for locating R&D. It continues to score highly on most of the factors that companies see as important.

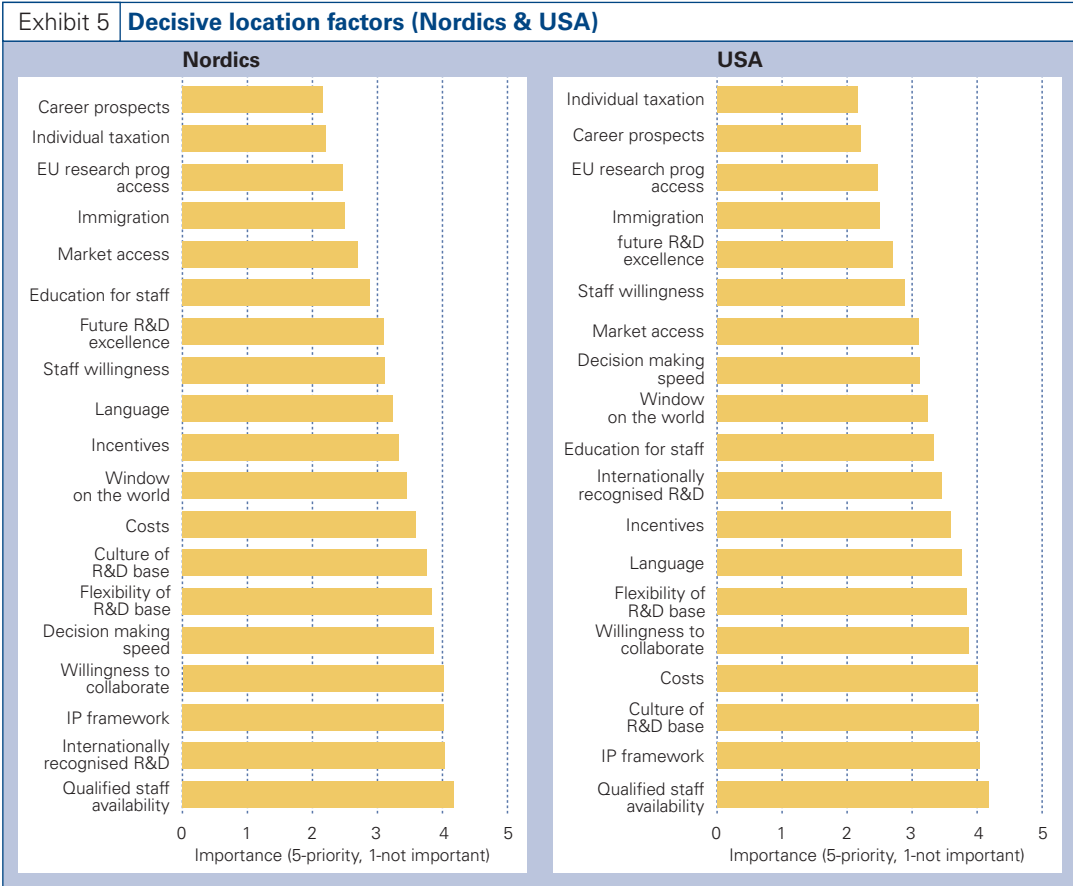
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That said, the sheer size and rate of change of Asian markets – and the strength of countries such as India and China as sources of talent – mean that global firms will invest in a research and development presence in those countries. Of the survey respondents, 76 percent foresee that their next R&D location will be opened in Asia. This is consistent with other work: for example, we found similar results when surveying views among Belgian, German, Austrian and Swiss companies (see Vantrappen, Bohlin, and Bijmens, “A Climate for Knowledge: How Governments can Enable Innovation” in Prism 2004 no. 2, p.25). But that doesn’t mean Europe is facing disaster in research. Most companies expect the level of R&D they perform in Europe to stay the same or increase over the next 10 years, with only a quarter anticipating a decrease. R&D in India and China – and doubtless elsewhere in Asia – will grow. Western firms will want an R&D presence, through direct investment and/or collaboration with research providers such as universities, in those countries. This can be on a very large scale – at the time of writing, for example, Dow Epoxy had just announced plans to invest more than US \$ 200 million over the next five years in R&D facilities in China. Meanwhile, Asian firms with global aspirations will invest both at home and internationally and their growing potency will make them important partners for European and North American research institutions and companies.



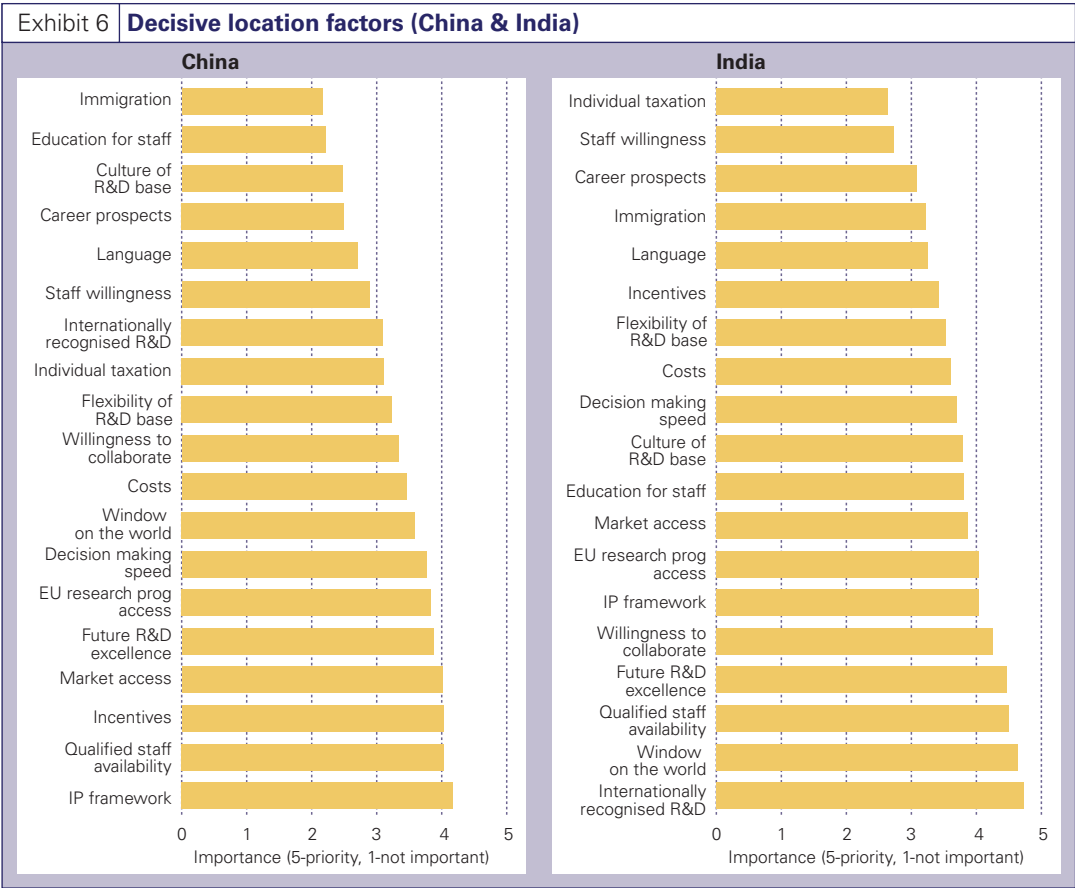
In a second study, sponsored by UK Trade & Investment, we interviewed decision-makers from over 70 companies across four parts of the world that for different reasons are important in globalised R&D. In each case we focused on a selection of sectors especially important in that country in relation to R&D collaboration. We looked at the US,

home to the world’s largest science and technology base. We looked at the Nordic countries, sophisticated and mature R&D performers with high R&D intensity and, because of their comparatively small size, well versed in international collaboration and investment. Then we looked at companies from the fast-growing economies of China and India, recognising that companies from those countries with global aspirations will be increasingly important players in the world of international research and development, while leading universities and research institutions in those countries operate formidable science base in scale, quality and cost.



Turning to the results from US and Nordic companies, there is a good deal of consistency between the two sets of opinions as to which factors rate most highly in the choice of a location for investment on collaboration, and

broad consistency with the first study. The top factor for both US and Nordic companies is the availability of high quality, qualified staff. A willingness to collaborate, for example among the academic and research community, is rated highly, as is the related issue of the culture within the R&D base and its flexibility in co-operation. A sound intellectual property framework is important too. More obvious issues such as cost and language barriers feature, but are somewhat less strongly weighted, particularly by Nordic companies.



Turning to companies in India and China, several features stand out. Indian companies look for partnerships with countries with an internationally recognised reputation for excellent R&D, and which are able to provide a “window on the world” of wider science and technology developments. Companies in both countries look for partner locations which are taking the necessary steps to ensure they

sustain their R&D excellence into the future, and both also look for locations where they can be sure of a pool of well qualified staff from which to recruit. In the case of European locations, investments and collaborations that give access to EU research programmes are given a moderately high rating. Against this, some of the more obvious factors such as relative costs and the presence or absence of language barriers assume lower significance. Perhaps unsurprisingly, Chinese companies attach weight to a location that offers a secure intellectual property framework.

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There's an important message for governments in these findings. The growing importance that companies attach to the availability of suitably qualified staff is a salutary warning for developed countries which, in relation to their population, are producing far fewer graduate scientists, technologists and engineers than the Indians and Chinese themselves. A healthy disciplinary base in universities and colleges and a favourable public reputation for technology-based industry look like being essential characteristics of countries that will continue to be partners of choice. Moreover, the fact that India and China rate highly the commitment of the country to sustain its R&D excellence in future is a warning for Western countries that are failing to keep up with the fast-growth economies in financial support for the research base in universities and elsewhere. On the positive side, however, many local and regional government and public agencies are focusing support on clusters or 'poles of excellence', where co-operation between companies and strong links to the science base in universities and research institutes can be built up. Arthur D. Little has helped a range of them to do so, such as the Walloon regional government in Belgium and the UK's Regional Development Agencies.

During the study we were surprised by the low level of awareness among many companies of the details of the R&D capabilities available internationally. We asked particularly about the perception of the UK's capabilities as a science and technology partner. The UK has one of the highest-quality and, in terms of scientific output per unit investment, the most cost-effective science bases among the advanced countries and, as our recent work for the UK government's Office of Science and Innovation has

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shown, it is more internationalised in character than is normal for countries of its size. Intuitively, one might therefore have expected the UK's science base to be reasonably well understood by companies elsewhere. In fact, we found that, beyond a general perception that the UK has good science, detailed awareness was extremely low across the majority of companies interviewed – not only in the Chinese and Indian companies, some of them relatively new to international collaboration, and in the US where firms might consider the States largely self-sufficient in science and technology, but also in the sophisticated, mature R&D performers from the Nordic countries. So another message for governments is: make sure that potential R&D investors have ready access to appropriate, targeted information on science and technology capabilities – don't just assume a general good scientific reputation will suffice.

R&D in India and China – and doubtless elsewhere in Asia – will grow. Western firms will want an R&D presence, through direct investment and/or collaboration with research providers such as universities in those countries. Meanwhile, Asian firms with global aspirations will invest both at home and internationally – and their growing potency will make them important partners for European and North American research institutions and companies.

Insights for the executive

There are some important lessons to draw for CEOs and CTOs looking to choose where to place their R&D and scientific investments and collaborations:

- Look for a location where you can be sure of access to a pool of highly motivated, high-quality staff from which to recruit. That's probably going to be a location with well reputed, well funded universities and a record of technological advancement in your own or cognate areas.
- Look for a location where the research community is characterised by flexibility and openness to working with business, and willingness to collaborate in the service of business needs rather than just scientific

curiosity. You will then be able to make the most of linkages with the scientific, technical and research community, for instance through collaboration or joint research with the universities, or through personal links established by your own staff located in the area concerned.

- Take the trouble to understand and map out the research capabilities available to you in some detail across the candidate locations. Few companies have the necessary “mental map” of the capabilities across the public and private sectors on which they could be able to draw and from which they could derive significant business advantage. Taking the trouble to map out what’s there could be a very valuable investment of time indeed.
- Look for locations where the talent pool is technically highly qualified and where the culture is such that it fosters creativity. Next to access to expertise and collaborators, creativity and mindset were judged high on the list of factors determining location. Whereas technical skills may easily be mapped out, mapping out creativity is more of a challenge. It may require the company to engage with communities other than the technical and scientific, for example architecture, art and design. In many companies, there is a lot of focus on technical qualifications, but nothing happens for a group of very technically bright people if they do not have the right mindset (or creativity) to use their knowledge in different ways.
- Look for locations in a country where the intellectual property framework is clear, reliable and well respected. This is an area where “advanced” countries still score. For example, the UK has recently introduced a set of model frameworks for handling IP from joint research (the “Lambert Agreements”)¹, while Ireland has introduced an intellectual property code of practice², drafted with the help of a team from Arthur D. Little and explicitly designed to make Ireland a loca-

¹ Lambert review: <http://www.dti.gov.uk/innovation/randd/collaborative-business-university-research/page10577.html>

² Irish Code of Practice: <http://www.sciencecouncil.ie/reports/index.html>

tion of choice for international partnerships. A key aspect of best-practice IP management frameworks is the ability to reach agreements quickly and simply, with speed of decision-making being at least as important a factor as the fine detail of ownership and division of rewards. Interestingly, Nordic companies in our survey identified decision-making speed as one of the top factors in choosing a location for collaboration.

- Don't overestimate the importance of tax breaks and funding incentives. They're welcome, of course, but for most companies we've consulted, they're not the major influences. Factors concerned with people, innovativeness, creativity and engagement with commercial and technological partners predominate. In short, talent, not tax, is the top issue to consider.
- Work with regional and other public and government agencies to maximise the benefits of whatever location is chosen – developing contacts with local universities, engaging with industry clusters and helping sustain a strong science and technology skills base in the region.

Insights for the policymaker

Governments and companies that want to keep their home country as an attractive place for international R&D will need to work together to ensure the right conditions are in place:

- A simple and clear IP framework;
- A high-quality public research base;
- Incentives and styles of leadership that encourage academics and others to collaborate with industry and see their careers benefit from doing so;
- A positive and upbeat perception of science, technology and engineering among young people;
- A sound, up-to-date, motivated and well equipped teaching capacity within universities and colleges.

Countries that invest in these assets will be well placed to secure R&D investments with leading companies. Those that don't risk losing the science and technology assets that they already have.

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