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More Research for Europe

Towards 3% of GDP

Background

The Commission's communication (COM(2002) 499) responds to the European Council's call in March 2002 to raise research spending in support of the broader goal of making Europe the globally most competitive and dynamic knowledge-based economy.

The communication notes the growing gap in European R&D investment compared to the United States, now in excess of €100 billion a year. There is an ambition to increase R&D investment towards 3% of EU average GDP by 2010, with the proportion of business funding approaching two thirds of the total. These are figures already achieved in the US and in some northern European countries.

The Commission outlines areas requiring concerted action, in particular public framework conditions; use of public finance for business enterprise R&D; and R&D and innovation policies within overall corporate strategies.

Response by the European Industrial Research Management Association

The gap is real

1. The communication gives a comprehensive picture of the growing gap between R&D investments in Europe and those in other regional economies, a gap confirmed by other commentators such as the OECD (1) and mirrored by patterns of deployment of human capital. Left uncorrected, this is likely to have deep consequences for the nature of European competitiveness and the structure and dynamism of its industries.

A sense of belief in the future

2. We welcome and strongly support the Commission's initiative to redress this situation. While it is possible to debate individual targets and approach, the aspirations of strength and depth in Europe are shared. Any meaningful response should demonstrate urgency: other economies will not sit back and wait.

   It is the objectives, quality and efficiency of the response that matter, not just the amount of money that is spent. In a global economy, what are the reasons for industries to locate their R&D in Europe and then to grow this investment?

   The aim must be to reinforce a general momentum of belief in the importance of R&D in support of economic growth and well-being. This belief must be

[1] OECD, Main Science and Technology Indicators, 2002.

backed up by world-class capabilities; effective market-oriented infrastructures; appropriate legislation; supportive markets for the fruits of this R&D; and high quality human capital. Only this way can we ensure that Europe is seen as the preferred location in the 21st century for forward-looking industries and people.

Business Risk

3. The capacity to develop, deploy and apply know-how, including technology, helps define a company's ability to achieve continued commercial success. This depends upon investment, which is made according to the perceived best ways of balancing *risk* and *return* within the adopted business strategy.

   In this respect, R&D is no different to other potential investments and competes with them for available resources. More opportunities are available than can be resourced and decisions about the form, location and amount of R&D needed to support a given strategy are influenced by many factors. These include the nature and maturity of the sector of operation and the company's ability to access the high quality resources it requires.

   The *stability* and *predictability* of public framework conditions (including fiscal incentives) bear heavily on all investment decisions as do the *market opportunities* that exist. It is easy to see from areas such as biotechnology, energy, and the environment to see how these matters can develop. Particularly in new fields, market demand may need stimulation. Public procurement also has a key role to play.

Today's gap reflects different patterns of industrial success

4. Although total R&D funding in Europe lags behind that in the US, there is no evidence that established European-based firms with large investments in R&D currently make significantly different decisions about these *levels* of investment compared to their US counterparts. (Refer to the Appendix for background data.)

   Worldwide, the major proportion of industrial investment in R&D comes from a relatively small group of companies. Differences among this group are best interpreted in terms of their international distribution across sectors and where their R&D is being resourced.

   Of the 600 companies now making the largest investments in R&D, 286 are based in North America and 169 in Europe. North American-based companies dominate the most research-intensive industry sectors (165 of these 286 are in the top three sectors compared to 36 of Europe's 169). Nonetheless, even in these sectors, the European-based companies do invest on average at least the same proportion of sales in R&D as their American counterparts.

   Looking now at sectors with lower overall R&D intensity within this group of companies, there is no significant difference in the numbers that are European and American-based or in their relative R&D intensities. Here, it is often the Asian companies that lead the pack.

Investing in global centres of excellence

5. Companies usually begin by carrying out R&D in their home base and then extend elsewhere as their operations become more global. Today, European firms are increasingly investing in the R&D resources and facilities that exist in other parts of the world, particularly in areas of high technology. This migration of activity happens as a result of mergers and acquisitions; through the deliberate relocation of R&D centres; and by partnerships with institutes further from home.

These actions are significant: decisions to relocate R&D will generally mark a step-change in approach and centre of gravity that will not be easy to reverse.

Reinforcing success

6. Many of the large, research-intensive North American companies are relatively new. One interpretation is that economic conditions and attitudes have made it easier in recent years for companies in areas of advanced technology to be formed and then grow to world-scale level of operation within the American economy.

   If these trends continue, there is a clear risk that the locus of technology-led economic growth will move away from Europe. Equally, it demonstrates that success can breed success when a critical mass of high quality resources, predictable regulatory and fiscal environments and supportive markets co-exist.

The continued importance of know-how

7. Input from many sources, including our member companies, convinces us that the requirement for high levels of intellectual capital and know-how will continue to grow. This will not be limited to the so-called "high tech" sectors. The questions are really how this capital and know-how will be gathered and maintained and the nature, extent and location of the R&D that underpins it.

Challenging objectives require concerted approaches

8. The objectives outlined by the Commission are therefore vital for us all but the targets proposed will be extremely hard to meet. A concerted approach is necessary.

   Substantially greater levels of productive investment by private enterprise in R&D in Europe can only be the result of an extensive reappraisal of measures and policies across the board: financing, human resources and infrastructure, regulatory and legislative environments, and attitudes. Fundamentally, the issue is about the ability of companies in a given region to use R&D to achieve world-scale levels of operation.

   This will require a long-term commitment from the European Union *and also from Member States* (2) that extends far beyond R&D policy into areas such as education, market, competition and enterprise policies.

Coherent, connected, supportive policies

9. Much has been written about Europe's relative weaknesses and there is no need to repeat this here in any detail. It is sufficient to note that European systems and institutes are *excellent in parts* but there is a need for *more coherent and supportive policies* across the board, such as:

   - Helping citizens understand the importance of R&D, not just for reasons of employment and knowledge creation but as a key investment in better standards of living;
   - Investing in excellence, underpinned by high quality inquiry-based education, and strengthening the attractiveness of careers in science, technology and engineering;
   - Improving coordination of Europe's public R&D assets to raise overall standards, recognising that excellence is not just about developing a few

[2] The recent provisional communication COM(2002)565 "The European Research Area: Providing New Momentum" addresses this same point.

leading international resources;

- Learning lessons from experiments in business incubation at regional and local levels. Investments to encourage company start-ups can only make a difference if this leads to a sustainable new industrial capacity with an adequate demand for its products. Major problems exist in Europe in taking companies beyond the start-up phase, yet political attention tends to focus only on the initial steps. Problems are magnified by a shortage of the high-calibre managerial talent needed to address this particularly challenging task.
- Eliminating the barriers that national boundaries still maintain: reduced mobility, inconsistent regulation, incompatible technical standards, limited collaborative R&D, inadequate technology transfer and handling of intellectual property; overall greater costs;
- Facilitating productive partnerships between the public and private sectors and among companies themselves: public funding for R&D; co-operation during the industrialisation phase; better integration of the results of academic research into industrial development programmes; sufficient basic research; responsibilities aligned with the specific competencies of the partners. (We return to the handling of intellectual property within partnerships below.)

Good practice

10. The nature of R&D and the manner in which it is performed will continue to evolve. Past models may not be a good guide to the future.

    a) The social sciences have achieved importance alongside the physical sciences and have much to contribute to overall business success.

    b) Research partnerships are taking on greater importance than was the case some years ago when centralised corporate models of R&D were an appropriate response to the needs of the day. Even the largest firms now depend on a nimble ability to combine resources and knowledge from different sources at all stages of product development. We need to become better at managing these activities.

    Our studies demonstrate that most important success factors for collaborations are:

    - clear goals based on mutual strategic value;
    - trust established by a lack of hidden agendas;
    - committed people with clear lines of communication; and
    - effective project management.

    Self-evidently, these same factors will apply to public-private partnerships on a larger scale.

11. At local and national levels, there are several examples of good practice regarding public-private partnerships. We note Finland's renaissance; Singapore's ability to maintain regional leadership; the qualities that exists around Cambridge in the UK. In each case, the belief in future industrial vitality has been clear.

12. The tendency to compare Europe with the United States is not always helpful but some points are worth noting:

    - There is no sense that the quality of work within European public institutes is inferior to that carried out within their American counterparts.
    - Prestigious American universities are currently more prone than their European counterparts to place unrealistically high prices on collaboration and (partly as a consequence of the Bayh-Dole act) tend to limit the rights of the funding partners to the results that emerge.
    - In general, the European institutional awareness of technology transfer is less well-developed than in the US.
    - The resources that are available in the US federal laboratories and through initiatives such as the Advanced Technology Programme and defence-oriented research, offer nuclei around which significant collaborative efforts can coalesce, leading to critical mass and long-term strength.
    - The process of nucleation supported by market stimulation and / or public procurement is particularly important when activities are based on large, pervasive projects with a mix of short and long term perspectives across several areas of technology (e.g. in the defence field, space, electronics information and communication, advanced materials etc.) Europe has almost nothing that is comparable to US initiatives in these areas.
    - The US also places greater emphasis on competition alongside partnership, so that, once the research priorities have been set, a number of activities can run in parallel and the most successful identified, rather than combining everything under one umbrella. This is a good way to reward success rather than reduce these activities to a lowest common denominator.

How might EIRMA help?

As the leading European association focusing on industrial R&D and technology-led innovation, EIRMA's mission is to support the competitiveness of European industry through the better management of technology-led innovation and industrial R&D. Our activities reflect issues that have topical importance to industry, including matters that relate to the Commission's initiative.

The main resources we can bring to bear are:

- International contacts (including outside Europe) across sector boundaries between people with shared professional expertise;
- An ability to explore subject matter in a pragmatic manner and disseminate this understanding for common benefit; and
- A rich and well-documented 35 year-strong repository of good management practices.

We believe that this Association, through its activities, can champion the need for industrial R&D and help heighten awareness and visibility of good practices in support of the Commission's initiative.

There are several areas where we believe we can also offer a directed input and would welcome the Commission's help and assistance in taking these forward if this is felt to be appropriate.

Industry-academic partnerships and intellectual property

We have noted the increasing importance of partnerships between companies and public institutes such as universities. It is clear that a more seamless integration is needed between academic and industrial R&D, while respecting their different roles. There is also a growing sense among European companies that steps need to be taken to create better pragmatic models for handling the intellectual property rights that result from such partnerships.

We suggest that this need can best addressed through a collaborative effort involving EIRMA and the European University Association together with other interested organisations working at national, local and sector levels. We are willing to co-manage such a joint project.

Development into Eastern Europe

The ambition of a competitive Europe must include the accession countries, which have rich scientific traditions but are poorly equipped to compete in the areas discussed here.

We see a strong need to extend eastwards an understanding of good industrial research management practices that this Association has helped to document, while tailoring this understanding to the specific needs and situations faced by companies in these countries.

This is not something that can be undertaken lightly. It will not be sufficient simply to encourage recruitment into EIRMA among companies that are based in eastern Europe (although we have members from these countries and they benefit from what we do). A focussed effort will be required, which we are prepared to undertake but which will require additional funding and skilled manpower.

Stronger networks for understanding and disseminating good management practice.

EIRMA's strengths are concentrated towards medium and larger sized firms. Other organisations and academic institutes active in the fields of R&D management and enterprise policy address other parts of the system and operate more locally. This diversity is beneficial - all-encompassing solutions rarely exist - but the overall system is not as strong as might be desired.

Europe needs strong supporting networks from the local community up to international levels, including smaller and larger enterprises as well as others with interests and expertise in market-oriented R&D.

We have taken some steps towards achieving greater cross-fertilisation, for example by establishing the Hendrik Casimir award, which gives students at leading European institutes an opportunity to work with us to develop their, as well as our, understanding of this complex field. We would like to set up further initiatives where these offer common benefit. The rate at which this can be done depends, as always, on the appetite for progress and the resources available.

Appendix: Background Data

It is illustrative to compare the data presented by the Commission (which considers R&D investment in national and regional terms) with the situation at company level, where these geographical considerations have become less relevant.

Most enterprise investment in R&D comes from a relatively small group of companies: 600 companies fund around three quarters of the OECD's total:

Gross Domestic Expenditure in R&D within OECD countries (GERD, 2000)	$600 billion
% OECD GERD financed by industry (2000)	approx 64%, i.e. $380 billion
R&D Investment by the leading 600 companies (2001)	approx $300 billion

NB: These data comes from different sources (2,3) and their internal consistency has not been confirmed. Total GERD, but not company R&D investment, is corrected to reflect countries' purchasing parities. The first line measures investments *within* the specific countries, whereas the third line reflects investments *by* specific companies, irrespective of where these are made.

Patterns of R&D Investment and Market Capitalisation

The list of companies ("DTI 600") (3) making large investments in R&D overlaps, but is not identical to, the list of companies with largest market capitalisations ("FT Global 500") (4). Nonetheless it is illustrative to compare patterns of regional market size with the distribution of large companies and levels of R&D investment.

	Asia / Australia	Europe	North America
Approx regional share of OECD total GDP	20%	32%	46%
Companies	based in Asia / Australia	based in Europe	based in North America
Share of total market capitalisation of FT Global 500 companies	16%	30%	51%
Total R&D investment of DTI 600 companies	22%	31%	47%
Average R&D / sales of DTI 600 companies	4.1%	3.6%	**5.1%**

The first three rows show broadly the same pattern but figures for average R&D / sales are significantly different.

[3] UK Department of Trade and Industry, R&D Scorecard, 2002.

[4] Financial Times, 2002 analysis of 500 companies word-wide with largest market capitalisations.

Sector Patterns of R&D Investment

The macroeconomic patterns of R&D intensity depend upon the number and sector distribution of companies making large investments in R&D. The following table gives the number of research intensive companies in each sector / region and (in parentheses) the average research intensities (R&R / sales) of these companies. (Average research intensity is calculated as the sum of R&D investments within the group of companies divided by the sum of their sales, see reference 3. Again, these calculations reflect where the companies are based, not where the R&D is executed.)

Sector	Asia / Australia		Europe		North America		Global
Pharma & biotech	15	(12.2%)	19	**(14.2%)**	**26**	(12.4%)	(13.0%)
Software & IT services			6	**(11.4%)**	**53**	(10.1%)	(10.2%)
IT hardware	18	(5.8%)	11	**(13.4%)**	**86**	(10.8%)	(9.4%)
Support services			1	**(6.8%)**	**2**	(5.0%)	(5.6%)
Electronic & electrical	**23**	(6.1%)	8	**(6.5%)**	14	(2.9%)	(5.3%)
Health	1	(5.1%)	7	(4.3%)	**15**	**(5.0%)**	(4.9%)
Aerospace & defence			8	**(7.0%)**	**9**	(3.2%)	(4.3%)
Chemicals	19	(3.7%)	**17**	**(4.7%)**	14	(4.1%)	(4.2%)
Automobiles & parts	14	**(4.3%)**	15	(4.0%)	15	(3.9%)	(4.0%)
Personal care	2	**(3.8%)**	5	(2.8%)	**6**	(3.4%)	(3.3%)
General retailers			1	(1.1%)	**2**	**(8.2%)**	(3.2%)
Household goods	**6**	**(4.6%)**	2	(1.3%)	7	(2.6%)	(2.9%)
Engineering & machinery	9	(3.2%)	**21**	(2.3%)	14	**(2.7%)**	(2.6%)
Media & photography	**4**	(3.2%)	3	(1.3%)	2	**(5.7%)**	(2.5%)
Telecommunications	3	**(3.5%)**	**8**	(1.3%)	1	(0.6%)	(1.9%)
Leisure & hotels	2	**(5.9%)**	**3**	(4.7%)	2	(0.5%)	(1.8%)
Food processors	2	**(3.5%)**	3	(1.7%)	3	(1.1%)	(1.7%)
Diversified industrials	1	**(5.1%)**	**10**	(1.3%)	3	(2.2%)	(1.5%)
Construction & building	**5**	**(1.4%)**	3	(1.0%)			(1.2%)
Steel & other metals	**5**	**(1.6%)**	3	(0.9%)	2	(1.0%)	(1.2%)
Electricity	**8**	(1.1%)	4	(1.1%)	1	(0.8%)	(1.1%)
Gas distribution	1	(1.7%)					(1.1%)
Beverages	1	**(2.1%)**	1	(0.6%)			(1.0%)
Tobacco	1	**(1.0%)**	1	(0.5%)	**2**	(0.9%)	(0.9%)
Forestry & paper			**2**	**(0.8%)**	1	(0.3%)	(0.5%)
Oil & gas	2	(0.4%)	**7**	(0.3%)	6	**(0.6%)**	(0.4%)
Overall	142	(4.1%)	169	(3.6%)	**286**	**(5.1%)**	597 (4.3%)

The dominance of North American-based companies in sectors with high R&D intensity is striking. This dominance disappears rapidly as one moves down the table.

Future Trends

EIRMA and sister organisations around the world regularly survey members concerning perceived future trends in R&D practice. Surveys (5,6) carried out in mid 2002 suggest there will be a general emphasis in 2003 on leveraging the value of R&D spending in both Europe and the United States:

- Greater strategic focus on R&D alliances, joint ventures and technology licensing
- More spin-offs based on developed technology
- More grants and contracts for university R&D
- A greater willingness to run R&D also as a revenue-generating technical service for third parties.

American companies report that there is likely to be:

- More contracts with federal laboratories
- Lower intensity of R&D spending
- Lower recruitment

Paris, October 2002

[5] Industrial Research Institute, R&D Trends Forecast for 2003.

[6] EIRMA, Organising and Funding Industrial Research and Development, October 2002.