

Experts Group « Knowledge for Growth »

Globalization of R&D: linking better the European economy to “foreign” sources of knowledge and making EU a more attractive place for R&D investment

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This report does not necessarily reflect the views of the European Commission. It draws on the written contributions and oral discussions of the members of the Experts Group. It is also based on some empirical and theoretical research done by other scholars (see references).

Helpful comments by D.C.Mowery are gratefully acknowledged.

Executive summary

1 - R&D internationalization is an important phenomenon. It involves the global allocation of a precious resource for national economies. The reason for this Report is that there is a strong feeling, based on partial evidence, that Europe is not taking part as it should do in the global knowledge economy game. For example, the share of US overseas R&D expenditures in Europe is declining while its share of overseas R&D expenditures in other countries (particularly in Asia) is increasing fast.

2 - Peculiar policy measures targeted specifically to turning R&D internationalization to the benefit of particular countries or regions are difficult to ascertain. We have observed that the policy toolbox overlaps, to a large extent, with the more generic ones that aim to enhance R&D capacities and innovation systems. However, increasing R&D mobility reinforces the importance of some policy axes. This Report thus reviews and underscores the importance of these R&D investment-related policy axes.

Problems and issues

3 - The big problem for Europe is not so much that European companies move their R&D capacities outside. They have good reasons to do so – ranging from nearness to foreign local markets to the need to be exposed to new ideas and intellectual resources. The central problems are that i) the beneficial returns from foreign knowledge that are both located at home and abroad are hard to reap; and ii) not enough foreign companies seem interested to move closer to European markets and ideas.

4 - The main issue is, clearly, how to better link the EU's domestic economy to foreign sources, either through European firms locating R&D abroad or foreign companies bringing their R&D capacities to Europe. Two sub-problems emerge:

- i) Could Europe (and how) expect beneficial returns from and take advantage of foreign knowledge that are both located at home and abroad. How to “activate” the knowledge produced through these two particular classes of global R&D in order to maximize the spillover benefits? (absorptive capacity problem)?

- ii) Could Europe increase the quality and the quantity of foreign R&D capacities moving to Europe, and how to build stronger locational advantages?

Need for European responses

5 - The first challenge is to ensure that R&D managers who seek for new location may anticipate a positive supply response (in terms of knowledge, human resources and academic collaborations) of the European knowledge infrastructure. A clear policy solution to ensure this positive supply response is to intensify institutional effort to build the European research area, thereby addressing Europe's issue of the fragmentation and national character of the public research. Creation of a homogeneous research area is likely to generate more R&D funding

possibilities, to intensify competition between scientists, and to minimize R&D performance duplications. Overcoming the fragmentation of the Europe's research system would address and correct this major structural deficiency in the organization of public research and of public-private research interaction in Europe.

6 - The second challenge is to develop and reinforce innovation vibrancy and capacities within the right fields of specialization ("being right" in this matter involves quite subtle vision of what should be and how should evolve the European knowledge base). One main problem here deals with the weakness of the European strategic capacities. Europe still misses a large Community-based R&D portfolio distributed among several agencies with distinct yet overlapping agendas that would be able to provide adequate incentives and generate impetus to shift resources away from areas of lower productivity to areas of greater productivity.

7 - Finally the simple economics of R&D location (involving issues of indivisibility and Marshallian externalities) taught us that national responses to R&D globalization are likely to be ill-suited to the main challenges. However, the European responses should not substitute for national efforts. The whole challenge of building locational advantages and linking the domestic economy to foreign sources need sufficient national responses too.

Impediments to a European responses and a sketch of solutions

8 - The major deficiency of the Lisbon strategy is the governance of the policy process. The soft or open method of coordination proves to be effective only when the issue is to increase resource allocation in goods that exhibit quasi network externalities. In such cases, prospective benefits from the collective achievement is a condition for adequate individual national efforts. In other words, there are strategic complementarities between national actions. However, the problem of resource allocation in R&D does not fall in this category. In that case, individual States may hope to benefit from collective effort (spillovers) without engaging too many resources in such effort. There is, therefore, a mismatch between the method of governance and the economic nature of the goods which are involved in R&D policy.

9 - In such a case, strong and vigorous initiatives from the Commission are needed to generate more incentives and leverage effects. But a second problem arises: the two budgetary levels in Europe (Union, member states) exhibit an inverse relation as compared with the US case. In

Europe there are a low budget at the Union level and higher national budgets. As a result, the dissipated efforts of national States echoes with the weakness of the centralized capacity of the European Union.

10 - The issue is, thus, to “invent” a new policy process involving original models of research funding that is able to ensure sufficient level of resources allocation, given that the allocation process is decentralized and that the main good at stake (knowledge) has the characteristic of a semi-public good. In this spirit we conclude with three more specific policy orientations, which could be effective to place the European economy at the focal point of the global knowledge game.

i) The Report mentions the potential role of new areas of integrated knowledge and technology-based services such as health care, energy or environment that might offer opportunities to creating competitive advantages in Europe. These are also areas where the centrality of R&D is emerging, which might help gather coalitions of member states, and private and public stakeholders in favor of credible commitments to R&D programs that can appear as the cross-section solution of structural problems (in health, in environment, in energy).

ii) Strengthening the research and technology infrastructure may prove to be central for improving the attractiveness of Europe as a base for R&D operations. There are evidence that gaps have developed in many OECD countries and other regions between the needs for and the availability of these infrastructures to industry. There are therefore opportunities for a major impact on the global knowledge game for countries or broader regional entities to invest heavily in these infrastructures, while ensuring the participation of industry players in the investments decisions and finance. For example, the successful development of the Technology Platform initiative may change incentives and create new motivations for foreign companies to move some of their R&D capacities into Europe. Also Technology Platforms and Research Infrastructures – if opened to foreign firms – may play a central role in the materialization of the spillovers from foreign R&D capacities that are both located at home and abroad.

iii) The most recent members of the EU exhibit special characteristics in terms of R&D capacities (they have a history of technical strength and a relatively inexpensive scientific workforce) that should be used as opportunity to better place them in the global R&D game.

11 - In sum, there is an urgent need to mobilize all existing elements of the future European research and technology area (research infrastructure and technology platforms, Framework Plan), quasi-element (CERN) and future elements (European Institute of Technology) as mutually and reciprocally interdependent forces, so that they may exhibit cross-catalytic reinforcement toward consistent policy objectives such as : creating more critical mass and competition in the European Research Area; activating the many forms of unexploited knowledge through the improvement of risk taking, competencies and readiness to innovate; and maximizing leverage and linkage effects of the growing research and technology infrastructure. This mobilization has to be done on key areas of focus that have been selected after careful particularization and prioritization process.

Preliminary thoughts

1 - The quality of available data on R&D internationalization is weak. It is difficult to understand the data and to discover trends of R&D internationalization. Lack of evidences on the effect of R&D location on home and host countries, compounded by the complex mechanisms of spillover effects in the host and home countries make it problematic to infer the effects of R&D internationalization. In particular, while the existence of positive productivity spillovers and agglomeration effects for inward investment is relatively well-known, little is known about the impact of outward investment on domestic activities.

2 - Given such difficulties, the Group of experts has decided to organize a working party on “data availability assessment”, relating to R&D internationalization specifically as well as from a broader perspective (coordinated by R.Veugelers).

Policy significance of this question

3 - There is a strong feeling, based on partial evidence, that Europe is not taking part as it should do in the global knowledge economy game. Available data suggest the existence of R&D “overinvestment” of EU companies in the US *relative* to the R&D investment of the US companies in the EU. In 2001, this accounted for a net outflow of about EURO 5 bn for 2001, and this outflow is increasing. In contrast, the share of US overseas R&D expenditures in Europe is declining while its share of overseas R&D expenditures in other countries (particularly in Asia) is increasing fast.

4 - R&D internationalization is an important phenomenon. It involves the global allocation of a precious resource for national economies. The *Anchor Tenant* hypothesis assumes that R&D capacities above a certain size are powerful in generating externalities in the form of thickening markets for innovation and technologies on both supply and demand sides that will benefit the whole local system. Delocalization therefore deprives the home country of some of these externalities. Damages could be higher if delocalization involves R&D related to entirely new fields. In such case, some key driving forces and coordination mechanisms missing in the home country would impede the capacity of the local system to move collectively towards these new fields.

5 - Peculiar policy measures targeted specifically to turning R&D internationalization to the benefit of particular countries or regions are difficult to ascertain. We have observed that the policy toolbox overlaps, to a large extent, with the more generic ones that aim to enhance R&D capacities and innovation systems. However, increasing R&D mobility reinforces the importance of some policy axes. This Report thus reviews and underscores the importance of these R&D investment-related policy axes.

The problem has been identified but not its origin or its consequences

6 - The big problem for Europe is not so much that European companies move their R&D capacities outside. They have good reasons to do so – ranging from nearness to foreign local markets to the need to be exposed to new ideas and intellectual resources. The central problems are that i) the beneficial returns from foreign knowledge that are both located at home and abroad are hard to reap; and ii) not enough foreign companies seem interested to move closer to European markets and ideas.

7 – Questions remain about the origins and consequences of these problems. Is this a R&D problem or a symptom of a larger crisis? The lack of non European R&D capacities entering the European system may be attributable to several factors: Is it that the EU a) is deficient in good, worthwhile ideas; b) is not a good place to conduct R&D; or c) is not a good place to produce R&D-intensive products that require local development support? Is the deficit of inward FDI R&D a problem because : a) the demand for R&D performed in EU is too low to support the development of the required knowledge infrastructure (training, etc.); b) the EU would not benefit from the localized spillovers ; c) the EU industry would not be competitive and lead to decrease in employment rate; or d) all of above? Further studies are needed to improve our knowledge and understanding of the global process of R&D allocation and its consequence for the European economy.

8 – Studying the above set of questions in a rigorous way requires to distinguish between research activities and development activities. Location decisions of development capacities are mainly driven by production location advantages and the proximity to high potential markets strategies. Location decisions of research capacities are mainly driven by an assessment of quality, size and

specialization of the knowledge base. It is important to stress that this distinction neither denies nor minimizes the importance and significance of the strong efforts which are made in the knowledge economy to integrate improvements from the basic research lab to the factory floor. The distinction between R and D is important for policy purposes as it underscores the fact that different R&D location drivers (adjacency to markets and to ideas) still matter. High integration among the various segments of the whole process might also generate some interdependencies and feedback between location decisions that could be considered as policy opportunities to influence those location decisions (see above point 34).

Main policy issues: improving absorptive capacities, increasing locational advantages

9 - The main issue is, clearly, how to better link the EU's domestic economy to foreign sources, either through European firms locating R&D abroad or foreign companies bringing their R&D capacities to Europe. Two sub-problems emerge:

- i) Could Europe (and how) expect beneficial returns from and take advantage of foreign knowledge that are both located at home and abroad (absorptive capacity problem)?
- ii) Could Europe increase the quality and the quantity of foreign R&D capacities moving to Europe, and how to build stronger locational advantages?

10 – The first sub-problem addresses the absorptive capacity issue: can Europe get something back from research operations done abroad by European companies in terms of widening the spillovers effects beyond the expected firms' specific benefits? Similarly, can Europe profit better from R&D done in Europe by foreign companies? The main question to be addressed here is, therefore, how to “activate” the knowledge produced through these two particular classes of global R&D in order to maximize the spillover'benefits?

11 - An interesting feature of Europe's problem is that there are strong variations across the member countries in their ability to benefit from knowledge spillovers resulting from R&D of domestic companies located abroad. Recent empirical evidence show that countries whose firms invested in the UK benefited from the knowledge-base of this host country but with strong variations: the spillover effect is particularly large in case of Switzerland, Sweden and the USA, i.e. three technologically leading countries. These differences show that this particular class of spillovers (generated by domestic companies located abroad) is neither negligible nor automatic but that its magnitude is strongly conditional to the absorptive capacity of the home country.

12 - In the broad range of problems raised by R&D globalization, the issue of creating and increasing locational advantages is a crucial one. Output market potential, quality of R&D personnel, academic collaboration potential and intellectual property protection appear as the main drivers of location decisions from the most recent surveys. They are therefore the levers that policy makers should try to set in action. But European policy makers should do it in a concerted and coordinated way, so that the potential agglomeration economies would not be dissipated through an uncontrolled and frenzied locational tournament between European regions.

13 – The two issues just identified (improving absorptive capacities; increasing locational advantages) are typically issues that determine policy options of wider relevance than the narrow objective of finding an acceptable balance between inward and outward FDI-R&D investments. The whole menu of policy orientations involves the enhancement of knowledge infrastructure, including the mitigation of its fragmentation on a national base, the policy of “activating” knowledge through the improvement of innovation capacities, and the problem of selecting (and moving toward) the “right” S&T specializations. In such perspective, a (non-exhaustive) list of priorities has emerged from group discussion. We present them under the two following headings.

R&D managers seeking for new locations must anticipate positive supply response of the European knowledge infrastructure

14 - One set of priorities deals with building and improving the knowledge infrastructure so as to create an adequate supply of human capital, ideas and academic collaborations. It is crucial that R&D managers of non European companies, when undertaking location decision, anticipate a positive supply response of the European knowledge infrastructure to their demand for scientists, ideas, academic collaborations. This set of priorities involves several issues:

- changing the EU funding mechanism for academic research to emphasize bottom-up approach, making the selection process more transparent and keeping excellence as the central criterion for allocating grants¹;

¹ Although it is an important priority, EU funding alone will not tip the balance. In fact, EU funding still accounts for a modest share of the total public R&D investments in academic and other performers in many European countries (we address this issue later in the Report, see points 31 and 32).

- creating human-resource fund for co-financing graduate students and attracting world class quality scholars back into EU countries;
- enhancing competition at European level between researchers, laboratories and universities, as well as between potential funding agencies (including member-states funding agencies)²;
- improving the market for scientists and removing any barriers for foreign scientists to be recruited in Europe in both public and private sectors; and
- shifting public R&D investment – most of which remains under the control of member states – away from public laboratories and into university research, allocated on a competitive basis.³

15 – Europe’s knowledge infrastructure is characterized by the fragmentation of public research on a national base, making it very difficult to meet the objectives listed above. Such a fragmentation of public research policy across Europe leads to at least three pernicious effects: fewer opportunities for researchers and teams to be funded; fewer competitions amongst researchers’ teams; and excessive duplication of research projects which leads to inefficient allocation of resources and sub-critical mass in a majority of member States (how many centers of excellence in biotechnology can Europe afford and how many “funding windows” should be available to ensure that “candidates for centers of excellence” can have a chance to demonstrate their potential?). As a result, there is a growing mismatch and a duality between strong internationalization of private R&D and strong national dimensions, which still dominates the organization of public R&D. Mitigating such fragmentation appears to be critical to improve the knowledge infrastructure.

Innovation vibrancy and the selection of the “right” S&T specializations

16 – Another set of priorities deals with the improvement and strengthening of the innovation capacity (defined as the ability to produce continuously “new to the world” technologies, products and services). Innovative vibrancy is again critical to influence location decision which involves:

² A point was made that the US funding system involves incredible duplication, through a large number of potential gates, increasing the probability for a research project to be funded; such US peculiarity has been referred during the Group discussion as the “art of creating productive chaos”.

³ Actually no survey of managers indicates that the strengths of public R&D laboratories constitutes an important attraction for their R&D investments.

- Supporting private R&D both at the EU and national levels. There are several (neutral) instruments which address market failures that have the effect of impeding private firms to invest in R&D, even though some of these R&D would have potential for private returns. Non-discrimination of foreign firms vis à vis domestic enterprises and free access to national funding and public procurement for (domiciled) foreign-owned enterprises is the key to increase attractiveness.
- Developing capital markets (high tech stock markets and VC financing) at EU level to encourage entry and growth of new firms⁴.
- Designing and implementing other classes of policy (macro-economic, competition and labor market) in a consistent manner. A big mistake is to concentrate on a single policy measure without paying attention to other policies that could be inconsistent with the R&D policy objectives.
- Further efforts to remove regulatory and other obstacles (including public procurement regulations) to full harmonization and integration of markets for knowledge-intensive products in industries such as ICT and biomedical technologies.

17 - Not all innovations have the same economic value; some of them have significant impact on total factor productivity while others have not. An important determinant of the capacity to attract foreign R&D is the quality and specialization of the domestic knowledge base. Indeed, the fact that the knowledge base exhibits valuable specializations (in areas of great productivity potential for the future) is a key driver for R&D location decisions. Therefore it is important to ensure that innovation capacity includes the capacity (of the economy) to shift resources away from the areas of lower to the areas of greater productivity.

18 - The Group, therefore, addressed the issue of the strategic capacity of governments to create satisfactory incentives and motivations to move the whole system toward a new target and to shift resources away from areas of lower productivity into areas of greater productivity. This is a controversial issue since this policy logic departs from the neutrality principle and entails the risk of market and competition distortions. Thus, policymakers should avoid it except in cases where there are glaring market failures that need to be remedied. Recent history of technology policy in OECD countries have shown that such strategic capacity (involving non neutral public

⁴ Of course, US VC firms can solve the problem: finance is a mobile resource. However, guidance on the EU environment will be weak. Local intermediaries for innovation (incubators) are needed; however they are less mobile than finance.

interventions) has been a key factor notably in the building of the US leadership in the high technology economy.

19 - The ingredients of the US strategic capacity are known. It involves a diversity of public agencies; all working on specific but overlapping agendas; a key role for the Department of Defense (DoD) showed both in the history of Internet revolution and, recently, in information security R&D programs launched after September 11. In both cases the impact of government-sponsored research was great in building the knowledge infrastructure in particular areas, generating spillovers to the benefit of the industry (including SMEs), creating incentives for business R&D to respond positively to this policy and initiating market development through public procurements⁵.

20 - The success of such policies is strongly contingent upon careful policy design (including attention to competition policy issues) in order to avoid or reduce the potential problems (picking winners, government failures, competitiveness distortions, early lock in). The latter are likely to appear when a policy departs from its neutral stance and aims to create imbalances to favor the development of particular technologies and industrial applications, and such problems are even more likely and more serious when the technologies and applications are not directly linked to key government missions⁶

21 - The issue for Europe in such a view is to create or strengthen some institutions or organizations able to take the functional role of the U.S. DoD, and other public agencies, in driving initial dynamics of building capacities to overcome coordination problems among decentralized agents and move the whole system towards new areas. It is important to underline that the Group agreed to neither accept the US mission-oriented policy structures as a model for emulation nor to recommend the creation of a pure functional copy of the US DoD (although it is rightly considered as a key element of technology policy in this country) as the perfect solution to the European lack of strategic capacities. Blind imitation is to be avoided here. For many reasons,

⁵ Commenting on this Report, D.C.Mowery expressed some skepticism about the possibility of reproducing elsewhere and in other areas this glorious episode of the US technology policy: this policy success was only possible because of identification of investments with a specific, high-priority government mission (national security). US has failed repeatedly in energy R&D because of the lack of strong link between public R&D spending and government mission with strong political support. Moreover, the rapid and successful commercial exploitation of Internet after late 1980s rested mainly on the existence of a large domestic market of demanding and innovative users who had access to very inexpensive hardware.

⁶ It could also be the case that some of these problems could emerge from government “neutrality” or a laissez faire stance taken against all kind of “industrial policy” initiatives.

the functional equivalent of the US DoD should be designed in a very distinctive way and does not need to be defense-related R&D.

22 – Another issue is to get a clear vision of the next areas of greater productivity potentials, given the current strengths and weaknesses of the EU members individual and collective national systems of innovation. However, the issue is more complicated than simply selecting the most “exciting” fields and allocating resources there. This is not a trivial problem: technology foresight and forecasting approaches tend to produce the same “priority” ranking regardless of the context of the clients for whom they are prepared. In some countries, public policy has perhaps overemphasized new science-based leading edge industry in an unimaginative way, resulting in greater uniformity of their national knowledge bases and deterioration of their distinctiveness and originality. A possible consequence of this is that large companies suffer in global competition or act increasingly as a global knowledge network, and allocate their innovative activities outside the home country. Policy makers must pay attention to this “particularization” process to find the key areas for focus. In sum, shifting resources toward new areas must be coupled with the reinvigoration of the more traditional and mature industries, which can be possible by the potential for “co-invention of applications” of the new general purpose technologies in using sectors.

23 - New areas of integrated knowledge and technology-based services such as health care, energy or environment might offer new opportunities for creating competitive advantages in Europe given its culture, history, scientific and technological capabilities and social orientations.

Is there a need for a European response (for an integrated Europe) to address these questions?

24 – This report addressed critical issues that are strongly related to the R&D globalization problem. For each of those issues, we have articulated the problem and given some insights about the policy implications. As a matter of fact, there certainly is a need for a European response to each of these problems and challenges.

25 – The first issue deals with absorptive capacities improvement as the only means to reap higher benefits of R&D undertaken in Europe by non European companies or undertaken abroad

by European companies. A policy of activating knowledge should be directed towards the activation of the many forms of unexploited knowledge generated by these various classes of global R&D. The second issue deals with increasing locational advantages. As a matter of fact, these two issues determine the common menu of policy challenges that has been studied in this Report.

26 – The first challenge is to ensure that R&D managers who seek for new location may anticipate a positive supply response (in terms of knowledge, human resources and academic collaborations) of the European knowledge infrastructure. A clear policy solution to ensure this positive supply response is to intensify institutional effort to build the European research area, thereby addressing Europe's issue of the fragmentation and national character of the public research. Creation of a homogeneous research area is likely to generate more R&D funding possibilities, to intensify competition between scientists, and to minimize R&D performance duplications, while maintaining a healthy margin of redundancy. Overcoming the fragmentation of the Europe's research system would address and correct this major structural deficiency in the organization of public research and of public-private research interaction in Europe.

27 – The second challenge is to develop and reinforce innovation vibrancy and capacities within the right fields of specialization ("being right" in this matter involves quite subtle vision of what should be and how should evolve the European knowledge base - see above in para.22). One main problem here deals with the weakness of the European strategic capacities. Europe still misses a large Community-based R&D portfolio distributed among several agencies with distinct yet overlapping agendas that would be able to provide adequate incentives and generate impetus to shift resources away from areas of lower productivity to areas of greater productivity.

28 – Finally the simple economics of R&D location (involving issues of indivisibility and Marshallian externalities) taught us that national responses to R&D globalization are likely to be ill-suited to the main challenges. The EU is composed of a majority of small countries. As the issue deals with the creation of competitive mass (knowledge base above a certain level in quality and size), national responses are likely to generate inefficiencies:

- R&D involves substantial indivisibilities at both the micro and macro levels. At the micro level, a wide range of research areas require the commitment of relatively large amounts of R&D to ensure the feasibility and viability of these projects (the minimum efficient scale of projects is large). At the macro level, significant infrastructural, services-related,

financial and human capital assets, which are critical for innovation, would only be available in adequate quantity and quality if enough R&D is being carried out. This implies that even the best R&D producers in Europe (as measured with relative indicators, like BERD/GDP) may not be competitive in terms of absolute measures.⁷

- National/regional (but un-coordinated) responses are likely to generate an inefficient locational tournament among Member States. In fact, the economic logic of locational tournaments is based on one scarce resource: the agglomeration economies. Intra-European and non-coordinated tournaments may lead to the undesirable result that a significant part of the potential agglomeration economies are dissipated with no one site attractive enough.

29 – The European responses should not substitute for national efforts. The whole challenge of building locational advantages and linking the domestic economy to foreign sources need sufficient national responses too.

The political economy of organizing “public goods” policy responses: the European mismatch between weak center and free-riding members

30 - The major deficiency of the Lisbon strategy is the governance of the policy process. The soft or open method of coordination proves to be effective only when the issue is to increase resource allocation in goods that exhibit quasi network externalities. In such cases, prospective benefits from the collective achievement is a condition for adequate individual national efforts. In other words, there are strategic complementarities between national actions, thus it is not surprising that European integration has progressed in such areas (telecommunications and standards-setting processes, single sky). However, the problem of resource allocation in R&D does not fall in this category. In that case, individual States may hope to benefit from collective effort (spillovers) without engaging too many resources in such effort. There is, therefore, a mismatch between the method of governance and the economic nature of the goods which are involved in R&D policy.

⁷ This suggests « en passant » that *relative* measures (like R&D intensity) might not necessarily be the most informative indicators when the policy debate deals with R&D capacity (while *relative* measures are for example quite informative in fields like education or health policy). *Absolute* measures are more appropriate for some classes of policy questions dealing with R&D investments.

31 - In such a case, strong and vigorous initiatives from the Commission are needed to generate more incentives and leverage effects. But a second problem arises: the two budgetary levels in Europe (Union, member states) exhibit an inverse relation as compared with the US case. In Europe there are a low budget at the Union level and higher national budgets. As a result, the dissipated efforts of national States echoes with the weakness of the centralized capacity of the European Union.

32 – The issue is, thus, to “invent” a new policy process involving original models of research funding that is able to ensure sufficient level of resources allocation, given that the allocation process is decentralized and that the main good at stake (knowledge) has the characteristic of a semi-public good. In this spirit we conclude with three more specific policy orientations, which could be effective to place the European economy at the focal point of the global knowledge game.

Towards more specific policy orientations

33 - We mentioned above (23) the potential role of new areas of integrated knowledge and technology-based services such as health care, energy or environment that might offer opportunities to creating competitive advantages in Europe. These are also areas where the centrality of R&D is emerging, which might help gather coalitions of member states, and private and public stakeholders in favor of credible commitments to R&D programs that can appear as the cross-section solution of structural problems (in health, in environment, in energy). It is possible that, within EU, coordination of subgroups of member states could help in this matter. This need not be a threat to the EU. There is a role for setting common “ground rules” for the formation of such sub-coordinations (transparency, restricted time horizon, openness to all EU firms, no local content affecting process design). Even under those restrictions it is likely to be easier for subsets of countries to find partner for commitment of national support in R&D alliances. Moreover they may be easier vehicles to attract foreign firms as “affiliates”.

34 - Strengthening the research and technology infrastructure may prove to be central for improving the attractiveness of Europe as a base for R&D operations. There are evidence that gaps have developed in many OECD countries and other regions between the needs for and the availability of these infrastructures to industry. For instance, the budget for National Institute of Standards and Technology (USA) infratechnology research has declined by a factor 2 relative to

industry R&D spending during the period 1977-2002. The fact that most of technological infrastructures are club goods (there are spillovers but they are quite clearly concentrated into a few number of agents which are easily identifiable, such as all firms of a given industry) and their low visibility contribute to the decline of their research budget⁸. But the fact that the research and technology infrastructures are poorly supported in most developed countries creates difficulties since they leverage the productivity of R&D, enhance quality and process control, and facilitate efficient market-transactions for complex, technology-based products and services. There are therefore opportunities for a major impact on the global knowledge game for countries or broader regional entities to invest heavily in these infrastructures, while ensuring the participation of industry players in the investments decisions and finance. For example, the successful development of the Technology Platform initiative may change incentives and create new motivations for foreign companies to move some of their R&D capacities into Europe. Also Technology Platforms and Research Infrastructures – if opened to foreign firms – may play a central role in the materialization of the spillovers from foreign R&D capacities that are both located at home and abroad.

35 – The most recent members of the European Community exhibit two interesting features vis a vis the global R&D problem: they have a history of technical strength and a relatively inexpensive scientific workforce. While these countries have not yet attracted so much FDI R&D investments, there is here a policy challenge for Europe to get them more involved in the global R&D game. Their specific characteristics should be considered as opportunities and the strengthening of the research and technology infrastructures in these countries is a strong priority.

36 – In sum, there is an urgent need to mobilize all existing elements of the future European research and technology area (research infrastructure and technology platforms, Framework Plan), quasi-element (CERN) and future elements (European Institute of Technology) as mutually and reciprocally interdependent forces, so that they may exhibit cross-catalytic reinforcement toward consistent policy objectives such as : creating more critical mass and competition in the European Research Area; activating the many forms of unexploited knowledge through the improvement of risk taking, competencies and readiness to innovate; and maximizing leverage and linkage effects of the growing research and technology infrastructure. This mobilization has

⁸ Economists know that funding schemes for the provision of club goods are particularly difficult to build and implement.

to be done on key areas of focus that have been selected after careful particularization and prioritization process.

Bibliographic note:

To write this report, I have used the notes prepared by the members of the expert group, the EC documents circulated by the secretariat as well as the rich discussions we had during the Session.

Some arguments are also based on the following papers:

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