Discussing the role of ERA in the Lisbon process, the divers understandings of the ERA and the role of the framework programme in fostering Europeanisation

Background paper for the FP6 expert panel

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Objective and contents

The objective of this background document is to propose a reflection on "the ERA dimension of community activities". It aims at providing the evaluators with a conceptual framework of the ERA, that is how one could consider its aims, roles and functions. This should help the evaluators in their effort to position the objectives, processes, results and potential effects of FP6 activities.

We start with positioning ERA within the Lisbon process, which clearly shows that ERA is for the European Council a means towards the central objective followed, 'the most competitive knowledge based economy and society'. But it seems that this means is gaining importance having been recently qualified as the 'primary pillar of the Lisbon objectives'. We then consider two approaches of the ERA. One deals with the activities that are considered by the Commission as central to achieve it. Part 2 examine these dimensions which constitute as many objectives against which to benchmark FP6 'which was designed to help realise the ERA'. Part 3 proposes a complementary approach focusing on rationales for building the ERA. Once account is taken of the fact that ERA is not a state but the repeated outcome of an long-lasting process of Europeanisation, four dimensions of a rationale, are analysed: fragmentation, knowledge production dynamics, innovation capabilities of existing industries, societal challenges. Each enables to define further potential role of FP6 in fostering this Europeanisation process. This document is rather long. Potential roles of the FP are in italics in parts 2 and 3.

PART 1 – Positioning ERA within the Lisbon process

This first section will show that there, at least until very recently (2008) no direct linkage between the Lisbon Process (as it is discussed by the European Council and can be followed in the successive Presidency conclusions about, and reviews on, the Lisbon Process. A careful analysis drives me to conclude that ***the Lisbon strategy requires to succeed that ERA is fully implemented, but the path to a fully-fledged ERA is still long***. It also drives to conclude that FP6 and FP7 have been "designed to help realise the ERA".

11- Short historical background

Historians of Europe like Michel André (2006) consider the ERA as an old story, already present in the first EC documents of the late 1960s. Michel André makes a further hypothesis that is very important in capturing the 'implicit focus' of EC activities on ERA. He says that the idea was on the policy agenda when the Commissioner was coming from University

circles at large (4 commissioners including the last 2 ones) and tended to disappear with the 5 other commissioners who pushed another agenda strongly linked with industrial policies. Does this mean that ERA is first and foremost about organising public policies and public sector research at the European level? This has been at least the view of industry (see for instance EIRMA answer to the Green Paper).

12- A strange dissonance: ERA does not appear as a central aspect of the Lisbon process

The mission I was given considers ERA ‘‘as the cornerstone of European knowledge economy and society”. And this is very visible in a number of documents of the Commission, especially the first document published in January 2000 “towards a European Research Area” and the 2005 communication on ‘Building the ERA of knowledge for growth’. But reading presidency conclusions of meetings of the European Council provides a completely different vision. The knowledge based economy and society is the central feature and links with the famous new strategic goal for the next decade announced in 2000 at the Lisbon conference - “become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion” (Presidency conclusions, 2000). What is interesting and revealing in the 2000 conclusions – and will remain year after year – is the structure of these documents. This strategic goal goes through a number of core directions which deal with the European social model (social reforms), macro-economic policies & integrated financial markets, ‘economic reforms for competitiveness and innovation’ (which cover most of what deals with tax credits, venture capital and start-up policies, better regulation and public procurement). Then and only then come policies for nurturing directly a knowledge-based economy and society, the core of which lies in (a) education and life-long learning, (b) the information society (from infrastructures to contents) and (c) the development of ‘a European area for research and innovation’.

Let me further elaborate this point. In the 2000 presidency conclusions one finds no mention whatsoever of the Commission’s view of the situation expressed in the grounding paper ‘Towards a European Research area’ (Brussels January 18, comm 2000(6)) about “the fragmentation, isolation and compartmentalisation of national research efforts and systems and the disparity of regulatory and administrative systems”. Similarly, the mid-term review by W. Kok’s panel only mentions once in passing in future directions ‘setting up an area of research and innovation’ (a point that is not considered in their review of actions undertaken). Even more striking the Aho report (2006) on creating an innovative Europe does not use the term once. The 24 guidelines established in 2005 for streamlining the Lisbon process after the Kok review) do not mention once the ERA. Finally readers can visit the website of the Commission on the Lisbon Strategy: they will see that the first objective ‘more research, technology and innovation’ goes through 4 key areas. The ERA is not one of them, but is mentioned as one complementary important link on a similar footing than the programme i2010.

ERA is thus clearly not an objective per se, but one means (among others) towards an end.

13- A shifting view of ERA

2008 probably marks an important turning point. The Council appears to align to the long standing views of the Commission. In most of the documents of the Commission about the ERA, ERA is an objective that is far from being reached, and thus subject to specific actions. In particular the Commission has long said that its principal instrument for realising it was the Framework Programme (see Box 1)

Box 1- Science and technology, the key to Europe's future - Guidelines for future European Union policy to support research, Com (2004) 353

"The 6th Framework Programme was designed to help realise the European Research Area. It placed strong emphasis on new instruments to structure research efforts and overcome fragmentation. The 7th Framework Programme will continue to support the realisation of the European Research Area, which is at the heart of the EU's research policy. But it resolutely puts emphasis on research themes in areas where the EU should reinforce and better exploit its knowledge base, develop technology leadership and raise the visibility of its research action".

But it is only in 2008 and still only at the level of the Competitiveness Council that ERA is mentioned as a major objective. It is now considered as being "a primary pillar of the Lisbon Objectives" (see Box 2)

Box 2- Informal Meeting of Ministers for Competitiveness (Research), Ljubljana April 14-15, 2008

"Ministers reaffirmed the fundamental role of ERA as a primary pillar for the Lisbon objectives Europe now needs to develop a common vision and effective governance of the European Research Area (ERA)."

This drives to my first conclusion for the panel to take into consideration: ***the Lisbon strategy requires to succeed that ERA is fully implemented, but the path to a fully-fledged ERA is still long***. And there is a special responsibility of the Framework Programmes to participate to this process.

However what is ERA remains unclear, or, as my letter of mission says, it "still remains a fuzzy concept, especially when it comes to its operationalisation". There are two very different ways to approach the situation: one is to identify the list of actions considered important to foster a greater existence of the ERA, the other is to look at analyses made about the nature of the ERA (and the reasons which make it necessary). We shall review them in turn, starting with the first approach.

PART 2 – defining ERA through the actions considered necessary to achieve it

For the Green paper (2007), ERA – and not the knowledge-based society – is made of three components: "a European internal market for research, where researchers, technology and knowledge freely circulate; effective European-level coordination of national and regional research activities, programmes and policies; and initiatives implemented and funded at European level".

21- The European internal market for research, technology and innovation

How are these translated in 2000 and 2007 (the two key communications on the ERA produced by the Commission)? (see summaries in appendix)

There are clearly major points of continuity dealing with **infrastructures** (moving from 'access to existing ones' to anticipation of future needs and creation of new infrastructures) and with **researchers' training and mobility**, de facto linking ERA to the Bologna process. This is complemented by the accent on **research performers**, however between the two dates we move from 'centres of excellence' to 'excellent research organisations' (we shall return on this point in the next section). For both, **university-industry partnerships** are an integral part of adequate 'knowledge flows' and 'knowledge sharing'. One could add the debate that started in 2000 about the excellence of European fundamental research or "**frontier science**" (moving away from the so-called European paradox: 'Europe is good in research but poor at turning it into innovations').

The Green paper however marks a strong reduction in scope in one central dimension: it does no longer consider **conditions fostering 'dynamic private investments'** (which, as said previously, are part of the second pillar of the Lisbon strategy). This has been strongly highlighted by the industrial community (see their answers to the Green Paper, e.g. EIRMA). It also underplays all elements dealing with 'shared values' and relations between **science and society**, in particular ethical and Health Environmental and Safety (HES) issues (while having developed important actions on these topics).

Many of these developments have been recently encapsulated in the notion of 'fifth freedom' proposed by the March 2008 European Council.

Box 3 - About the fifth freedom, Presidency conclusions of the European Council, 13/14 march 2008, p. 5/6

Member States and the EU must remove barriers to the free movement of knowledge by creating a "fifth freedom" based on:
- enhancing the cross-border mobility of researchers, as well as students, scientists, and university teaching staff,
- making the labour market for European researchers more open and competitive, providing better career structures, transparency and family-friendliness,
- further implementing higher education reforms,
- facilitating and promoting the optimal use of intellectual property created in public research organisations so as to increase knowledge transfer to industry, in particular through an "IP Charter" to be adopted before the end of the year,
- encouraging open access to knowledge and open innovation,
- fostering scientific excellence,
- launching a new generation of world-class research facilities,
- promoting the mutual recognition of qualifications

This analysis translates the fact that there is, as mentioned by Andre, a strong continuity in the contents given to what constitutes a 'European research area'. *They serve as many benchmarks against which consider FP6 achievements*: *in particular,*

in what ways did the infrastructure programme and ESFRI helped improving/reinforcing the European situation? In what ways the Marie Curie programme and the European charter

have helped in fostering researchers training and mobility? Did NoE foster excellent frontier science and help reinforce the excellence of research performers? Did specific programmes help in deepening existing U-I partnerships or promoting new ones?

22- Coordinating EC and national policies

The second component – coordination of national policies and the EC ("going beyond 15 +1" as said in the 2000 document) – witnesses strong changes in wording: we move from a view based on the optimisation of public resources to one where the bottom-up coordination of "research programmes and priorities" becomes central and to what is now called "joint programming". This is a radical shift in ways of addressing one long established mission given to the European Commission, that is to coordinate top-down national programmes. *It drives to consider, as one major potential achievement of FP6, the role that the new instruments and approaches developed have played in nurturing this transformation, in particular the development of Integrated projects, ERA-Nets and Technology Platforms (with the anticipated development of Joint Technology initiatives).*

23- Initiatives implemented and funded at European level: the need for robust rationales

As to the third component – "initiatives implemented and funded at European level"- it is fascinating for the reader to see that both communications remain silent apart from very general and banal sentences. My view is that this third element links with the debates that have taken place over the last five years about the interpretation of 'European added value'. Both the Ormala 5-year assessment and the Aho report asked for a clarification and a "strong concept". The answer to Ormala's requirement remained quite confusing (see appendix) while the proposal of FP7 (see Box 4) proposed a three-fold definition. We find of course the two previous components – phrased here as strengthening excellence and as playing a catalytic role in the coordination of the activities of Member states. But we also find a third one: establish a critical mass of resources in key areas for Growth, and to face 'pan-European policy challenges' (adds the Commission's answer).

Box 4 - Science and technology, the key to Europe's future - Guidelines for future European Union policy to support research – Comm (2004) 353

"The Union's action has a recognised "European added value" which stems from its combined effects at several levels: (a) Establishing a "critical mass" of resources, particularly in key areas for growth such as microelectronics, telecommunications, biotechnologies and aeronautics; (b) Strengthening excellence through competition at European level and transnational collaboration ; (c) Exercising a "catalytic" effect on national initiatives and improving the coordination of the activities of the Member States"

It is now clear that we are far from the classical definition of 'subsidiarity' (a wording that has disappeared from the European jargon), that is only develop at the European level what member states do not do themselves, or at least that we face a positive and not a negative subsidiarity, that is recognise the best policy level where to locate efforts to be done.

In both cases, this gives a further direction to look for FP6 achievements: did it address these 'key areas for growth' or these 'pan-European policy challenges'? But this leaves the reader

with the same impression of fuzziness: what are the criteria and processes that enabled to define these key areas and Pan-European policy challenges? For me this is where lies the 'fuzziness' of the ERA concept. And this requires to enter into substantive debates about the rationales for the ERA.

Part 3 - Rationales for the ERA: toward an alignment of viewpoints?

This third part is dedicated to a further elaboration of rationales for the ERA and their consequences on how to analyze the role of FP6. We start by clarifying this role with two sections where we differentiate ERA (as the definition of a optimal state to achieve, which is normative) and Europeanisation, as the processes that help progressing toward that aim. We then propose four critical dimensions of (or simply four) rationales underlying Europeanisation: fragmentation, knowledge production dynamics, innovation capabilities and collective goods/societal challenges.

Focus on processes (1): Europeanisation is key

For most scholars in the field (cf. a key reference, the book edited by Edler and Kuhlmann in 2003), what we are discussing is a process, and one that has a long history, not limited to the FP. It is therefore important to differentiate between ERA as a vision or an anticipation about a future state of affairs, and Europeanisation of research, technology and innovation activities in Europe.

E&K emphasize Europeanisation as a political process in complex stakeholders arenas. They highlight, with others, the multiplicity of forms taken by this process, and the critical role in it of inter-governmental constructs. Most of the major European successes we commonly refer to, from CERN to Airbus and ESA, come from such developments. Depending upon the research or industrial lens taken, analysts insist either on the importance of bilateral relationships in the initiation of such inter-governmental arrangements, while others will show how important CERN and ESF have been as a truly European space in generating new endeavours.

Analyzing this process, it is striking to see that moves towards Europe seem irreversible: once a transfer has taken place (one way or another), the activities remain organised and shaped at the European level: who would consider 'renationalising' space research (or having a fully fledged autonomous programme)? The same applies for most large facilities (even applied ones such as for meteorology). And this is true for 'de facto' transfers. In other papers, I have demonstrated the central role given to the EC in Information and communication technologies, and the core role played by the FP in shaping European capabilities (through programmes such as Esprit, Race and Telecommunications Applications, before they were gathered in the Information society programme).

Focus on processes (2): multi-level governance

This has raised another debate: is there a threshold in this Europeanisation process above which the balance shifts and 'federal-like' activities become the main driving force? Will we witness, as Caracostas and Muldur thought (see their 1997 book), the emergence of a

"European system of innovation", making of member states national systems what regional systems are to the German or Spanish systems of innovation? The ERA would then be the outcome of this shift, and an external reader of the recent conclusions of the competitiveness council might consider that it is now a view that member states are adopting (box 5).

Box 5 - Informal Meeting of Ministers for Competitiveness (Research) April 2008
(note : this minutes have been endorsed by the May presidency meeting)

"Europe needs a **long-term vision on ERA …** based on the "knowledge triangle" of research, innovation and education".
The vision should include the following
- free movement of knowledge, the 'fifth freedom',
- modern universities and research organisations
- all actors in research and private sector, including SMEs enjoying conditions favourable to investing in research and exploiting its results,
- Citizens benefiting from the contribution of large-scale R&D efforts to solve major societal challenges"

Most scholars however consider that the dichotomy between unitary and federal states is not an adequate reference to speak of the on-going transformation process, even if we end up with a European constitution. They consider that the articulations of the different levels of democratic legitimacy – basically the city, the region, the state and Europe – will have to work together, to join efforts and to create synergies if they wish to solve the problems they are faced with, which seldom (if not never) relate to only one of them. The term 'multi-level governance' has been coined to capture the fact that, problem after problem, the type of arrangement will differ, both in term of actors involved, and in term of modalities of action[1].
Such an analysis raises then the following questions: what are the drivers that push towards more Europeanisation for research and innovation? And, if one recognises that, depending upon the problems, degrees and modalities of Europeanisation may differ, should research and innovation policies be taken as a whole or should there be different situations (said otherwise: does one size fit all)? Pushing the questioning further, some wonder if what has not been yet Europeanised should be (the process being yet incomplete), or is it a de-facto reflection of the existence of different levels of 'critical mass' – certain types of research, certain fields or certain industries not requiring such an aggregated level of public action?

Four dimensions of ERA to consider

To address these questions, one needs to disentangle them in their interlinked but analytically separate components. This is critical to analyse the role that the European Commission and its main instrument, the Framework Programmes, can play in fostering Europeanisation processes.

[1] The term Governance also refers to another dimension, which is present at all levels, and deals with policymaking processes and the complementation of representative democracy with participative democracy: actors concerned (stakeholders) want to be active in shaping the policies that concern them. Patient associations or environmental groups are illustrations of the growing role of NGO in the shaping of policies. See Callon et al., 2001 for an authoritative demonstration.

Building on recent reports and on the work done by colleagues in the PRIME network of excellence, I have identified four central dimensions to consider that I shall address in turn.

1- What is the fragmentation we are discussing? And what does it entail in term of policies at the European level?
2- What are driving forces in knowledge production? And how to analyse them?
3- What is at stake about European lagging innovation capacities?
4- Why do we consider that societal challenges are key for the future of the Union?

31- Fragmentation: first and foremost an organisational issue

I have already emphasised the central argument of the 2000 Commission's communication about the "fragmentation, isolation and compartmentalisation of national research efforts and systems", and the shifting understanding between the two key communications from 'centres of excellence' to 'excellent organisations'.

The ERA rationales report (April 2008) makes a detailed analysis using academic work done during the past 15 years. It concludes that, if there is any such fragmentation, this is not at the level of individual groups performing research but at the organisational level. Using the work done in Prime on universities (Bonaccorsi and Dariao, 2007), the report underlines that there are strong agglomeration benefits that translate into performance for generalist universities up to around 3000 academic staff. Prime NoE (see Luukkonen at al. 2006, 2008) argues that there are also strong effects of 'virtual organisations' in fields/specialities that are small in size and require to agglomerate at the European level to develop shared facilities (in our case: training and indicators and corresponding data bases).

The ERA rationales report goes one step further and considers that fragmentation does not concern only performers but also funders. The recurrent argument when comparing the US and EU landscape deals with more diversity in the US. However funding of research is far more concentrated in the US (at the federal level between few agencies) than in Europe. I made a few years ago a conjecture demonstrating that in a given field, there were on average 3 to 4 sources of funds (available to all) in the US facing at least 10 or more significant sources of funds in Europe (with at best 1 or 2 available to all) (Laredo, 2004). This conjecture, which has been further developed (Laredo 2008a), concluded that this difference in organisational setting, explained why there was four times more 'nobelisable science' produced in the US as compared to Europe (Nobelisable science is taken here a marker of 'frontier science' most policymakers aim at). It went one step further saying that whatever action is developed at the European level, due to time lag, the situation would continue for at least the next decade. And in the same article, I even predicted that the ERC with its present way of working (that is behaving as one more independent agency in this overcrowded world of funding agencies in Europe) was bound to play a marginal role, and that significant effects could be expected only if the ERC turns into 'the agency of agencies'.

What are the implications for FP6 evaluation? It is not concerned with the ERC. But it is concerned by this issue through two FP activities.

1) It is highly concerned with the ways agencies in Europe try to coordinate. What is the role of ERA Nets in this movement? The Horvat report is very positive about the changes it is promoting. I share their views, and it is important that the panel builds its own opinion. It is

all the more important that the freedom given in FP6 (all activities were concerned) has been restricted in FP7 (only those ERA Nets fitting into the priorities defined under the 'cooperation' part of FP7, the idea of an institutional line under cooperation promoted by FP6 2004 monitoring was rejected).
2) It should investigate the structural effects of networks of excellence. NoEs were an open-ended experiment which has been implemented in multiple ways (because both of promoters and also of the very diverse ways in which this notion was understood and implemented in the different services of DG Research and DG INFSO). The issue is less to have an overall evaluation of the performance of the instrument as such, but about learning in which conditions they are relevant and which types of partnerships and activities correspond to them[2].

32- Knowledge production dynamics and fast growing fields of knowledge

The EC argumentation speaks of key areas for growth. What are these? If we look at the last 20 years of public policies, they empirically clearly appear. They correspond to what is labelled NBIC meaning information and communication technologies, biotechnology and nanotechnology[3]. There is not one national policy in the world that does not highlight these. But does the fact it is present everywhere warrants EC intervention? And which intervention? To propose the panel an interpretation I draw on the theoretical work of Bonaccorsi on 'search regimes' (Bonaccorsi, 2005) and on work developed since on 'knowledge and institutional dynamics' (Kuhlmann et Larédo, 2007, Laredo 2006, Laredo et al., 2008)[4].
Bonaccorsi proposed that 'search regimes' differ following three main properties: the rate of growth, the degree of divergence (or diversity of options explored) and the nature of complementarities required. The latter are cognitive (importance of interdisciplinarity), technical (the importance of large facilities or technological platforms) and institutional (the importance of university-industry linkages, or the role of clinicians in biotechnology).

a) Why is the rate of growth important? Let me take only one marker: articles in the WoS. The average annual growth is around 1% per year but it averaged 8% for genomics research in the 1990s (OST) and is over 10% since 1998 in nanosciences (nanotrendchart 2008). We know from management that in any 'market' growing at 5% or more, positions can change very rapidly, actors previously central may be marginalised in a few years… Thus following the rhythm is a necessary condition.
So concentrating European efforts on 'fast growing fields' is a central 'European added value' because it enables European research to remain in the global competition. Thus this should be an important role and achievement of European programmes.

[2] For instance as the coordinator of PRIME, I strongly reject the idea that performance is correlated to the number of participants. For what concerns PRIME we think that we demonstrate the contrary. At the same time we show very different involvements which correspond to our initial requirements of having 2 types of involement in the NoE: full and associate members. This was refused by the EC for legal reasons, while it was accepted until the end of FP5, may be a point for the panel to reflect upon!
[3] The C corresponds to cognitive siences, but this remains to be seen as a fast growing area.
[4] For further developments see the specific session of 'institutional and knowledge dynmaics' made at the Toulouse conference of knowledge for growth (July 7-9, 2008). The background paper and the presentations are available on www.prime-noe.org, (page: 2008 highlights).

b) Why is the degree of divergence critical? I suggest the following answer. Evolutionary economics highlight the importance of variety to nurture innovation and growth. In a way, this generalises the notion of 'paradigm' developed by Kuhn, proposing a dynamic model whereby most activities take place within a 'dominant design' (be it a 'technological paradigm' as proposed by Dosi or Kuhn's normal science). Radical change (whether breakthrough innovation or frontier science) happens through 'heterodox' developments and their ability to attract colleagues. We enter then in a 'fluid phase' whereby multiple options (often in competition) are explored. The issue lies then in how a narrowing process takes place and a new dominant design / normal science is established. To make it short[5], this can happen very far downstream in markets (think of the battle between the VHS and Betamax standards) or on the contrary very early in the research process (as shown by work done on nuclear energy, Cowan 1990). But most of the times it happens during the development phase and goes through the establishment of standards, norms and/or regulatory frameworks. The FP have been major players in at least two instances: the adoption of the GSM standard (with the benefits that accrued both to European firms and to citizens) and wind energy (with the EC megawatt mill projects which both demonstrated the feasibility of it, established the safety standards and prepared the economic conditions for its deployment, very soon embedded in a European directive). However life is not always as simple as that, Researchers are prolific and very efficient at multiplying concepts and options (as Bonaccorsi has shown for computer science). New arrangements then become central for ordering the introduction of new concepts (even radical ones). The ICT world with the ITRS roadmap that anticipates 5 generations of technology over one decade is an archetypical example of such arrangements. As Courtney (1997) beautifully said, for a breakthrough innovation to succeed, one has to transform the vision the industry has of its future and of its ways of working.
Programmes aiming at fostering the long-term competitiveness of Europe should thus be major promoters of such 'crystallisations'. The alignment of sectoral visions (associated with shared strategic agendas as is a stated objective of 'technology platforms'), the demonstration of new options, as well as the standards, norms and regulatory environment they require should thus constitute important landmarks to assess the long term success of European programmes.

c) Why are complementarities essential to this process? In one word they provide the "how" things take place. What do you need to undertake to nurture the growth, and to foster the emergence and crystallisation of new 'breakthrough' options? Our central argumentation is that the type of complementarities required radically change depending upon the fast growing field you are considering. Comparing post WWII physics with IT and Biotechnology in their early deployment, we show the extent of differences.
R&D was structured by the early adoption of dominant designs and large specific facilities in high energy physics. In IT on the contrary we witnessed distributed production with a

[5] I attach two longer developments made of these points: Laredo 2007 (in English but dealing with one aspect: scienttific commons and IP regimes) and Laredo 2009 (in French and dealing directly with knowledge and European dynamics).

growing role of patent pools and important relations between industry and public research (complemented by generic infrastructures: very large computers and information highways). The situation radically changed once more with biotechnology based on individual patents as a key resource for future 'blockbusters' and driven with an ecology of licensing, start-up and venture capital (with no technical entry barriers).

This is in turn linked with very different public interventions. High energy physics, aeronautics and space were associated to large (civil and/or military) programmes, the creation of dedicated research institutions for knowledge production, national industrial champions and government-based lead users. While some scholars tend to discard this model as 'linear' and thus outdated, it is interesting to note that it has driven the Europeanisation process through shared facilities (e.g. CERN), through shared programmes and corresponding agencies to manage them (e.g. ESA) and through the establishment of European-based global players (e.g. EADS and Airbus).

What is clear however is that this type of public intervention did not prove relevant either for IT (e.g. the failure of the French Plan Calcul) or biotechnology (e.g. the failure of Nixon's war against cancer). The British Alvey programme was the front runner of a new approach to public intervention, which the EEC took fully on board with the ESPRIT, RACE and BRITE programmes. We have dedicated a book to the characterisation of these 'technological programmes' (Callon et al, 1997) which address an existing industry, drive it to anticipate on its future, and focus its interventions on the technologies that are considered as key for next generations, and the corresponding standards, architectures and design tools. These collaborative programmes turned important for industry as they provided the technological pool out of which to select the relevant options to integrate in their products, the danger for one firm being not to share these technological options with others, but being barred from accessing the one option optimal for the design of the new product it was developing.

Again this coo-competitive framework did not apply to biotechnology. What turned central was the ability to generate new firms from the breakthrough science developed. Europe is supposed to have fared badly in this game, thus all the policies in favour of start-up firms, spin-offs from universities and venture capital. But recent academic work tend to downplay this analysis along two directions: Europe does not fare so badly compared to the US in relative terms, once account is taken of the difference in public investments in fundamental research in life sciences. And secondly these spin-off firms should be seen less as potential new world players than as demonstrators of the relevance of their proposed option. Then counts the ability of existing pharmaceutical firms to drive these products through the stringent later phases of clinical trials, and in this 'game' European firms seem to perform quite well!

In a recent paper (Laredo et al, 2008) based upon the work of the nanodistrict and nanotrendchart on-going projects, we argue that nano sciences and technologies are again a different story where technology platforms go with 'long distance' interdisciplinary developments and very high institutional complementarities with a central role of incumbent firms from multiple industries. This drives to strong agglomeration phenomena (200 clusters representing the core of world production) and an unprecedented shift towards Asia (Japan

but also and fast growing Korea, Taiwan and China). This raises questions as to the portfolio of instruments public policies should adopt[6]

How to read these in term of the role of FP6? There could be two complementary dimensions. The first one deals with the core focus of the activities: probably infrastructure associated with physics (such as ITER but not only) and new breakthrough designs that agglomerate actors in existing related industries; fostering collaborative research in IT but not only, also helping new heterodox options anticipating next generations to crystallise (what are the next GSM or the followers of the OMI initiative? And what is there the articulation with the Eureka platforms and now the technology platforms that have developed)? Enlarging the pool of frontier science in biotech and nurturing a friendly ecology for spin-off firms for biotechnology. The nano picture is more blurred, but a portfolio is emerging around four directions: foster heterodox research (defined by the unusual interdisciplinary connections generated), support the development of concepts and methods that are necessary to all actors working at the nanoscale, nurture an adequate cluster ecology (Europe is very dispersed compared to other regions of the world) and develop HES and ethical research (since incumbent firms do not strive for new markets but nano-enabled products in existing markets). The second direction is more procedural and deals with the dual ability to drive actors in each field to develop long-term visions that are essential for developing critical mass, and to maintain a constant flow of heterodox developments (to nurture variety).

33- The innovation capacities of established European industries

These 'high tech' sectors, however important they are, represent a small section of European industries, in term of added-value, profits as well as employment generated. What role for European public policies for these other industries? The balance between 'direct' and 'indirect' public support completely shifts for these industries. What is important is an 'innovation friendly ecology'. This goes first through training (and we know the growing importance given to professional bachelors and masters, far away from our fashionable debate on the Shanghai-based ranking of universities). It then goes mostly through 'indirect' interventions mostly promoted by other public policies: fiscal policies (e.g. RD tax credit), financial policies (firms access to loan, supporting the development of a venture capital industry), procurement policies (remember that over 15% of the total added value is related to public expenditure) and standards and regulation (an issue that rates high in the European political agenda with its focus on 'better regulation'). A third dimension deals with the quality of communication infrastructures, as witnessed by trans European networks. These policies can be global or specific, especially addressing SMEs. Europeanisation in these fields is to insure the existence of similar situations in all member states. This is how one can explain the central role given to the 'national reform programmes' by the European Council.

There are however two caveats.

- An ecology is not only made of an adequate institutional environment, it lies first and foremost in a rich actor-set that enables mutual learning. It was long identified by Marshall

[6] A question all the more central for me that I chair the ANR strategy committee on nano sciences and technologies.

who saw industrial districts as the alternative to vertical integration in large firms. This has been revived through the Italian industrial districts and put on the political agenda when Porter coined the notion of 'clusters'. We know from experience that clusters are mostly a bottom-up construction with often a strong role of regional policies (e.g. the Basque Country), but we now also know that national efforts can be catalytic in fostering their development (e.g. the French policy on poles de compétitivité). There are debates on the role of large firms and global players in their ability to succeed (e.g. the anchor tenant hypothesis). Should there be a European role, beyond what structural funds are doing or the incitation of DG Regio for regions to develop innovation policies?

- The second caveat is more basic. Services play a central role in employment (as a whole and even more in term of creation). All our public interventions assume that innovation in services is mostly organisational (new business models) and that it is enough to focus on the technological capabilities of the supplier equipment industries. *Did the FP take hold of these questions and addressed them one way or another?*

Finally, for a long time OECD had added a final dimension to these indirect policies, the access and use of 'generic technologies' that pervade the whole industrial fabric. This is particularly visible in the wordings of the European Council on the information society. It should thus be one focus of the information society programme. Many scholars have shown that it goes with the development of generic software and with intermediating capabilities that help tailoring and piloting their uses in different industries (these are particularly important in 'mature' industries mostly made of SMEs).

How should these last two activities be split between regions, nations and the European Union, is far from being clear, but trying to advance knowledge on these might well be considered as a relevant contribution of FP6.

34- Societal 'grand' challenges' as the key dynamics towards the ERA

In 1994, Gibbons et al. produced a challenging book where they argued that we were witnessing the advent of a new mode of knowledge production, the famous mode II, no longer driven by new fundamental research but by socially-based 'problem solving' ambitions. It considered that, in a society where half of an age class goes to higher education, knowledge can be produced in multiple places and not solely in academic and large firm labs. It also forcefully argued that the key driver for supporting the production of knowledge would shift and be strongly embedded in societal issues. The fact that historians have demonstrated that there was nothing new and that mode II had always prevailed, did not change the strength of the argumentation. In our democratic societies, what drives investment in research is more and more focused on issues societies face. We seldom reflect on the fact that NSF is a very minor share of US federal expenditure on R&D which is vastly mission oriented (Bozeman & Dietz, 2001).

The issue then for the European Union and the ERA is what should be Europeanised. Going back to history might help better address this point. The first R&D efforts decided by the then EEC were linked to the 1974 oil crisis and the will the improve the energy autonomy of Europe: this is along these lines that the activities dealing with solar energy and then more broadly with 'non nuclear renewable energies' were developed. And between 1974 and 1978 followed specific programmes on "medical and health care research" and on "environment" as these

were societal problems all member states were facing. The 1980s and the 1987 'single act' forgot about these pointing only, in the wake of the ESPRIT programme, to the technological basis of European industrial competitiveness. But successive environmental crises and climate change have forced these dimensions back on the agenda, with their indirect inscription in the Maastricht treaty (research to support other European policies) and FP5 argumentation centred on developing 'problem solving research'.

Still these have remained secondary lines of action, and even more of policy-relevant argumentation. The importance of innovation in collective goods as a major policy objective was underscored until very recently even when arguing it was a 'public engine for innovation' (Laredo, 2003). With colleagues, we proposed to complement the FP by a fund dedicated to innovation in public goods, considering that demonstrations were central to their adoption. This had nothing really new as one must remember that there was a demonstration programme for renewable energies (on top of the research programmes) and that the Esprit and Race programmes were complemented by a "telematics application programme" largely focused on collective issues (health, collective transport, city of the future, life in rural environments just to name a few).

The ERA rationales report has proposed to go one step further and to organise the core of the Europeanisation process for the next decade around the 'grand challenges' our European countries jointly face, from climate change to ageing (far more than the Alzheimer disease) through to environment and new forms of energy. It considers that such developments can happen if and only if national governments and Europe pool their means since on each of these problems today, the European Union as such is a marginal player, but creating a fund of significant enough a size might turn catalytic to mobilise energies and integrate activities.

I think it would be a mistake to consider that the European Union through its programmes has done nothing in this direction. I have already mentioned the central role of the FPs in the development of wind energy as a credible energy option and potential industry (away from its Nordic grassroots origins). I think there are many others that should be highlighted and from which to learn for making the huge step proposed. I personally think that this is by far the most important development FP6 evaluation can make.

References (to be added)

Appendix

Towards a European Research area (Brussels January 18, comm 2000(6).

"How should this idea of a European research area be defined? It should embrace in particular the following aspects"

1- "a stock of material resources and facilities optimised at the European level": networking centres of excellence, research facilities and electronic networks
2- "More coherent use of public investments and resources", more coordinated implementation of research programmes, closer links between scientific & technological organisations
3- "more dynamic private investment": indirect instruments, IP, start-up & risk capital,
4- "a common system of S&T reference for policy implementation" (research needed for political decisions, HES issues, a forum for all not-for-profit national structures with IPTS in a leading role)
5- "more abundant and more mobile human resources": mobility, careers, women, youngsters
6- "a dynamic European landscape open and attractive to researchers and investment": role of regions (use of structural funds, benchmarking of regions, use of prime regional movers), east-west integration, attractive for the rest of the world
7 "an area of shared values": more consistency in foresight and a platform for exchange, science & society (consensus, citizens conferences…), ethical issues (link the EC and national groups, develop shared principles)

Green paper The European Research Area : new perspectives, Com (2007) 161

The European Research Area that the scientific community, business and citizens need should have the following features:
– **An adequate flow of competent researchers** with high levels of mobility between institutions, disciplines, sectors and countries;
– **World-class research infrastructures**, integrated, networked and accessible to research teams from across Europe and the world, notably thanks to new generations of electronic communication infrastructures;
– **Excellent research institutions** engaged in effective public-private cooperation and partnerships, forming the core of research and innovation 'clusters' including 'virtual research communities', mostly specialised in interdisciplinary areas and attracting a critical mass of human and financial resources;
– **Effective knowledge-sharing** notably between public research and industry, as well as with the public at large;
– **Well-coordinated research programmes and priorities**, including a significant volume of jointly-programmed public research investment at European level involving common priorities, coordinated implementation and joint evaluation; and
– **A wide opening of the European Research Area to the world** with special emphasis on neighbouring countries and a strong commitment to addressing global challenges with Europe's partners.
In addition, three important concerns cut across all dimensions of the ERA:
- European research policy should be deeply rooted in European society.
- The right balance should be found between competition and cooperation.
- Full benefit should be derived from Europe's diversity which has been enriched with recent EU enlargements.

Extracts from the detailed answer of the Commission to the 1998-2003 5-year assessment, comm (2005) 387, p. 8.

"The essential rationale for the Framework Programme is that it finances activities that will benefit from public sector support, which can be more effectively carried out at a European level and thus produce a value over and above that which could be achieved through regional or national programmes."
(The FP7 ex-ante impact assessment) "contains a very clear analysis of the European Added Value, grouped into three categories: pooling and leveraging of resources; fostering human capacity and excellence in S&T through training, mobility, career development and competition at European level; better integration of European R&D. The various sub-components of each category are also set out including: critical mass; the leverage effect on private investment; big science; European training mobility and career development, competition in research; pan-European policy challenges and coordination of national research policies."