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FROM PARTS TO WHOLE

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Abstract. Two years ago (in 2000), the EU launched the research strategy document "Towards a European research area" where the main aims for research and development in Europe as a whole were indicated. Nevertheless, the research policies differ, especially in larger and smaller countries. In this paper, the various aspects of research policies are examined based on the recent ALLEA studies "National Strategies of Research in Smaller European Countries". These studies involved both the member and candidate countries. The experience of different countries is analysed and the best practice indicated. The research policy in Estonia is described in greater detail. Finally the ideas leading towards general European research policy - from parts to whole - are discussed.

1. Introduction

The European Union has recently paid a lot of attention to shaping the EU research policy in order to strengthen the European role in science and technology worldwide. The Research Directorate-General of the European Commission launched (January, 2000) the communication "Towards a European research area" (Towards 2000). Said Philippe Busquin: "... (the communication) is meant to contribute to the better overall framework conditions for research in Europe," and adds: "... it will rather be the result of a process to which all the relevant actors will have to contribute." The communication was adopted in March 2000 during the Portugal presidency of the EU. The first step implementing European Research Area (ERA) is the proposal for the 6th Framework Programme (2002–2006) (Proposal 2001). It clearly states three objectives:

1) to integrate European research;
2) to structure the European Research Area;
3) to strengthen the basis of the European Research Area.

It is obvious that today the European research pattern is still fragmented and the "top-down" (i.e. EU) and "bottom-up" (i.e. national) initiatives should be encouraged. At present these initiatives serve mostly different interests with only certain overlapping activities. This is not surprising because research activities in

Europe are basically national. Only about 17% of the total public expenditure on European research is by joint efforts and only about one third of that (i.e. 5.4%) is through the European Commission (Towards 2000). The ERA communication defines many aspects of future EU activities, among them clearly directed towards coherence are:

- more coherent implementation of national and European research activities;
- greater European cohesion in research based ... on the role of the regions in the European research efforts;
- bringing together the scientific communities, companies and researchers of Western and Eastern Europe.

The last concerns, in other words, improving the contacts between member and candidate countries. The OST analysis says: “Closing this gap is a major challenge for Europe” (European 2001). The proposal for the 6th FP serves the idea of contributing to the full realization of ERA (Proposal 2001). It stresses stronger connection with national initiatives and the genuine partnership between the EU and its member countries.

In this paper some ideas are presented, reflecting possible ways to develop science and technology policies, especially in smaller countries. We focus on Central and Eastern European countries (CEEC), where some problems that stem from the recent past, are still to be taken into account. Then we address the experience in smaller Western European countries and try to draw some conclusions about the national strategies in S&T of CEEC, which should be helpful as well in constructing the European Research Area.

2. Current situation

Creating a whole from the parts brings up several problems as the case studies show (European 1999, ALLEA 2000). There are many ideas shared by all the actors: quality of research should be promoted, co-operation, networking and mobility are important, governmental funds and/or special incentives should be created for priorities, there should be mechanisms for disseminating knowledge to the public, research ethics is important, etc. These ideas are all stressed as significant on European scale (Towards 2000). Nevertheless, not all goes smoothly, especially in the candidate countries. There are at least two types of potential conflicts of interest: size-conditioned between large and small countries, and status-conditioned between member and candidate countries.

In 1999, ALLEA (the Association of **All E**uropean **A**cademies) established a working group (WG) to analyse the research strategies in smaller European countries. The first Report of this WG to the General Assembly of ALLEA in 2000 has indicated several special incentives together with some weak points, typical of the smaller countries from Central and Eastern Europe (ALLEA 2000). Clearly, much has to be done both in formulating precise targets in their S&T policies and for overcoming the difficulties.

The weak points in many smaller candidate CEE countries are the shadows of the past (ALLEA 2000). These involve science structures that might still be preserving the old patterns, funding schemes that might still be rigid (not speaking about their obvious insufficiency), administrative difficulties that are related to the governmental capacities, shortage of qualified (young) workforce that shadows both science and administration, etc. In order to overcome these difficulties one should think of "push and pull" strategies. The "push" should come from national initiatives, the "pull" – from European initiatives. Below we shall briefly analyse these weak points comparatively.

First, the science structures. Typically, in CEE countries structures were of three types: academic research institutes, universities and "ministerial" (we should now say, governmental) research facilities. The academic research institutes were strongly favoured in many countries. However, the walls between those research institutes and universities were high and that had negative impact on the general level of research and education (there were exceptions here and there). Although apparently similar to the situation in Germany with Max Planck Society and universities, or to France with its C.N.R.S and the universities, the totalitarian regime was able to distort the scheme. The positive side of supporting research institutes out of the universities was creating some high-level centres, especially in sciences. After 1989, the situation has changed but not along any unified patterns. In some countries, the academies have been restructured and became western-type learned societies without research institutes or keeping very few of them; in some others, the academies have retained the research institutes, mostly on a smaller scale. The decisions taken to change the situation were influenced by historical, cultural and economical conditions but unfortunately also by political debates. The latter, as we all know, are based on compromises and voting, not on objective analysis and clear foresight. This way or another, the international evaluation carried on in many CEE countries has helped enormously to estimate the strong research fields. However, the evaluation proposals were not always taken into account in the implementation. Sometimes the explanation for doing so referred to some local specific interests or the lack of funding to start the changes. Whatever the specificities of the different situations, it is now quite clear that those countries where the appropriate international advice was seriously taken into account are now in a much better position.

Second, the funding schemes. Again, the old schemes were mostly institutional and the quality of research was not taken into account. Introducing the quality criteria and peer-review were the most important tools in changing the old situation. Again, there are good and not so good examples. The grant agencies have been established in most of the CEE countries, their role is between 5...30% of the whole public funding (ALLEA 2000). The basic funding, be it targeted or institutional, should be based on quality. Here the schemes vary more, starting from the preservation of institutional funding to the clear peer-reviewed targeted funding. Quite probably, the balance should be somewhere in the middle – periodical assessments should give a permanent funding for certain periods, while targeted and peer-reviewed funding should encourage quality research. For a transformation period targeted funding is certainly an excellent tool to establish stronger research groups and to get rid of weak ones. From that point of view, the recent action of the European Commission aiming at identifying centres of excellence in the pre-accession countries must be recognized as most appropriate. As it was stressed recently, “it will be rather useful, if the majority of these centres of excellence could receive long-term funding to establish them as European or regional attractors for research and training activities” (Anguelov et al. 2001). The structural funds were mentioned as a possible source for this long-term funding, but together with some cost-sharing schemes, thus trying both to avoid any conflict of interest with the member states on that issue and involving deeper the countries into the process of consolidation of their research infrastructure**.** This is a difficult process but the fruits to gather later are worth the effort.

Third – administrative difficulties. A well-known dilemma is always present: the governments (public) want results, researchers want freedom. Clearly, both extremes are not effective in the long run. The combination of the two wishes gives the best results. The freedom of research can lead to unexpected new applications and guarantees the increase of knowledge. This can be effectively used for getting results in needed fields. In the ideal case there should be several tools for funding various activities. In Western Europe such tools have been formed through a long evolutionary process. The governments there are aware of the importance of knowledge and keep research going. In the transition period, however, the governments face so many problems that they might lose their sense of far-sightedness. That means valuing only the “cash-in-cash-out” principle. As far as there are accompanying capacity problems, science administration might suffer. In order to overcome these difficulties, the science strategy papers should be agreed, adopted and implemented. Then it is possible to set up official targets, agree on priorities and on funding schemes, for research as well as for development.

There is another quite interesting aspect in CEE countries. The totalitarian regime actually maintained a steady funding for sciences with not so much interference in the everyday research. The situation was certainly completely different in humanities and social sciences where tight control existed. What was difficult was to open gates for new ideas – cybernetics and genetics being the best-known examples in the fifties of the previous century. Nevertheless, with a certain delay, those areas have also been developing fast – in science the most decisive factor is the human capacity. This way or another, the impact of pressure on research in certain fields has caused the reaction against any administration. So the estimates on “weak administration” of R&D in CEE countries are actually based on the lack of strategy approved by the scientific community and agreed by the government.

Fourth – shortage of manpower. This is again a typical constraint found everywhere but has a special character in CEE countries. The point is that the brain drain has affected the present situation. The external brain drain is different in various countries, but one should pay a special attention to the internal brain drain, of which two kinds can be distinguished. First, after getting their degrees or even before promotion the young people leave science for better salaries. Second, the perspective high-school graduates choose easier diplomas elsewhere rather than in science and engineering. It is easy to suggest that scientific careers should be more attractive. One simply faces reality of the everyday life and then takes decisions according to the existing constraints. In order to overcome such difficulties, governmental incentives together with activities of the scientific communities should be concerted and implemented.

What has been described above is mostly general (and emotional) overview of a few key problems. In what follows, some concrete experiences are considered.

3. Experience of incentives

By definition, there is no way to predict scientific discoveries, but there is always a possibility to direct the activities to one or another field of human life, technology or environment. This can be done by science strategies and also by foresight exercises. The most known and well-cited document in this widening library is “Science: the Endless Frontier” by W. Bush – the US “White Paper” in 1945 that had an enormous influence on R&D in the US. In what follows, we propose a brief insight into some more recent experiences in Finland, Ireland, Austria, and Portugal.

Finland started the intensification of R&D in the 1980s when the government adopted the R&D strategy and the following governments have kept to it. In blunt figures, the R&D intensity from the GDP has risen from 1.4% in 1984 to 3.0 in 1998 (State 2000). The science policy in Finland has been developed “first, as a separate policy sector; second, in conjunction with technology policy, aiming to establish a free-flowing dialogue, and third, as part of the national innovation system and its broad perspective”. As for a small country, the objective is “...to develop the national research and innovation system by means of a high relative input and a careful allocation of research funding...” (State 2000). There are several funding sources – the Academy of Finland, National Technology Agency (TEKES), Technical Research Centre of Finland, core budget funding for universities et al. The initiatives are directed towards developing international research co-operation and creative research environment. The Finnish Programme of National Centres of Excellence in Research started in 1994, and has been extremely effective. The Centres get their status through tough competition and those awarded the status get additional funding. The centres of excellence are research units with strong researcher training going on as well. Actually Finland pays a lot of attention not only to researcher training but also to their future professional careers with many competitive positions open: research professors, senior fellows, junior fellows, post-doc researchers.

The review on the state and quality of scientific research in Finland can be recommended as a remarkable success story (Anguelov et al. 2001). A success story, however, needs constant monitoring. The Finnish government has recently asked an international expert group to perform an overall evaluation of applications in 1997–1999. The results of this evaluation are also worth stressing (State 2000):

- "the additional public appropriation for research seems to have had a positive impact on private research investments";
- "the effects of research input on employment have been clearly positive";
- "the additional funding has also had positive effects on regional development", etc.

The priorities indicated by Antti Prihti et al. (2000) have an unmistakably clear message:

- "policy-makers should continue to set ambitious aims for research funding";
- "the conditions for basic research should be strengthened";
- "the cluster approach should be improved and extended";
- "the new and old economies should be integrated", etc.

These lessons and recommendations should be taken very seriously because they are drawn from recent practice. As a result of such policy, the following should be stressed. The Finnish share of world publications has risen from 0.65% in the 1980s to 0.91% in 1999, the growth of the high-tech import has risen with the same speed as the expenditures to R&D; Helsinki and Oulu regions are mapped in the EU research activities scale as intensive zones (State 2000). And this is a small country with about 5 million inhabitants.

The experience of Ireland is interesting in the sense of how the International Assessment of the Organization, Management and Funding of University Research in Ireland (1996) was implemented (Bric 2001). The criticism was that the financial support for basic science was very small and there were inadequate funding structures involving support for postgraduates. Two years later, in 1998, the Programme for Research in Third-Level Institutions (PRTLI) was launched. It has three objectives: "to enable third-level institutions in Ireland to realize their research capabilities; to fund researchers to develop high-quality research; and to encourage collaboration both within and between institutions" (Prihti et al. 2000). Funds were provided by government and the research system has greatly benefited from this initiative. In addition to that, the government has established two new Research Councils, one for Humanities and Social Sciences (in 2000), the other for Science, Engineering and Technology (in 2001) to recognise the needs of individual researchers and smaller projects.

Third, a good example comes from Austria. Günther Tichy from the Institute of Technology Forecasting has analysed the Austrian trends compared with those in the US and Europe. He has summed up his analysis in such a precise way that we are tempted to repeat it here (Tichy 2001):

"At least four lessons can be learned from the Austrian experience: Firstly, that recent emphasis on high-tech in general and New Economy in particular, is overdrawn. A small country in a medium state of development may in some cases get more value for its promotion money by promoting high-tech innovations and high-tech improvements in those (traditional) industries in which it has already accumulated distinct capabilities of its own. The Styrian car cluster is a good example for a highly successful approach of this type. Secondly: investment in high-tech equipment can be a temporary alternative for small countries in a medium state of development. The more, however, such a country succeeds in catching up and the closer it comes to the level of its most advanced competitors, the more it has to search for country-specific high-tech market niches. Thirdly: organisational innovations, specific institutions, organising technological co-operation or the formation of clusters, are at least as important as purely technical innovations. Fourthly: the Austrian experience suggests that government, academia and business should co-operate not only in R&D but earlier on, in designing the institutions that support innovations. Such a partnership approach was typical of almost all Austrian projects, from Fachhochschulen and Kplus-centres to cluster management."

In addition, the Austrian experience in creating the research programmes should be stressed (Mittelfristiges 2001).

For the EU accession countries, the experience of Portugal could be very useful. First, the situation in 1990 is briefly described as follows (Dias Agudo 2001):

- very limited financial and human resources by European standards;
- underemployment of highly qualified staff members;
- weak links between the scientific and technological system;
- ambiguity in the definitions of the bodies co-operating and promoting research, with useless duplications;
- non-existence of an overall scientific and technological policy, etc.

In some sense such a situation is quite familiar to the CEE countries (c.f. Section 2).

The government created the Ministry of Science and Technology in 1995. The Ministry has taken a strong line in formulating science policy, and started and encouraged many actions for strengthening R&D in Portugal (Dias Agudo 2001):

- planning and co-ordination of research was reorganized;
- research evaluation was started;
- stability of funding was ensured;
- attention given to the technological capacity of the enterprises;
- funding was improved;
- attention given to the scientific culture in general;
- special operational programmes created, etc.

Indeed, the EU accession countries can learn quite a bit from this experience.

4. Process of catching up: Experience from a candidate country

Here we briefly describe the situation in one of the smallest candidate countries – Estonia. Small in size (only 1.4 million inhabitants), Estonia has been fast in changing its S&T structures. General restructuring during the last decade was directed to four key problems: restructuring decision-making, reorganising research establishments, reorganising funding and reforming higher education (Engelbrecht 1998–1999, Dagyte et al. 2000). The main aims have been to implement the best practice from other countries but bearing in mind the constraints of (i) smallness and (ii) the transition period.

On the positive side, there is a clear and flexible legislative basis for the S&T system and education. Next, funding is based thoroughly on peer-reviews. The long-term (project-based) funding is decided by the Ministry of Education on the recommendation of the Science Competence Council (SCC). The same Council gives also recommendations for funding the infrastructure. Both basic and applied research is funded. Short-term grants are allocated by the Estonian Science Foundation (ESF). This is the system based on the bottom-up initiative. Fixed funding ratios between the disciplines are set up only for grant-funding. Roughly speaking, the budgets of SCC and ESF were measured as 2.2:1 in 2001. In addition, infrastructure is about 30% from the project-based funding.

Up to 2000, innovation was funded by the Estonian Innovation Fund. The matching principle with industry was used but technically the Fund had only a limited budget. In 2000, the Ministry of Economic Affairs restructured the Fund creating the Technology Agency. At present, the budget of the Agency depends on the results of privatisation.

From the best practice in Estonia, the following should be underlined:

- there are incentives for supporting young people in research; these include special research fund for PhD research, post-doc positions, special PhD and MSc research stipends from grants;
- there are examples of attracting private sources to improve the infrastructure: a new laboratory for tumour research was built for the Estonian Biocentre by funds of Citrina Foundation (UK); a new building for pre-clinical education and research was built for Tartu University on the loan by the World Bank;
- the first step is taken towards improving the infrastructure for biological collections;
- the Centres of Competence were established at Tartu University and the Tallinn Technical University supported by the PHARE Programme;
- peer-review is the basis for all funding decisions.

The drawbacks in the R&D in Estonia are also evident. The first is the small impact of the research for innovation caused by the general economical situation. This is also partly the reason for the low indicators of funding R&D, because the interest from the industry is low. The second is the general situation of the infrastructure, and the third – limited manpower. The threat of brain drain is not so evident but it exists.

Evaluators have sometimes mentioned the imbalance of public investments towards basic research and those fields of science that are not directly connected to industries. However, such a funding has kept high standards of research and education which is a “must” for a small country. It is clear that this imbalance in funding should be changed not by altering the ratios between the fields but by increasing funding towards innovation and development, i.e. creating conditions for implementing the results of the research.

What has not been achieved during the last decade, was an official agreement on Science Strategy. In 2001 the government passed the Science Strategy document entitled "Knowledge-Based Estonia" to the Parliament. The main ideas in this "White Paper" are the following.

First, the strategic aims are similar to those in other countries:

- increase the quality of life and social security;
- renew the knowledge base and enhance the education on all levels including life-long learning;
- increase the economic growth by supporting the capacity of enterprises to implement the results of R&D;
- support co-operation on national and international levels.

In a small country like Estonia there are many constraints and also many needs. It is difficult to list them in an order of importance, but some of them are as follows:

- limited qualified manpower;
- limited funding;
- a need to keep the national educational system functioning;
- a need to foster research for national identity (language, history, nature, etc.);
- a need to foster basic research in order to guarantee the quality of higher education and give possibilities to talented people in these fields to work from home;
- a need to foster applied research and development to get more innovative ideas for the industry.

Clearly, the needs should be balanced and it is possible only by making choices. The instruments for that are the quality requirements, estimations of possible outcomes and concerted actions. The last instrument seems to be the most important because in a small country the averaging effects are weak. In addition to that the transition period still influences the development by its pragmatic short-sighted views and often the cash-in-cash-out principle prevails.

The present government intends to define its role in S&T, stressing the shares of an investor, a catalyst, and a regulator. As an investor, the government plans to invest more into the education and S&T, including basic and applied research and supporting the infrastructure. As a catalyst, the government works out strategic plans for education, supports collaboration between various actors, and creates conditions (including taxation) for the private sector to use new knowledge for innovation. As a regulator, the government creates and supports a system for applied research and innovation, creates and funds national programmes for supporting the key areas of R&D.

As in almost all countries, there is a need to concentrate efforts in S&T in order to reach critical mass and to enhance competitiveness. The key areas should be chosen for which the activities will be concentrated. These key areas depend first of all on the existing scientific potential, possible applications and economic conditions. Defining them, one follows the line of pushing. The other side is related to the existing economical factors (especially industrial) that needs R&D to be involved – that is the pulling effect. In a small country like Estonia both these conditions are extremely important, still exacerbated with the effects of transition period. So the S&T strategy formulates three key areas:

- technologies for the information society;
- biomedicine with applications;
- materials technology.

As for the existing industrial needs, there is the governmental support as well. And certainly the research of the Estonian language, history, nature, etc. is not neglected.

There should also be instruments not only for realising the ideas in key areas but also in general terms. The S&T strategy shows how to strengthen the infrastructure for applied research and innovation. The Technology Agency (ESTAG) is the main governmental institution for that. The conditions for creating Technology Centres at two leading universities should bring researchers closer to industrial interests. In order to support high-level research, the Estonian network of Centres of Excellence in Research has been created. That means also direct mapping of excellence and linking them into the European network. Two centres (one in physics, another in biotechnology) already exist under the EU scheme, the seed money for the others in 2001 was already allotted by the government. The support for young researchers is regulated, although the system still has bottlenecks due to the small budget. The S&T strategy stresses the need to popularise research results and make knowledge more accessible and highly rated. Much more attention should be devoted to Programmes, especially in order to foster the key areas. National Programmes on Health, the Estonian Language and Culture already exist, although with limited support.

Estonia is now participating in the Fifth Framework Programme and already feels a strong positive impact in shaping priorities locally. The recent EU document "Towards a European research area" has been widely discussed. The common agenda for large facilities is approved as well as the need for central computer data banks like those for genomics and proteomics, in astrophysics, etc. There are several examples of cooperation with CERN, Maxlab in Lund, Coriolis Laboratory in Grenoble, etc. Another aspect is that Estonia, as a small country, can see a possible impact in promoting virtual centres of excellence. A common European education and research network should be considered as one of the top priorities. Estonia also welcomes the coordinated implementation of national and European research programmes. Here, the opening of national programmes would be an important step forward. As for the instruments of indirect support to research, then first, the development of the common education and research network and second, protection of intellectual property, are of importance. The mobility of researchers is always a two-way road. However, the existing gap in income means that the utilization of the principle of free movement is hindered as far as west-to-east movement is concerned. The European research area means a real cooperation that needs a reinforced role for regions. The suggestion to combine Structural Funds with R&D funds provided by FP is welcome, and

Estonia also expects the Commission to be more active in encouraging governments to channelling such funds for the R&D capacity building. For the successful integration of the Estonian scientific community into the common European research area we stress the improving standards of research, intellectual property rights and open debates on ethical issues of research. In particular, attention should be paid to enhancing the European patent system (introducing the grace period, for example), common policies related to stem cell research, patenting of gene sequences and genomes, etc.

Since 2000, Estonia is also a full member of the European Science Foundation. Being actively involved in various inter-governmental and non-governmental institutions, Estonian scientific community has its representatives and votes in shaping the future European R&D policy. For example, Estonia has its representatives in all the ESF Standing Committees and is already involved in the ESF activities. The Estonian Contact Point for the 5th FP takes care of EU projects and applications. Estonia is also engaged in the IPTS/JRC Project on EU-Enlargement, Building Linkages on Prospective Activities. Chairing the ALLEA WG on National Strategies of Research in Smaller European Countries, Estonia has established good links between Academies. In this context, cooperation with UNESCO Venice Office has been extremely useful.

International cooperation has produced good results in astrophysics, solid state physics, molecular biology, marine sciences, etc.

Is it enough to be effectively integrated into the European Research Area? The ideas are certainly matched to those of ERA but the implementation will depend on constraints. The help and advice from member countries is appreciated, in the case of Estonia the role of Finland and Sweden cannot be overestimated. For example, the first international evaluation of research in Estonia was carried out by Sweden, the Programme of Centres of Excellence follows the experience and advice from the Academy of Finland, etc. We all know that "it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that" (Carroll 1986). This is the real problem not only for smaller countries, but for all countries trying to change their present situation. Although the keywords for running may have been repeated too often, excellence, networking and mobility are nevertheless to be fostered. There are instruments for networking and mobility but excellence is based on minds, who could use the instruments and conditions (i.e. funding). In such a way the human factor comes in. That is why in small countries the principle of supporting the existing excellence should be followed, otherwise creating excellence could be too time-consuming. The dilemma – either the best or many (everybody?) – is actually the most difficult to solve.

5. Towards European research policy

Our main concern is how the candidate countries will be interwoven into the EU networks. Research has in fact always been international. The problem is mostly in tools and in national identities. In Section 3 it was shown that there is a remarkable scientific potential in small countries, which, especially in CEEC, is not properly mapped. The analysis of the European Commission concerning CEEC relies on data up to 1998 and much has changed within the last three years (Restructuring 1999). Nevertheless, together with the European Commission analysis of the S&T indicators (also up to 1998) in the member countries, the basis is fixed (Strategic 1998). Now the situation is changing fast with new EU initiatives and the question of national, regional, and European interests is more than ever a hot problem. In reality it means finding the strengths and concentrating upon them. This is an inevitable action also in smaller countries and the prerequisite for cooperation. Here is the main point for CEEC – if a country realises the importance of science and technology for creating the future welfare and formulates a clear and successive research strategy, then the situation can be changed fast. Certainly, in the candidate countries, the situation is diverse and the main indicator of R&D intensity (GERD/GDP) is much below the EU average (Towards 2000). As far as the GDP in candidate countries is also much less than the EU average, the situation is even worse than the RD intensity level shows. Although much talked about, not all the candidate countries have adopted national research strategies. The situation is characterised as "too many reforms and ambitions for too little money" (Knowledge-Based 2000).

What then should smaller candidate countries do? ALLEA WG has formulated some recommendations (European 2000):

- not only increasing the funding of R&D in general but channelling it to the most prospective areas;
- not only introducing incentives for encouraging innovation *per se*, but creating foresight programmes and formulating a National Development Plan;
- not only introducing incentives for stimulating young people in S&T but estimating the long-term needs of manpower in academia and society;
- not only stimulating peer-reviewed research but creating the centres of excellence in research and supporting the formation of such international clusters;
- not only improving research infrastructures, but combining them with education and innovation.

Is that enough? In our opinion, all starts from understanding. Politicians should understand the role of science and technology and the humanities for the future of their country, the scientific community should understand the social mission of science, the public should understand the importance of knowledge. This means that all actors have to agree both nationally and internationally. Only then could the ideas of the European Research Area be coherently realized together with national interests.

When writing these lines, the ideas of the 6th FP (2002–2006) are widely discussed. The influential international institutions like ESF, ALLEA together with national bodies like MPG and national research councils (or academies) have analysed the proposals. The idea of networking is supported even by the method used in preparing the ESF and ALLEA respective statements – these are based on opinions of member organisations. There are several points to be stressed in these statements. Concerning the role of smaller countries, the ESF says that "rigid application of the principle of large-scale funding may well have the effect of excluding smaller countries from effective full participation in the FP" (Europe's 2001). The ALLEA warns "against criteria and procedures unduly disadvantaging smaller groups" (Science 2001). Similar ideas are shared in the joint statement of the ESF, ALLEA and EUA (European University Association). This attitude demonstrates clearly that the scientific community accepts all the research groups on equal basis.

On the other hand, structuring and networking is stressed in all these statements. All agree that mobility should be a two-way road but in reality the lane leading to smaller countries is rather empty. There is a very simple explanation to that given by Ion Siotis at the recent conference in Brussels: mobility is the willingness to move to where the action is (Siotis 2001). That indicates to the small countries that the actions should be visible. Still, there is also another concern in accession countries: mobility is directed more at PhD and post-doc level. For those in mid-career and senior level there are less opportunities, but networking should be the main instrument. In this context, Vytautas Daujotis from Lithuania has proposed creating a European social insurance/security fund (2001).

The question of basic research is a big concern for the smaller countries. Given the funding constraints and existing infrastructure, the possibilities to carry on basic research are considerably more modest in these countries. Nevertheless, with a careful choice depending mostly on the existing potential, basic research is important to maintain the level and give education (cf. Section 4). One should also not forget the fact stressed by the European Physical Society (2000) – basic research and its results "can add to the confidence and pride of the nation's citizens". The World Bank (WB) stresses the importance of the knowledge economy in EU accession countries (Strategy 2001). WB proposes to undertake a knowledge forum with several EU accession countries where the main problem is the transfer of knowledge to economy.

Europe as a whole contains various nations, languages, cultures. It is said that diversity is one of the richnesses of Europe. Diversity in this sense is a jigsaw puzzle made of bigger and smaller parts. The quality, however, depends on how the whole works and how the parts are related to each other. Smaller parts are as important as bigger ones, without them the whole is full of holes. And what is actually small? Estonia is smaller than Finland, Finland is smaller than Poland, Poland smaller than Germany, Russia smaller than China – all is relative. In some sense the smaller parts pay higher price for being parts (i.e. countries) – more relative efforts and manpower are needed for official structures. Nevertheless, the small parts are the balance indicators in Europe, the diversity of identities gives strength and plays the role of a driving force. Says the former President of Estonia Lennart Meri: " If there would not have been small countries in Europe, these should be invented!" Research is one of the unifying cements in the knowledge-based Europe with many focal points, networks, traditions, and ideas.

What was described briefly above, is the scene of activities in formulating the science policy in Europe and finding the instruments to implement it. With so many actors, the coherence is always a question. Still, the wish vectors are coherently directed in the space, therefore the results should soon be visible.

6. Summary

By definition, research is an ever-changing activity. It means that science policy and scientific research is a changing environment. If a country accepts that like in Finland, then progress can be expected. Clearly the future depends on our grey cells that should be used in their maximal capacity to overcome the difficulties and differences. Scientific networking is a glue for the European Research Area. The mapping of research centres in EU accession countries (which are mostly small) and including them into the general network will enrich the European scientific community.

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