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Creation and transfer of knowledge – the critical need for closer ties between the academic world and the private sector*

Executive summary

A key issue in Europe's economical strategy to respond to global challenges is the "European Paradox". This refers to the fact that Europe excels in the generation of scientific knowledge but lacks the ability to transfer this knowledge into innovation and products. Despite considerable investments in science and research infrastructure, Europe lacks a viable strategy to overcome this paradox. In this report we analyze the problem in some detail and propose a resolution.

The core of the European Paradox lies in the weakness of the European research structure and coordination. Inventions are generally supposed to be performed in the Academic World and the following innovation process in the Private Sector. But the lack of an effective and constructive collaboration between the European Academic World and Private Sector impedes the required transfer of knowledge. This lack of collaboration is based, among other things, on the fact that the objectives and goals of the European Private Sector are completely different from those of the Academic World. Communication between the two is also often hampered by the increasing interdisciplinarity, which has become a dominant factor in many research areas.

The EU Commission has suggested establishing a "closer integration of the research phase with the demonstration phase" through enhanced prototyping and pre-industrial development in the Academic World. But this is not an optimal solution. In our experience, it would severely impede the high quality curiosity driven research performed at universities. This would undoubtedly also have a negative effect on the number of inventions and thus eventually on the process of innovation.

In order to resolve the European Paradox and to establish closer ties between the European Academic World and Private Sector, we propose that outstanding research institutes in Europe are given the possibility to be transferred into a new form of *European Research Institutes* (ERIs). These institutes should be partly financed on the European level, have freedom and political independence in governance, and should cover those areas that are of interest to European companies. To make the above-mentioned ERI model feasible it is necessary to rearrange quite a number of European concepts such as funding, governance, dynamics and *intellectual property* (IP) rights.

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1. Preface

It is generally agreed that Europe has been confronted with an unprecedented global economic decline, which is still dominating the political agendas. At the same time, Europe has to respond to global challenges in a wide range of areas.

The European Commission therefore established a second Expert Group (Ref. 1) to review and re-examine the role of *research infrastructures* (RIs) within the *European Research Area* (ERA), the creation of which was proposed by the European Commission in year 2000 (Ref. 2). There is a wide range of RIs across Europe. Some are listed within the roadmap of the *European Strategy Forum for Research Infrastructures* (ESFRI) (Ref. 1). Others, often identified in national roadmaps or recognized by national agencies, are also fundamental to the framework of the ERA. ESFRI, whose delegates are nominated by the Research Ministers of the Member and Associate Countries, has recently established a roadmap that identifies a total of 44 RI projects, which are considered as priorities for the European scientific community. The overall construction budget for these facilities is in excess of 20 billion €, and the operating costs will be around 2 billion € a year (Ref. 3). Out of these 44 projects, ten projects have effectively started, although much remains to be done to finalize all the details (Ref. 4). But the efficiency of the ERA concerning innovation is questioned, considering that only 15% of high tech products are coming from Europe.

In the proposal for the decision concerning the *7^{th} framework programme* (FP7), the Commission has pointed out that "it is paramount to overcome one of the key European weaknesses – the *European Paradox* – in generating splendid scientific knowledge and insufficient ability to convert this knowledge into innovation and commercial products".

Most of the proposed RIs comprise "large facilities" that support or host international research consortia in reaching their research goals. This will no doubt have an important and necessary impact on European research. But since the primary aim of the planned RIs is not to establish closer ties between the Academic World and the Private Sector, they will not solve the European Paradox.

Moreover, it is often emphasised that the importance of RIs is based on the impacts they have on research and innovation. According to a recent report of the above-mentioned Expert Group on RI (Ref. 1), "these (impacts) can be classified as direct scientific impacts, the new knowledge created and the theoretical advancement of science achieved via the research they facilitate, and indirect or technological impacts, the innovations in the production of goods and services that arise as spin-offs from the development of research infrastructures or the benefits accruing from the advances in scientific knowledge that stem from their operation." This means that innovations and, hence, the solution of the European Paradox, are considered as an indirect and not as a direct objective of RIs and are therefore not a primary goal of today's RIs.

In order to improve the European industry's competitiveness and to increase European productivity, it is therefore paramount to resolve the European Paradox. In this report we present a short analysis of the weaknesses of the European RIs and propose additions to the existing RIs. These additions offer closer ties between the Academic World and the Private Sector in Europe and hence will help to settle one of the most distressing European weaknesses.

2. The European Paradox

Concern about the lacking exploitation of scientific knowledge has also been expressed by the European Parliament, which several times emphasized that "all efforts must be undertaken to maximize outputs of the Framework Programme" and that "the participation of the business sector and the commercial exploitation of scientific knowledge and technical skills are important factors in ensuring that the Framework Programme can make a contribution towards the Lisbon agenda and the creation of growth and jobs". However, concrete measures how this should be done are still missing.

Commissioner Janez Potocnik therefore underlines in one of the papers from his Expert Group (Ref. 5): "in thinking about research and innovation, we must focus on the following areas and issues: Creating a single market for knowledge, allowing researchers, ideas and technologies to flow freely across Europe, which encourages better and stronger collaboration between industry and the academic world in an environment of 'open innovation'. We call this the Fifth Freedom and once fully established will create more competition and therefore support excellence in research - the basis for a competitive knowledge economy."

"Fifth Freedom" and excellence of research has often been brought up in public discussions. But these concepts have also repeatedly been criticised because there are different opinions about the procedures. The reality is that there are finite resources. It is naive to think that just calling for more money to be ploughed into science, without strong evidence for social benefit, will open any politician's purse strings. Research is to a large extent paid with tax money and, hence, "citizens have an increasing stake in the European Research Area and in science in Europe in general. There is a Europe-wide agreement about the value of science for the benefit of society and for the development of the economy" (Ref. 6). Or in other words: Science is indebted to the taxpayers and should reimburse them by transferring knowledge into new products that would be of benefit to society.

To develop the economy an environment of "Open Innovation" is needed. Innovation is based on new insights or scientific results, which in turn are often obtained by basic curiosity driven research at the highest level. In European countries not having research facilities such as *Max Planck institutes* (MPIs) or French *National Centres for Scientific Research* (CNRSs), basic research is only performed at universities. This implies that in most European countries the Academic World is the foundation for the creation of knowledge. Hence, in order to transfer this knowledge into new products and services an efficient collaboration between the Academic World and the Private Sector is needed.

In one of the European Commission's communications (2004-353) (Ref. 7), the Commission worries about the fact that "Europe lacks sufficient capacity to transform knowledge into products and services". As one of the reasons for these shortages the Commission points out that "today's infrastructure in Europe does not always meet the requirements of industry".

Excellence of research, research infrastructures, and mobility, are only a few examples, which have generated concern about the "European Paradox", not only within politics and science but also within society. Former Vice-Commissioner Gunter Verheugen, for example, emphasizes: "As a matter of principle, innovation is the cornerstone of the European economic strategy. The whole strategy is based on the idea that we have to compete in the globalised economy". And he adds: "In my view, in the future, we need to coordinate better. We need to pool better the existing resources at EU level and Member State level. And there is one problem, and I'm not proud that I

have to mention it. We still have not solved the intellectual property rights question, which is absolutely crucial for successful innovation policy. The Community patent is indispensable" (Ref. 8).

Though many more statements of this kind could be quoted, these few should be enough to alert us Europeans that there are reasons for the lack of sufficient capacity to transfer knowledge into products and services and why today's infrastructure in Europe does not always meet the requirements of industry. However, there is an emerging consensus among the scientific community in Europe that the European Paradox is not the result of insufficient creativity, intelligence or money but may primarily derive from weaknesses in the research structure and coordination.

3. Invention, the basis of innovation

An innovation is most often based on an invention, the creation of a new idea. The invention needs only be a theoretical thought and may not always result in a product. To invent is a highly creative process. An open and curious mind enables one to see beyond what is known. Inventors "think outside of the box". Business people sometimes say: Invention is the conversion of cash into ideas. Innovation is the conversion of ideas into cash.

New ideas are often created by research and are more easily generated through front line research than through improvements of existing ideas. Basic research and in particular curiosity driven research are therefore important prerequisites for generating new ideas and "seeing beyond what is known". Scientific institutions such as universities are supposed to perform curiosity driven research without the pressure of converting ideas into cash. Since innovation is based on new ideas beyond what is known, the process of innovation depends on the uniqueness of new inventions. These depend on the research strength and excellence of scientific institutions such as universities. In promoting innovation, all efforts are therefore needed to insure that scientific institutions are able to perform basic and curiosity driven research at the highest level.

The EU Commission has several times pointed out that "there is a limited margin of manoeuvre for increasing public funding in the future". It has therefore suggested that European universities raise more money for research from private sources. It has also urged them to intensify their interaction with industry by selling services and prototypes. This is often requested and needed when cooperating with companies and in particular with small and medium sized enterprises (SMEs). In many European member states, universities have thus been alerted for actual technological needs within certain fields. Universities have also been requested to stimulate researchers more directly to participate in the development of new production concepts, materials and processes.

It is generally agreed that the difficulty of transforming new ideas to industry is one of the major reasons for the lack of innovation in Europe. The EU Commission has therefore emphasized the need for a "closer integration of the research phase with the demonstration phase" through prototyping and pre-industrial development already at universities. We do not believe that this is a reasonable procedure for all university researchers. The freedom of universities allows researchers to make their own choices, whether they want to perform basic or applied research. However, establishing a "closer integration of the research phase with the demonstration phase" for all university researchers would prevent European universities to think outside the box and to see beyond what is known. Such an arrangement would undoubtedly have a very negative effect on inventions and thus on the process of innovation.

4. Innovation, the major driver of the European economy

To increase productivity one needs innovation. Unlike invention, innovation is a new way of doing something or "new stuff that is made useful". It is the result (product) of an innovation process. The Private Sector tends to focus on the process itself, from the origination of an idea to its transformation into something useful, to its implementation, and on the system within which the process of innovation unfolds. Since innovation is considered a major driver of the economy, especially when it leads to increasing productivity, the factors that lead to innovation are therefore considered to be critical to policy makers. It is especially the followers of innovation economics who believe it is important to use public policy in order to spur innovation and growth.

50 years ago, leading companies such as RCA, IBM, Philips, Siemens or General Electric, to name a few, were not only foremost production facilities but also performed high quality research. At the Philips Research Laboratory in Eindhoven, for example, several thousand of leading scientists performed not only applied research but also to a large extent basic research. It was therefore no surprise that the transistor and many other inventions were made at companies like Bell Labs. Research performed at these companies was often of much higher quality than that at most universities.

During the last decades, the situation has changed considerably. Most companies do not perform research anymore, but only development. Most of the companies that are still in the research business are not performing long-term research to any large extent. With a few exceptions (such as the pharmaceutical industry), this is especially true for European companies. As phrased by Commissioner Janez Potocnik, "the main reasons for the decline in EU-27 R&D intensity are an insufficient growth in business R&D expenditure and the fact that EU companies have invested more outside of Europe, in particular in emerging research-intensive countries, than non-European companies have invested in Europe" (Ref.9). Short term thinking of the European industry combined with the resistance to take risks has made it difficult for university researchers to cooperate with the private sector. This is one of the reasons why certain research institutions such as the CNRS or MPI are more focused on cooperation with the Academic World than with the Private Sector.

Hence, in Europe, inventions are supposed to be performed in the Academic World and the result (product) of the innovation process is taken care of by the Private Sector. In order to make such an innovation process efficient and successful, it is thus extremely important to foster a constructive collaboration between the Academic World and the Private Sector.

5. Why have Europe difficulties in the transfer of knowledge?

According to the EU Commission, the main objective of FP7 is for Europe "to become the 'most dynamic competitive knowledge-based economy in the world'. The 'knowledge triangle' – research, education and innovation – is a core factor in European efforts to meet the ambitious Lisbon goals". However, very few leading scientists in Europe are really satisfied with the recent evolution of the framework programmes. Networks inside Europe created with EU support, such as Integrated Projects (Ref. 10), have in many cases no well defined objectives or roadmaps but only rather loose structures. The creation of large consortia has revealed major difficulties in management and governance, low flexibility and little or no reduction of administration and bureaucracy.

In many European member states, the number of university professors with a background from the Private Sector is very limited. Most companies are not always aware of the latest research development, so it is not surprising that transfer of knowledge from the Academic World to the Private Sector is too often hampered by difficulties in communication. These difficulties are based on the fact that the objectives and goals of the Private Sector are completely different from those of the Academic World. Due to the different backgrounds, neither university researchers nor companies are always aware of the practical aspects of new ideas or research results.

Researchers at leading research institutions, such as the CNRS, are first and foremost focused on long-term and innovative research. It is therefore not surprising that they are reluctant in spending much time on collaborative projects with the Private Sector, as requested by the governance. On the other hand, outstanding research institutes, such as the *Electronics and Information Technology Laboratory* of the French Atomic Energy Commission in Grenoble (LETI) or institutes of the Fraunhofer Gesellschaft, which traditionally are most successfully cooperating with industry, are more and more realizing that interaction with the Academic World should and could be improved.

Difficulties in communication and, hence, in transferring knowledge from the academic world to the private sector are often also generated by the increasing interdisciplinarity in science which has become a dominant factor in many research areas. Materials science, for example, is no longer defined by a single sector but is now covering several classical areas such as physics, biology, chemistry, mathematics, medicine and mechanics. This complexity has caused considerable disturbances and worries within materials science, both with regard to research and education as well as relating to university structures. The different areas within materials science do not perform primarily basic research but also engineering science and are therefore closely connected with technology. Many companies, in particular small and medium sized enterprises, have problems with the complexity and interdisciplinarity of such disciplines. This often causes frustration and unwillingness among university researchers when communicating with the industry. However, since most professors at European universities are on a tenure track, they see no direct need to endure the troubles of cooperation between the Academic World and the Private Sector.

Obstacles in the cooperation between the Academic World and the Private Sector are also caused by the fragmentation of research in Europe. Another factor is the existing differences in European standards and regulations such as the already mentioned intellectual property rights. In all 27 European Member States, research is performed more or less on similar subjects. However, the funding levels are very varying as are also other resources, both in terms of infrastructure and manpower. Similar variations are observed within the potency and competence of the Private Sector. Research institutes in Europe are in general financed on a private or regional and/or national level. The primary obligation of public research institutes is therefore to foster regional or national economic strategies. This implies that the concepts of most of these institutes are supposed to be part of the national and/or regional research structure. This means that they are forced to cooperate with companies, which are not always interested in their new research results. Conversely, national companies are not always getting the desired and needed support from national universities. More intensive cooperation beyond national borders would no doubt solve many of these problems. However, regarding innovation, neither academia nor industry is utilizing the strengths of Europe as a whole.

Hence, one of the most urgent issues for an Innovative Europe is: Can the European Paradox be resolved by improving the transfer of knowledge from the Academic World to the Private Sector without jeopardizing curiosity-driven research and, hence, the research quality of European universities?

6. Resolving the European Paradox: New European Research Institutes (ERIs)

Since neither the Academic World nor the Private Sector have been able to resolve the difficulties with the European Paradox, additional efforts are needed for bridging the gap between the European universities and the private industry.

In Europe, research is performed at three levels, the regional, national and European ones. Because of the different cultures in European countries, it is reasonable that the national research councils oversee the regional and national levels, whereas European agencies should focus on the European level. Within investigator driven frontier research, the *European Research Council* (ERC) is one of these agencies. Its main aim is to stimulate scientific excellence. It supports the very best and truly creative scientists, scholars and engineers and encourages them to be adventurous and take risks in their research. The sole criterion for selection of grants is "scientific excellence". This, however, is not different from the criteria of national funding agencies. The ERC expects that its grants will help to bring about new and unpredictable scientific and technological discoveries. No doubt, this will inspire the innovation process, but it is not offering closer ties between the Academic World and the Private Sector. To "bring research results closer to the market" additional steps are needed. The most important one, we believe, is what we propose below as an add-on to the existing research infrastructure in Europe: The *European Research Institutes* (ERIs).

Already early in 2005, the need to bring the Academic World closer to the market was recognized by the President of the European Commission, Jose Manuel Barosso. That is the reason why he launched the proposal to establish a *European Institute of Technology* (EIT) in order to enhance innovation in Europe through the "knowledge triangle" of industry, education and research. This new concept generated considerable interest, but also concerns, in the European scientific community. As a result, the concept has undergone drastic modifications over the last few years.

During the summer of 2007, the EU Commission launched a call inviting proposals for the identification of the best practices of multifaceted and multilevel governance models to be implemented in the EIT concept. They should be based on the *Knowledge and Innovation Communities* (KICs) model. KICs are supposed to be innovative "webs of excellence": highly integrated partnerships that bring together education, technology, research, business and entrepreneurship (Ref.11). Right now the KICs model is in the process of implementation, but unfortunately the present concepts are far from the original objectives. The governance of KICs and their own legal status and independence from national regulations are not in agreement with the original intentions. One of the weaknesses is the fact that the chair of a KIC has less power than a CEO in industry.

The Private Sector was not willing to support the KICs model moneywise and hence it is the EU Commission that finances the first three KICs. This is also the reason why cities and regional authorities have been asked to participate in the KICs model and to take initiatives. The KICs model is therefore strongly focused on short-term projects, chiefly of regional importance, and involves participants with very different research cultures and objectives. Due to the limited flexibility of the KICs model, university researchers are therefore not convinced that this model will solve the European Paradox.

On the other hand there are already quite a number of outstanding research institutes in Europe that are trying to bridge the gap between the Academic World and the Private Sector. Some of these institutes are world-leading facilities. But they do not always foster constructive collaboration with European companies, because the private industry in Europe is often not interested in their products. In order to cover their expenses, these institutes are forced to sell their ideas and

prototypes to companies in Asia, which means that European research is stimulating the productivity in these countries instead.

Furthermore, research organisations such as CERN, the Max-Planck Gesellschaft or the Leibniz Society are for the most part focused on enduring and innovative research. They are therefore not primarily interested in collaborative projects with companies in developing new industrial products on traditional markets. Organizations such as the Helmholtz Society are mainly dealing with big science and seldom involved in developing new products. Other corporations like the Fraunhofer-Gesellschaft and the French Atomic Energy and Alternative Energies Commission (CEA) undertake applied research of direct utility to private and public enterprise. Considering the structure and objectives of these organizations, one may wonder why they have not resolved the European Paradox a long time ago. As one of the obstacles, the institutions point out that it is their financing system that often causes difficulties. It makes it difficult for them to interact with the Academic World and to deal with long-term projects. Furthermore, organizations like the Fraunhofer-Gesellschaft and CNRS are national institutions that do not cover all Europe.

In order to allow research results and new ideas to flow more freely across Europe and to increase European productivity through stronger collaboration between the Private Sector and the Academic World, we propose a modified model. The idea is to change the status of several of these outstanding public or private research institutes that already exist in Europe. They should be transformed into a new kind of public European Research Institutes (ERIs) and, hence, contribute significantly in resolving the “European Paradox”. In principle, such a transformation does not require additional funding but only a redistribution of existing budgets. This is in sharp contrast to the recently established roadmaps of RI projects.

7. The concept of European Research Institutes (ERIs)

ERIs are supposed to cover primarily those areas that are of interest for European companies. Taking into account all Member States, most of these areas are probably already covered, although the national distribution may be very unequal. Within certain industrial areas, one may have to decide whether or not it is necessary to establish new research institutes either from scratch or by using resources from the Academic World. Such decisions, and/or the selection of suitable research institutes for ERIs, should first of all be performed by scientific experts of the Private Sector. This should be done in an objective and impartial manner, based on the scientific and innovative excellence of the institute. Because of the shortage of expertise within the political institutions, specialized companies often prepare EU proposals. Such a procedure is not always fair, bearing in mind that, for example, in the FP 7 one single company participates as a partner of 64 projects! It is therefore paramount that organizations behind the selected research institutes are not participating in the selection process.

Research in Europe is foremost financed on national levels. It is therefore not surprising that German decision makers recently raised the question: Why should Max-Planck Institutes be involved in a KIC for cooperating with a Polish company? To make the above-mentioned ERI model feasible, it is thus obvious that a number of concepts have to be rearranged. Bearing in mind the above mentioned difficulties of certain European research institutions, this implies first of all that the financing of the research institutes must be part of the ERI program. Hence, national or regional financing of research institutes involved in the ERI program has to a certain extent to be replaced by European funding. This will enable the promotion of European cooperation between the Aca-

demic World and the Private Sector, even on long-term projects, not only on a national level but also between all 27 European Member States. This would open new cooperation possibilities for selected national research institutes.

Partial European financing may allow political institutions to follow up and control the efficiency and outcome of ERIs, but should definitely not allow them to influence decisions about the goals and objectives of the ERIs. The freedom and political independence of the ERI governance must be guaranteed and any increase of bureaucracy has to be avoided. This means that the CEO of one of the European Research Institute should be a scientist, not an administrator. The CEO should have the possibility and responsibility to decide about the research program and the use of the funding, independent of the political institutions providing the funding. Similar rules should be valid for selecting employees and setting salaries. We are well aware that national regulations in several Member States do not allow such freedom and we are therefore of the opinion that a better overall European coordination is needed. The freedom of research and/or technological development performed at leading European institutes is one of the main reasons for their success. ERIs are not a replacement, for example, for Integrated Projects or Networks of Excellence, but independent institutions working together on a voluntary basis governed by efficiency and mutual support.

Likewise, if not even more important, is the dynamics of these research institutes. Experience from several European countries shows that research institutes outside universities often tend to lose their self-motivation and performance capacity in course of time. One of the reasons for such a development is again based on national regulations, which require that essentially all employees must have permanent positions. The dynamics of the institutes is in these cases very limited, because they have no possibility to hire new employees even if additional expertise is needed for covering new objectives. In contrast, institutions like the Max-Planck institutes have only 40 - 50% of their employees on a tenure track. All other employees are on a time-limited contract, foremost as visiting scientists but also as group leaders. ERIs must have similar arrangements. This is of paramount importance for keeping the flexibility on the highest level and enabling research institutions to focus on new ideas and research results as quickly as possible. Overall European regulations are, also in this case, urgently needed. The same goes for rules, which allow the reorganization or exclusion of an ERI as soon as the institute in question has lost its self-motivation or performance capacity. A control board for the ERI program, which is appointed or nominated by the funding authorities, could achieve this.

Other important aspects are the intellectual property (IP) rights and benefits. Collaboration between academia and industry on a European level is complicated by the fact that intellectual properties are presently not treated equally in the 27 Member States of the European Union. Europe needs to improve coordination and in this context the Community patent is indispensible for a successful knowledge transfer and innovation policy. Provided this can be achieved, there are still different rules at European universities regarding the ownership of IP rights. In countries like Sweden, it is the inventor who owns the IP rights whereas in other Member States they are owned by the university or shared between the inventor and university. In order to facilitate the cooperation between universities and ERIs, the owner shares of IP rights should be negotiated by the partners involved in the innovation process (i.e. the researcher(s) at the university and the ERI(s)) and not be regulated by intricate national or regional regulations.

8. Advantages of the proposed model

European Research Institutes (ERIs), as proposed by us, are facilities with high dynamics. In contrast to research centres at universities they are not restricted by traditional structures and regulations. Their budget is independent of national university regulations implying, e.g., that all incomes from research funding or the Private Sector are used without overheads. Furthermore, they are allowed to hire a larger part of their employees, including group leaders, on time-limited contracts.

Unlike a majority of European universities, ERIs will have access to the most advanced technologies and are equipped with the most modern tools for providing proper prototypes and products as requested by companies. In several research areas, such equipment is generally very expensive and can therefore in most cases not be afforded by universities. Furthermore, to operate such equipment properly and effectively, the user needs high-level experience, which is only achieved over a longer time period. In certain areas, like for example in electronics, the lifetime of equipment is relatively short. This implies that it has to be exchanged quite often, which increases the maintenance cost quite considerably. Most universities have difficulties in coping with such expenses.

A further distinction between ERIs and universities is given by the different goals and objectives. Universities perform basic research and, in particular, curiosity driven research. They are usually unable to achieve their results based on a rigid timetable, because this would seriously hamper their freedom of research and their "thinking outside the box". On the other hand, strict deadlines are more easily kept by efficient research institutes. This is due to their high flexibility in combination with well-defined short term objectives and well co-ordinated programmes. Keeping deadlines is paramount for an effective and rewarding cooperation with the Private Sector, which has to deliver products to the customer in agreement with settled deadlines.

Within the proposed model, researchers from the Academic World can return to their research programmes without bothering about prototyping or commercial agreements with the Private Sector as soon as they have transferred their new ideas and inventions to one of the ERIs and agreed on the IP rights. ERIs are designed to have knowledge from both the Academic World and the Private Sector. They are therefore familiar with the different cultures and needs of both sides when evaluating new inventions or negotiating about commercial agreements. This insight is one of the most important prerequisites for an efficient transfer of knowledge from the academic world to the private sector.

To further strengthen the cooperation with the Academic World, it is paramount that members of ERIs act as supervisors for PhD students and take part in the educational programmes of universities they are cooperating with. Furthermore, experience shows that joint (or common) laboratories at universities, driven jointly by the university and a research institution, are promoting the transfer of knowledge extremely effectively. Joint labs differ from standard university laboratories or research groups only by the fact that they include one or a few members of the collaborating research institute. These members are helpful in judging new research results for their use as new industrial products. They also get acquainted with new research insights, which are not covered by the research institute itself.

In reaching their research goals, ERIs are supposed to cooperate with international research consortia comprising "large facilities". It is therefore important that they have free access to RI projects offered, for example, by ESFRI.

An additional facet, which is of interest in this context, is the issue of interdisciplinarity. ERIs are supposed to focus on well-defined aims, which are driven with high flexibility. But for obvious reasons this can only be done within a limited number of research areas. Yet cooperation with universities allows them – based on the support of the university researchers – to broaden their views and to get a better understanding of new ideas and their possible applications. Experience shows that research institutes develop such insights quicker and easier than the Private Sector, in particular small and medium sized enterprises.

Mobility of scientists and engineers between the Academic World and the Private Sector is, for several reasons, extremely limited in Europe. One reason is the different promotion systems at European universities. Though we are dealing with the European Union, university regulations and configurations, both with regard to education and research, are still rather different in the 27 Member States. These regulations complicate the possibilities for universities to hire people from outside the academic world. Like in the USA, which in comparison has a much higher mobility, European universities should be more open for applicants from industry and judge their experience and knowledge in a similar way as for applicants from the Academic World. When filling university positions, right now the number and citations of published scientific papers are often more important than experience or patents. Furthermore, the interest of companies no longer performing research, in people with merely experience in basic research, has decreased considerably.

Thus, recruiting people from ERIs would make it much easier for both sides to improve the mobility between the Academic World and Private Sector, with a long-term gain and strong impact on Europe as a whole as well as on each single European country. However, to achieve such an improvement for Europe as a whole, we strongly suggest that the administrative “red tape” in connection with the exchange of scientists in Europe is abolished. All efforts should be taken to make it easier for researchers, in particular for the young ones, to move from one laboratory to another. They should not be hampered by differences in taxes, pensions, social coverage and time-consuming applications.

ERIs will only be a success if European industry is willing to cooperate. Surprisingly enough, most of the European companies are showing an insufficient willingness to perform joint research with universities in a constructive manner. It is therefore even more surprising that high-technology companies often ask for research funding (both on the EU, national and regional levels) as subsidy for their entrepreneurial objectives. Many examples can be given showing that new ideas generated in Europe have been conveyed to other countries like the USA or Japan. There they are transferred into industrial products instead of being used for new goods and services in Europe. All this shows that a change in attitude is needed, which cannot be stimulated by EU funding alone.

9. Conclusion

Science can, and should, deliver new knowledge leading to increased economic strength and benefits for society. Unfortunately, in the past, these two aspects have too often been separated and the interconnection between them has frequently been overlooked. Economic benefits cannot be realized without first generating knowledge and new ideas. Ignoring or underfunding fundamental or curiosity driven “blue-skies” research on the basis that it does not provide immediately tangible benefit must be strongly challenged.

We do not believe that establishing a "closer integration of the research phase with the demonstration phase" through prototyping and pre-industrial development is a reasonable procedure for all university researchers because it would prevent them from performing long-term research and seeing beyond what is currently known.

In order to stimulate the transfer of knowledge of university researchers into new products and applications and to resolve the "European Paradox", without jeopardizing curiosity driven basic research at European universities, it is suggested that:

- Outstanding research institutes in Europe are given the possibility to be transferred into a new form of European Research Institutes (ERIs), with the dedicated aim to bridging the gap between the Academic World and the Private Sector.
- These ERIs, with European status, should take over the liability for prototyping and the development of products based on new ideas and insights produced by university researchers.
- ERIs primarily cover those areas, which are of interest for European companies and that the selection of these institutes are performed by scientific experts of the Private Sector and not by organizations behind the selected research institutes.
- ERIs are not a replacement for programs such as Integrated Projects or Networks of Excellence, but are politically independent institutions working together on a voluntary basis governed by efficiency and mutual support. They can be reorganized or excluded from the ERI program if they have lost their self-motivation or performance capacity.
- ERIs are partly financed on a European level in order to enable the promotion of Euro pean cooperation between the Academic World and the Private Sector, not only on a national level but also between all 27 European Member States.
- The CEO of a European Research Institute has the autonomy to decide about the research program and the use of the funding, independent of the political institutions providing the funding, as well as to select employees and set their salaries.
- New overall European regulations are provided regarding intellectual property (IP) rights, time-limited employments of researchers, autonomy of ERI CEOs and the abolishing of red tapes in connection with the exchange of scientists in Europe.

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Anmerkungen zum vorliegenden Rapport von Hermann Grimmeiss

Der vorliegende Rapport wurde vom Forschungsstrukturkommittee der Klasse Physik der Königlich Schwedischen Akademie der Wissenschaften mit dem Anliegen erstellt, einen Beitrag zur Lösung des Europäischen Paradoxons zu liefern – der Tatsache nämlich, dass Europa zwar Spitzenleistungen in der Forschung erzielt, aber Schwierigkeiten hat, die Ergebnisse in innovative Produkte zu überführen.

Die Einführung industrieller Innovationen erfolgt durch einen Innovations*prozess*, der von einer neuen Idee initiiert wird, die häufig durch Erkenntnisse aus der Grundlagenforschung generiert wird. Dies allein ist jedoch für einen Innovationsprozess nicht hinreichend, sofern nicht zugleich adäquate strukturelle und finanzielle Voraussetzungen existieren bzw. geschaffen werden, die eine wirtschaftliche Verwertung jener Idee ermöglichen.

Obgleich diese Problematik seit geraumer Zeit vielfach diskutiert und analysiert wird, fehlen noch immer überzeugende Lösungen. Der Rapport beschränkt sich daher nicht auf eine Analyse der Situation, sondern bietet Lösungen an, die verhältnismäßig rasch und ohne erhebliche Fördermittel realisiert werden könnten.

Im Fokus der Betrachtungen steht die Brückenbildung zwischen der europäischen Wissenschafts- und Wirtschaftlandschaft. Das Forschungsstrukturkommittee ist der Meinung, dass eine solche Kooperationsform notwendig und möglich ist, aber nicht auf Kosten der Grundlagenforschung – und damit der Wissenschaft im allgemeinen – gegründet sein darf, weil dies eine negative Auswirkung auf die Generierung neuer Ideen und somit auf den Innovationsprozess an sich hätte. Mithin ist im Rahmen solcher Kooperationsformen die Freiheit der Grundlagenforschung zu bewahren und nicht – beispielsweise durch Knebelverträge seitens der Wirtschaft – einzuschränken.

Interdisziplinäre und fachübergreifende Dialoge sind daher nicht nur innerhalb der Wissenschaft, sondern auch zwischen Wissenschaft, Wirtschaft und Politik zur Lösung dieser Problematik von außerordentlichem Belang.

Mit Blick auf die zunehmende Komplexität gegenwärtiger und zukünftiger Problemstellungen in der Zusammenarbeit von Wissenschaft und Wirtschaft und die dabei zu überwindenden Sprach- und Verständnisbarrieren kommt einer Einrichtung wie dem *Leibniz-Institut für interdisziplinäre Studien* (LIFIS) eine besondere Bedeutung zu. In den nahezu 10 Jahren seiner Existenz wurde in den *Leibniz Conferences of Advanced Science*, nicht zuletzt in der seit dem Jahr 2007 edierten Internetzeitschrift *LIFIS ONLINE* der interdisziplinäre und fachübergreifende Dialog innerhalb der Wissenschaft sowie zwischen dieser und der Wirtschaft beispielhaft gefördert. Das LIFIS erscheint uns daher als eine der wichtigen zukunftsfähigen Strukturkomponenten im Sinne des Rapports.

[15.03.12]