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# *Science for the future*[*]

**Abstract**

We are living in a changing world where science is also changing in harmony with needs of economical development. New methods and priorities come into play and the role of talents is also increasing. The role in this process of 3 emerging technologies, namely information-, bio- and nanotechnology are important as fields of new revolutions. Nanotechnology is discussed in more detail.

The European approach to the solution of the existing problems is also discussed briefly.

The world around us is changing at breakneck speed. We experience rapid technological, political, social and cultural changes and, in their wake, financial, economic, political, social and cultural crises. Old industries together with their value systems are declining and new ones are born. In industrial products as well as in services the proportion of knowledge added value is increasing. Therefore there is an increasing demand for human capacities, first of all for creative labor forces.

Global competition is of an overarching significance while it proves to be combined with decreasing social safeguarding. The increased mobility of people and geographically unbalanced wealth levels have resulted in an increased heterogeneity of national populations, and this process is accelerating. And while the significance of knowledge is evident for everybody, due to several reasons the productivity of national education systems is decreasing.

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In our knowledge-centered world knowledge-based societies are formed, societies that are innovation-oriented and their main economic resource is knowledge much of which is scientific knowledge. Science and technology are central in all the main facets of modern societies. This means that for people to prosper, they need a fundamental understanding and comfort with science and technology. For nations to prosper, they need the appropriate scientific capacity and national policies that reflect the best of science. For science to prosper, it needs to have the support of society and therefore the science–society relationship must be good.

Science is also changing. The complexity of scientific knowledge is increasing and the knowledge of the individual gets narrower and deeper. Interdisciplinary research expands. The problems scientific research is facing are increasingly complex. The costs of research, first of all those of infrastructure, are skyrocketing which is why a strong government involvement is needed. The critical size in research (both financially and in human capital) increases which can be realized e. g. by the networking of different research groups from professionally and/or geographically different regions or fields. One-on-one collaborations, large international projects (like the human genome project or the intergovernmental panel on climate change) or large shareable resources and infrastructure (like most telescopes or telescope arrays, the Large Hadron Collider or ITER) are typical examples of this tendency. In this spirit, new ways of doing science are becoming everyday practice. Knowledge is created in cyber place through the interaction of dislocated scientists and infrastructure. This way, science has become fully international and could be one of the first successful examples of globalization.

Since the number of solvable problems is higher than the available research capacity, we need to make priorities. A logical consequence is the new emphasis on frontier research. In this spirit even the traditional terminology to separate basic and applied research, or science and technology, is no longer appropriate. Research at the frontiers is characterized by the absence of disciplinary boundaries and new discoveries are often triggered by real world problems (or vice versa). Furthermore, progress in understanding phenomena and techniques for investigation go hand in hand. Therefore industry is (or should be) increasingly interested in research as it is done in the academic world.

This research develops through relying upon the following basic resources:

– global competition which results in higher quality;

– cooperation and networking aiming at a critical mass needed to solve a given problem efficiently, and dispensing with unnecessary duplication and fragmentation;
– the preferential support of excellence, a procedure working for all even for the potential loser; and finally
– a proper research infrastructure.

To be competitive in R and D the research potential has to be increased by:

– improving the human capital;
– developing the research infrastructure;
– strengthening the („basic") research basis;
– increasing the spending for research;
– creating an appropriate institutional system;
– improving academic-industry relations as well as
– international cooperation.

To support excellence is to find and finance talents, individuals who are able to solve complex problems or invent new solutions. Talents have become the world's most sought-after commodities, shifting the balance of power from the institutional side to that of the individual. And education has a large word to say in increasing the pool of talents. As the Chinese philosopher Chuang Tzu said in the third century B. C.:

If you plan for a year, sow a seed;
If you plan for a decade, plant a tree, and
If you plan for a century, educate the people.

There are, paradoxical issues, however, breaking the much-needed development of R and D. Let me list five of them:

1. The significance of science increases while the interest of the young generation decreases (the knowledge paradox);
2. The time needed to acquire knowledge increases while its obsolescence time decreases (the time paradox);
3. Good research in Europe is losing much of its competitiveness (the innovation paradox);
4. The role of R and D in competitiveness increases but decision makers are often tempted to forget about it (the competitiveness paradox);

5. The share of governments in financing R and D activities is decreasing, while the role of non-governmental contribution is increasing (the governance paradox).

To overcome these and some other problems, the European commission has launched its European Research Area vision. The idea is that **it should be an area where:**

– scientific capacities and material resources can be optimized in synergy,
– where national and European policies can be implemented more coherently, and
– where people and knowledge can circulate freely.

**It should be**

– attractive both to European researchers and the best researchers (talents) from outside the EU, and
– be based on common social and ethical values rooted in European traditions.

The main instruments in the realization of these goals are the R and D Framework Programmes. In FP 7 a new idea has been implemented, i. e. the Ideas Specific Programme. It focuses on frontier research and supports outstanding individuals (talents) applying for sizable grants to realize groundbreaking ideas. The programme is run by an Executive Agency (ERCEA) under the strategic leadership of a 22-member-strong Scientific Council.

Here are the **principles of the work of the European Research Council**:

To support frontier research based solely on excellence shown by both researcher and proposal; an open competition of outstanding individuals (talents) of all nationalities and ages; a willingness to move, stay and do research in Europe and stay at least 50% of the time in Europe, another 30% of the time on project (Europe = 39 countries of European Research Area), with generous funding for ambitious projects (up to €2 mil/€3,5 mil) and no quotas per country/region, gender, etc; all fields (domains from the humanities to engineering) must be supported.

Grants are awarded in a process of pan-European competition to advance excellent ideas, to free excellent researchers from their other duties in order for

them to be able to push the frontiers of science competing at regular intervals; collaborations are held fruitful as long as they arise naturally but no formal requirements to have them are issued; collaboration is not the only means by which European Added Value (EAV) can be produced.

During its short time of existence the ERC has proved itself to be a useful and efficient instrument to strengthen the European research base, a base that is hopefully to develop even further for the benefit of all Europe.