Frontier research in Europe - a Polish perspective

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A broader context: why is frontier science important?

Abundance of challenging, often dramatic, global and local problems in the world today:

- Securing sustainability of energy supplies
- Combating climate change
- Bridging social gaps
- Facing consequences of population aging
- Eradicating extreme poverty
- Preserving biodiversity in ecosystems
- Living in multicultural and multiracial societies
- Overcoming crisis of financial institutions
- Dealing with ethical issues in biomedicine
- …

Problems do not appear easily solvable!
In the years to come there will be more problems, not less!

Problems potentially affect everyone => true face of globalization

Today, it is not that we only want to collaborate (and compete) globally – we simply have to!

Science is at the forefront of globalization – it is considered natural that research develops through global networks.

Can science contribute in a significant way to solving challenges humankind faces today? Many question this!

But we have to fight for our view to be accepted: the nature of problems to be addressed is such that we have every right to ask:

If not us then who?

We have to make every effort to convince everyone in doubts: science underpins almost everything in our life – its many aspects, crucial to our well-being (from switching the light to using a mobile phone and to undergoing a surgery) which we tend to take for granted, would be unthinkable if not for fascinating human scientific discoveries and theories.

Science is not only deeply rooted in our everyday lives – its progress is also a condition for us to prosper in the future – and, in fact, to survive as the human race.

Why frontier research?

‘Frontier’ used to avoid outmoded distinctions between:

- ‘basic’ and ‘applied’ research
  ‘science’ and ‘technology’

  which have lost its relevance at a time when many research areas (biotechnology, information technology, nanotechnology etc.) often embrace elements of both

- ‘traditional’ disciplines

  because we often have to pursue questions irrespective of established disciplinary boundaries, engaging researchers from different backgrounds, with different theoretical and conceptual approaches, techniques, methodologies and instrumentation, perhaps even different goals and motivations.

Frontier research is what the best researchers with the most exciting ideas do!

- autonomy – a crucial factor
- need to handle the intrinsic risk involved

Broadly understood frontier research is:

- a necessary ingredient of the fundamental historical paradigm of the Western culture, and
- a ‘must’ if only we are to continue addressing a natural human desire to better know and understand the world surrounding us.
- The pursuit and diffusion of knowledge enjoy a place of distinction in the European tradition, and the public expects to reap considerable benefit from creative contributions of researchers.
- It is still generally accepted that supporting different forms of research is a crucial element in advancing public good.

Unless Europe together makes a commitment to frontier research of the highest-quality standards, it risks:

- losing part of its heritage and identity
- becoming a continent of imitators rather than innovators
- losing out economically, as well as politically, in a globalizing world
- giving up aspiration of developing its own vision of a desirable future for humanity and maintaining the capacity to shape it.

Contrary to the view of some, frontier research is also very ‘pragmatic’:

- it increases the stock of (sometimes immediately) useful knowledge, both codified (publications) and tacit (skill, know-how, experience)
- it trains creative and skilled graduates who are indispensable for truly innovative Europe
- it develops new scientific instrumentation and methodologies which often turn out to be useful also in the context beyond which they have been developed
- it helps to form communication networks and stimulates social interactions

- it offers researchers to be part of the ‘invisible college’ of peers which provides platforms beneficial to others – innovative companies in particular
- it increases intellectual capacity to solve complex and novel problems – which is sometimes directly useful in addressing technological problems
- it generates spin-off firms which are well-positioned to exploit the latest basic research results
- it provides social knowledge which may be instrumental for public policies or ‘creative industries’ advancements.

In other words:

Industrial research and technological development
as well as public policy making greatly benefit from proximity
and interaction with frontier research – and vice-versa.

Many proofs of this statement exist, for instance:

- relocation of much of the in-house research of the European pharmaceutical companies to the life science frontier research centres in the USA, as a rule adjacent to leading American universities and research centres

- numerous ‘think tanks’ located close to political power centres

How to do better than so far?

Diagnosis: Europe's share of global knowledge production is declining as a result of:

- insufficient funding (for frontier research projects in particular)
- insufficient support for leading research institutions ('Centres of excellence')
- ever increasing international competition
- fragmentation of research sector (European vs. national funding, limited mobility, suboptimal use of research infrastructure…)
- insufficient openness (social security issues within the EU, visa requirements for non-EU researchers, …)
- complex EU administration
- limited industry involvement in frontier research funding

- non-competitive level of (average) university education

- historically, too much EU support for ‘applied’ innovation-oriented research in industry – a policy generally considered not to have been a success

- inadequate cohesion policies directed at exploitation of research potential in ‘scientifically weaker’ member states

  - more structural funds for research infrastructure
  - better mobility incentives
  - simplification in funding procedures at EU level
  - better harmonization of national research policies with EU policy
  - handling ‘unfair’ remuneration levels
  - preventing damaging EU internal brain drain.

What measures to take to improve the situation?

Make ERA internally deeper and more coherent, and externally more open by increasing attractiveness of doing research at the European institutions.

Excellence in frontier research at (say, 250 best) EU institutions at the core of making Europe a favoured partner for the best minds from all over the world.

How are we currently trying to respond to the challenge?

Emphasis on world class competitive funding:

Creation of the European Research Council (ERC)

great idea and successful initial phase implementation

but

continuing legal problems

autonomy constraints

largely inadequate funding

As much as we need competitive individual funding, the question to be asked is:

to what extent do we need competitive institutional funding (is EIT an answer)?

Creation of the European Science Forum for Research Infrastructure (ESFRI), consisting of individual member state representatives assisted by EC staff.

Possible outcome:

- more structural funds to be used to fund new or substantially upgraded pan-European infrastructures
- creation of an ERC-like agency to ensure the primacy of ambitious scientific goals.

- Whilst a variety of small or medium size infrastructures are properly the responsibility of individual member states, a well-distributed set of major infrastructures supporting pan-European frontier research is of enormous importance.

- Synergy effects by harmonization of different funding sources (FP7, Structural Funds, national research funding, industrial involvement, …) is much needed.

- The needs of 'scientifically weaker' countries should be respected – autonomous regional infrastructures and those supporting existing large ones are vital for tapping the great research potential of these countries.

Such facilities, while capable of contributing to research at the highest level, would certainly require less up-front investment from host countries, reduce costs of experiments and help in training young scientists. They would also contribute locally, helping to increase the high-tech character of the region and make the society more aware of the challenges faced by science today.

Some ‘secondary’ (?) issues:

- Credibility of science
- Accountability of research
- Communicating science
- Science in the digital age
- Do we need common European science policy?
- Open access.

- There is a lot of evidence that the credibility problem science faces today is bigger than ever before.

- The decline of public trust in scientific institutions and individuals, felt strongly for instance in the current debates on GMO's or stem cell research, reflects
a further shift in the public perception to the extent which seems to question whether progress in science brings about any coherent improvement in the
well-being of the human race at all.

The current capacity of science to explore the future and to contribute to so much needed further social and economic progress comes up today in practice against a series of other curbs, if not serious obstacles:

- science dispenses both beneficial and adverse effects
- science input is often limited to a short-term horizon
- there are serious negative effects of compartmentalization of disciplines, hyperspecialization and brain drain
- information overload becomes at places unmanageable, prompting ex cathedra pronouncements.

- Large private companies may monopolize the information highways with the quality and objectivity of the data transmitted difficult to control.
- Some public experts with apparently biased views shaped by the business sector do often put science in public debates in an unwelcome role of acting against the public good, consequently negatively influencing public trust in research.
- Society will support frontier research only as long as it feels it can trust the scientists and the institutions that employ them – accountability of research endeavours to the public is a crucial requirement in this regard.
- Society at large must be convinced that research activities are at its service.

Accountability of research

- Scientists are no longer perceived exclusively as guardians of objective truth, but also as defenders of their own (individual or group) interests in a media driven scientific marketplace.
- Therefore, it is now more important than ever that individual researchers and their institutions constantly assess values that guide their research.
  - No established measures for assessing integrity in the research environment exist.
  - Fostering responsible conduct in research must be done in a creative way, otherwise it is ineffective.
  - Institutional self-assessment appears to be a constructive and promising approach to improving integrity of research.

Accountability of research

Responsible conduct of research:

- Intellectual honesty in proposing, performing and reporting research
- Fairness in peer review
- Collegiality in scientific interactions, including communications and sharing of resources
- Transparency in potential conflicts of interest
- Protection of human subjects in research
- Humane care of animals in research
- Development of procedures for thorough inquiries of potential scientific misconduct
- Sensitizing everyone involved in research to ethical issues.

Accountability of research

- Whether science is able to thrive in our fiercely contesting democracy depends on whether it builds an advocacy system to explain its goal, needs and methodological format. Will we be able to assure a much higher degree of connection, collaboration and accountability across science and higher education, industry and society at large to exploit the enormous potential which is here at stake?

Communicating science

Is society prepared to exercise its influence on science?

How we should talk the public into debating the ways to:

- understand merits and scope of scientific inquiry
- address in a non-biased way controversial issues (GMO's, stem cells, nuclear energy, religious orthodoxy, ...)
- deal with privacy of research data
- . . .

Communicating science

- Public understanding of science is something different than appreciation of a research institution
  – a communication mistake made by many researchers wishing to enhance the reputation of their institution rather than to explain the phenomenon of public interest.
- Scientists themselves must be involved in communication programs – in an era of sophisticated and complex science it is only them who can make room for a much higher degree of connection across science and society.
- Individual scientists and research institutions should be strongly encouraged to find ways to communicate all their findings – particularly important in health and environment sector.

Communicating science

A key ingredient in trying to overcome the current weakness is:

A new contract
redefining the relations between
science and society

Society has to be encouraged to make an effort to better understand science. ⟺ Science has to be constantly trying to evoke societal interest in it.

Society has to work out better ways to foster and control public expenditures on research. ⟺ Science has to accept accountability as a key ingredient of its mission.

Science in the digital age

Science in the digital age – or how not to overlook opportunities and threats?

- Is ICT a slogan, an uncontrolled revolution or a controllable development?
- ICT: the means rather than the goal!
- ICT as crucial for handling existing and creating new knowledge.
- As in other sectors of public life, the use of ICT has become an absolutely crucial factor in maximizing research benefits.

Science in the digital age

Predictions:

- Evolution of IT will continue to be characterized by rapid exponential growth with the Net becoming truly ubiquitous and pervasive.
- IT will challenge traditional academic institutions by relaxing constraints of space, and time, and benefits of ‘monopoly’.
- IT will change dramatically the ways we handle storage of and access to data, information and knowledge thus elevating the importance of intellectual capital relative to physical and financial capital.
- IT will greatly influence the methodology of scientific endeavor.

Science in the digital age

For a decade (or slightly less), the pace of change will not be revolutionary. However, inaction and procrastination now would be highly dangerous in view of certainty of rapid advances in ICT and the ‘natural’ inability of a research institution to change itself fast.

Science 2.0 can already be seen on the horizon!

Do we need common European science policy?

- Problem deeply rooted in an unanswered question of the European federalism/non-federalism.
- Should any new European institutions be created to respond to problems of science?
- Science policy nowadays does not seem to lie within the boundaries of the main stream European politics.
- How should we make science a politically relevant issue?
- Is an increased participation of scientists in shaping European science policy an answer?
- Is the European Research Council a step in this direction?

Open access

Scientific research is generating vast, ever increasing information, including primary data, data structured and integrated into databases, and scientific publications. Additionally, at least in some exploding fields, accessible repositories for materials and research tools have become a necessity rather than an option.

It becomes more and more clear that free and efficient access to information will be the key for sustained progress in science. To achieve this, significant investment is required to establish repositories for publications and data.

Open access to such repositories appears to be strongly supported by the scientific community.

For instance, the ERC is on record with a recommendation that the outcome of research it supports be freely accessible as soon as possible, preferably no later than 6 months from publication.

Conclusions:

- EU countries should finally start increasing the frontier research funding – the public sector funding remains crucial for frontier research advancement. Times of crisis offer opportunities to make the most of the (soon) coming economic upturn.
- To optimize the system, careful monitoring and evaluation of funding procedures and research results should always be performed using global standards as a reference.
- Improved collaboration between the EU Member States as well as with non-EU countries is crucial in view of the need to attract 'critical mass' of top-level researchers and infrastructural support to confront international competition.

- Europe urgently needs policies to increase its frontier research attractiveness:
  - Post-doctoral support, an essential part of scientific career, is not included in the FP7 People programme!
  - Mobility – linguistic and cultural diversity in Europe should be its wealth and not a problem, but apparently it is no so – many countries require university teaching in local languages, for instance
  - Significance of networked communities-of-excellence
  - Simplifications in funding procedures
    - ✓ greater emphasis on the actual science to be performed
    - ✓ many excellent scientists opt not to apply.

- Research attractiveness is not enough.

  Also needed: effective international policy!

  Because of huge knowledge production outside Europe, we need to move out to this expanding knowledge bank and to absorb it for the aims of research value creation at home. The challenge is enormous, given that Europe is already having difficulties absorbing knowledge produced within the EU.

- Attempts to better exploit the research potential in countries now ‘scientifically weaker’ appear fundamental to the just European ambition to secure its research position in the years to come.