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Academies, International Partnerships and Interdisciplinarity[*]

Abstract

Most, if not all, major challenges in the area of science and society today – be they issues of sustainable development, environment or the ethical dimension of science and technology – call for rigorous interdisciplinary approaches. They also require the greatest – and broadest – degree of scientific effort in their resolution. The National Academies and their regional and global groupings have a key role to play in the fostering of collaborative research at the international level, and the bringing together of the widest possible spectrum of disciplines and scientific talents. Examples of successful international, multidisciplinary initiatives launched by ICSU will be given as examples.

Mr Chairman, Ladies and Gentlemen,

Let me begin by expressing my pleasure at being here in Montenegro once again, and being able to represent the International Council for Science (ICSU) at this important gathering today.

The title of our session this morning is Academy and Society. Let me begin by asking: What kind of science should society expect in our world of the Third Millennium? It is clear that we need a science that would, first and foremost, meet basic human needs throughout the world, eradicate extreme hunger and poverty, provide primary health care, sanitation, and the provision of food, clean water and energy, reduce child mortality and improve maternal health,

[*] The paper is printed as submitted.

combat HIV/AIDS, malaria and other diseases, and generally improve the quality of life for all. It would allow greater understanding of the major global environmental processes, a more sustainable use of natural resources and the mitigation of natural disasters. These expectations of science are embodied in the UN's Millennium Development Goals. The paradox is that this reliance on sciences in tackling the world's problems as expressed in the MDGs does not negate the fact that at the same time in many countries large parts of the population are quite critical or fearful of the impacts of science and technology itself on society and the environment.

Academies of Sciences can do much to improve the negative perceptions of science and of a career in science by making clear that science is essential for tackling those major problems facing the world today – and needs to play a much greater role than hitherto in addressing some of the most pressing global challenges such as poverty and the degradation of our environment.

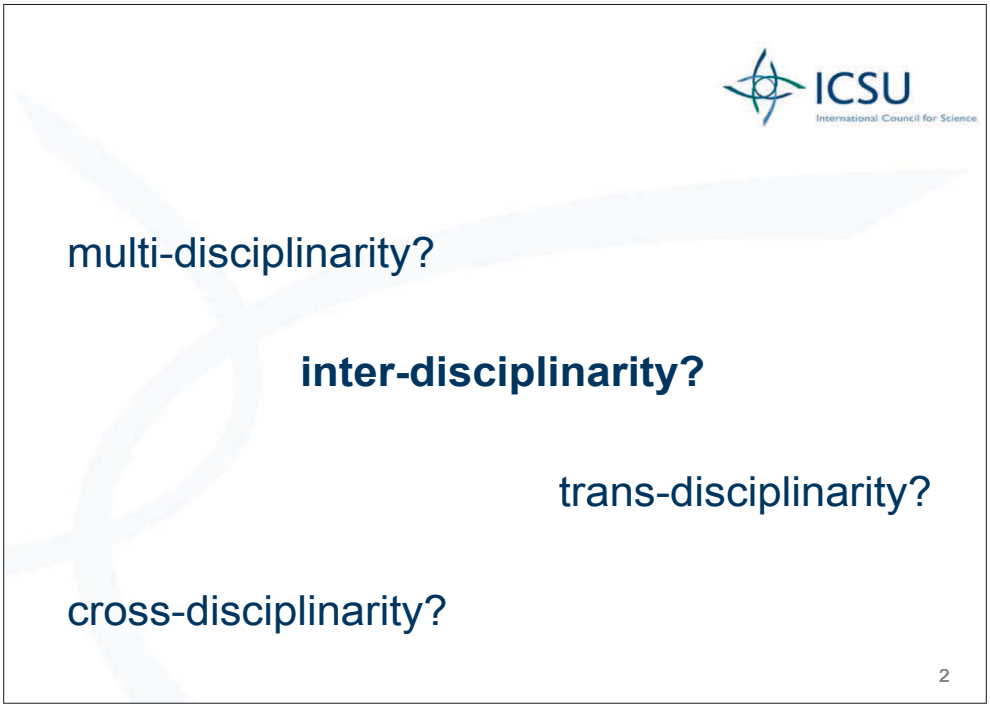
And those same Academies need to lead with actions in helping to devise and plan scientific research that is up to the task. Many of the major challenges before us require the bringing together of the teaching and research talents of all. After all, many of the problems are ones that transcend our artificial political borders. Environmental mishaps, for example, are no observers of frontiers. Such things affect us all, and it is only through the combining of expertise and experience regionally and globally can be hope to address them in the appropriate way. The importance of forums like this one today in providing mutual support and encouragement in the pursuit of international scientific cooperation cannot be overemphasized.

Advising society at large on real-world problems – and then carrying out the science in order to address those problems – requires that the various branches of science to work together. Let me say immediately that when I speak here of 'science' I am using it in its widest sense, to include not only the natural sciences but also the medical sciences, engineering, the social sciences and the humanities. If the science of the Twenty-first Century is to confront complex problems of a truly global scale it will need to be interdisciplinary in approach, drawing on all the talents from across disciplinary borders. We can see today how the major successes in molecular genetics and biotechnology, for example, owe so much to the advances made in physics, chemistry and biology. And environmental problems – we now understand – can only be thoroughly

addressed through the concerted efforts of geologists, chemists, biologists, engineers, sociologists, economists, and so on.

It is my contention that Academies of Sciences could, and should, be the natural agents of this interdisciplinarity, having within their memberships the senior representatives of the various disciplines or scientific divisions within the country.

While most Academies of Sciences around the World have a strong focus on the natural sciences, your Academies of Eastern and South Eastern Europe are marked exceptions to this general picture. Membership of most, if not all, Academies in the region is drawn not only from the natural sciences, but also the social sciences, the humanities, the medical sciences and the technical sciences. In a little survey we commissioned ahead of a conference ICSU sponsored with UNESCO in Chisinau last year, we discovered that the proportions varied from academy to academy, but overall those academies responding had an above-average mix of disciplines represented in their memberships. This gives you an enormous advantage in being able to bring your various disciplinary communities together within your countries, and encourage them to



work with and within regional or global programmes. Your Academies can be a very positive force for the breaking down of the traditional disciplinary walls in order to better address some of the major challenges I touched upon earlier. Academies with responsibilities for managing research through their own institutes and centres have a particular opportunity for encouraging and supporting interdisciplinary research.

Ladies and Gentlemen,

I could spend my time, and your time, on definitions [Slide 2]– discussing the differences between multi-, inter- trans- and cross-disciplinarity. I won't, because it would be a rather sterile exercise and not particularly helpful. Let us be content to recognize that many of the real pressing problems facing society today stand the best chance of being correctly addressed by teams of scientists (again, I use the word in the most generic way) bringing their diverse expertise and knowledge to bear, attacking a subject from various angles and methods in a sustained way, eventually cutting across disciplines and forming new methods for understanding the subject. Interdisciplinary approaches – and I'll stick to that word – typically focus on problems felt by investigators to be too complex or vast to be dealt with by the knowledge and tools of a single discipline.

Interdisciplinarity is not without its barriers, of course. History tells us that it is not easy to break down or weaken the disciplinary silos in order that discoveries and investments can be made in interdisciplinary fields. Most participants in interdisciplinary ventures come from, and were trained in, the traditional disciplines, but they must learn to appreciate differing perspectives and methods. A discipline that places more emphasis on quantitative 'rigor' may produce researchers who think of themselves (and their discipline) as 'more scientific' than others. At the same time, colleagues in 'softer' disciplines may associate quantitative approaches with an inability to grasp the broader dimensions of a problem. An interdisciplinary programme will probably not succeed if its members remain stuck in their disciplines (and in disciplinary attitudes).

From the viewpoint of the disciplines, in fact, much interdisciplinary work may be seen as 'soft': lacking in rigour, or ideologically motivated; such beliefs place barriers in the career paths of those who choose interdisciplinary work. And interdisciplinary grant applications are often refereed by peer reviewers drawn from established disciplines; not surprisingly, interdisciplinary researchers may experience difficulty getting funding for their research: the same is true

when promotion or tenure is at issue. Another factor that mitigates against interdisciplinary work in universities and research establishments is the channelling of limited resources preferentially to the individual disciplines.

Given these constraints, interdisciplinary research areas are strongly motivated to become disciplines in themselves. If they succeed, they can establish their own research funding programmes and make their own promotion or tenure decisions; in so doing they lower the risk associated with getting involved with such interdisciplinary research. Examples of former interdisciplinary research areas that have become disciplines include: neuroscience, cybernetics, biochemistry and biomedical engineering. We see the scientific disciplines fragmenting and combining: ecological economics is not yet a generally defined discipline, but it is an area of exciting scientific advances, and many other hybrid specialities recognize their genealogical roots: political economy, social ecology, bio-geography, and so on.

Over the last two decades, the International Council for Science (ICSU) has increasingly recognized the absolute need for interdisciplinarity, and its current Strategic Plan has it as the basis for much of its action. In particular, the

development of major international collaborative research initiatives has increasingly relied upon such type of collaboration [Slide 3].

You all know that ICSU is an umbrella non-governmental organization representing science worldwide. The ICSU family currently has 114 National Members (many, but not all, being the national Academies of Sciences) and 29 International Scientific Unions [Slide 4] (some of which are listed here to show the range of disciplines covered). Here is ICSU's strength – the bringing together of the national scientific constituencies with the major disciplinary groups to work on common projects and programmes.

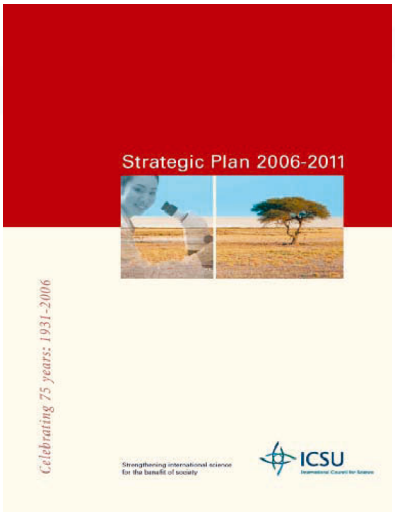
ICSU is not a rich organization; it is not a funder of research, but we like to think it is influential and capable of triggering major, timely initiatives. I'll come onto some of these initiatives now, for they illustrate the power of interdisciplinary collaboration in areas of importance [Slide 5].

In keeping with its first Strategic Plan 2006-2011 [Slide 6], ICSU has three major themes to its work

The ICSU Strategy

ICSU
International Council for Science

- An three-year planning effort including intensive consultations with Members
- Approved by General Assembly in October 2005
- Mid-term review at GA in October 2008



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Focus of the Strategic Plan

ICSU
International Council for Science

Three inter-related themes:

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It could be argued that all three themes require an interdisciplinary approach to a greater or lesser extent. ICSU is, in fact, best known for planning and coordinating major international and multidisciplinary research programmes [Slide 7] such as the International Geophysical Year 1957-1958, the International Biological Programme (IBP) 1964-1974, and the four Global Change Research Programmes (from 1980 onwards).

The need for multidisciplinary approaches in these programmes has changed rather dramatically over the past decades. The IBP provided, amongst other things, the basis for ecosystem science, which necessitated the bringing together of the different biological disciplines. This was not always easy, but the botanists, zoologists and microbiologists learnt to work together in a coordinated manner that advanced ecosystem science and provided a solid scientific basis for addressing the functioning of Planet Earth as an ecosystem.

When the planning for the International Geosphere-Biosphere Programme: a study of global change (IGBP) began in the mid-1980 s, the challenge was to bring the biologists together with the chemists and physicists to analyse the interactive physical, chemical and biological processes that define Earth Sys-

tem dynamics. The need to bring together all the relevant natural sciences offered a major challenge, and a number of obstacles to a truly integrated study of the Earth as a system had to be overcome. But just as IBP brought together the biological sciences, so IGBP proved successful in bringing together all relevant disciplines in the natural sciences. Efforts were also made to encourage the social sciences community to engage in addressing global processes to unravel the functioning of the Earth system and the International Social Science Council (ISSC) started to plan a human dimensions programme on global environmental change already in the late 1980 s.

It was in 1996 that the International Human Dimensions Programme on Global Environmental Change (IHDP) was established by ICSU and ISSC. It had become very clear that it was not possible to understand the Earth as a system without addressing humans as influencing the planet and as an essential driving force in shaping the future of Planet Earth. So, a major new step was taken to clearly recognize the need for not only including the relevant natural sciences but also the social sciences.

Since then, the four global change research programmes (World Climate Research Programme (WCRP), IGBP, IHDP and DIVERSITAS, all sponsored by ICSU) have entered a partnership – the Earth System Science Partnership or ESSP – for the integrated study of the Earth System, the ways it is changing, and the implications for global and regional sustainability – something that would have been scientifically inconceivable twenty years ago.

[The Earth System is the unified set of physical, chemical, biological and social components, processes and interactions that together determine the state and dynamics of Planet Earth. Earth System Science is the study of the Earth System, with an emphasis on observing, understanding and predicting global environmental changes involving interactions between land, atmosphere, water, ice, biosphere, societies, technologies and economies.]

All these initiatives do have certain features in common:

- ICSU shares sponsorship of the programmes with other like-minded organizations – UN agencies (WMO, UNESCO, UN University) or other NGOs (ISSC)

- The programming does not stop after the end of the so-called planning phase, programming continues and new foci of research are regularly intro-

ICSU Environmental Programmes

International Biological Programme (IBP) 1964-1974
World Climate Research Programme (WCRP) 1980-
International Geosphere-Biosphere Programme (IGBP)1986-
International Human Dimensions Programme on Global Environmental Change (IHDP)1996-
DIVERSITAS (2nd phase) 2001-
Earth System Science Partnership (ESSP)
International Polar Year 2007-2008

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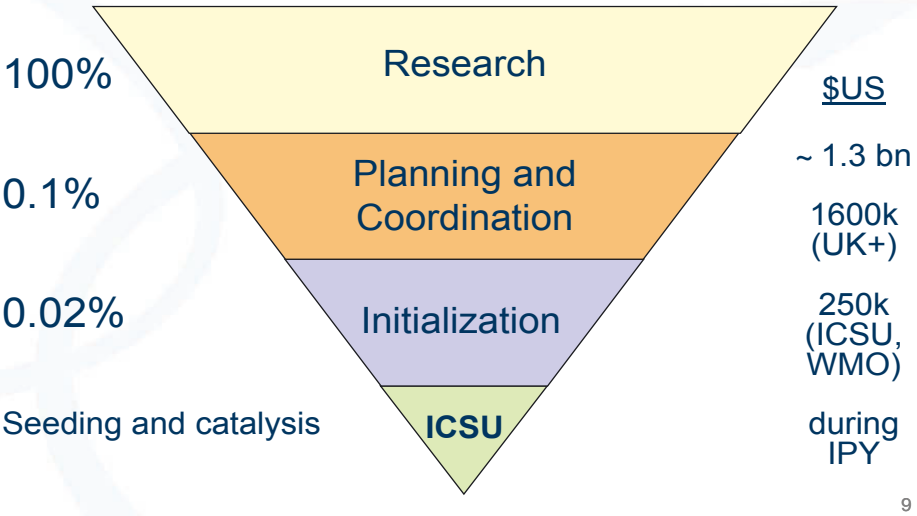
Financing IPY 2007-2008



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duced. Programmes are planned and guided by committees made up of individuals proposed by ICSU National or Union Members.

- Programmes do not have internationally agreed-upon funding of their own; scientists have to put their component programmes through the normal peer-reviewed assessment of the national or international funding agencies

- Limited seed money results in significant global research budgets [Slide 8, 9]

- Programmes benefit from the collective expertise of ICSU's National and Union members – the Academies and the constituencies they represent can play an active part in the establishment, definition, development and implementation of significant programmes of research.

I have chosen as my examples the various international environmental and global change programmes devised and set in motion by ICSU and its partner organizations, but what I have had to say could have easily applied to other areas ripe for interdisciplinary collaboration, such as the ethical dimension of scientific research, for example.

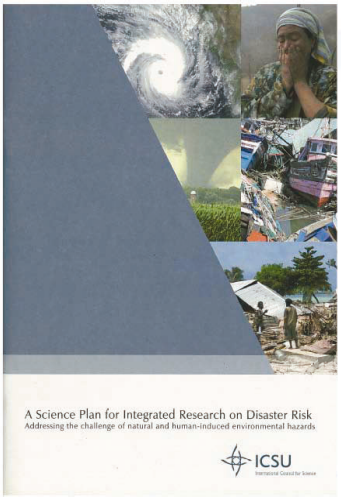
Integrated Research on Disaster Risk (IRDR)

addressing the challenge of natural and human-induced environmental hazards

Approval by the ICSU General Assembly expected October 2008

To be launched in 2009

ICSU
International Council for Science



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Let me close with brief mention of ICSU's latest initiative – and it is one with which I am closely associated [Slide 10].

Next week, at the ICSU General Assembly in Maputo, Mozambique, a new, rather ambitious interdisciplinary programme entitled 'Integrated Research on Disaster Risk' with a subtitle 'addressing the challenge of natural and human-induced environmental hazards'. To be planned over a decade, the programme will cover all hazards relating to geophysical, oceanographic and hydrometeorological trigger events: earthquakes, volcanoes, flooding, landslides, hurricanes, storm surges, heat waves, wildfires, droughts, etc., etc. There remains a great shortfall in current research on how science is used to shape social and political decision-making in the context of such hazards and disasters. There is also a clear need for more systematic and reliable information on such events; the aim of the programme will be to generate new information and data, and to leave a legacy of coordinated and integrated global data and information sets across hazards and disciplines, with unprecedented degrees of access.

It is an exciting programme, and one that will be the most challenging, from the point of view of its interdisciplinarity. To be successful, it will need to

involve all the sciences. I'm also convinced that the scientific communities in this part of the world have both the experience and the expertise in natural hazards and disaster mitigation to make a major contribution to the programme. I hope that the Member Academies will join ICSU in this major endeavour [Slide 11].

Ladies and Gentlemen,

I thank you for your attention.