ICSU Foresight Analysis

Report 2 A Success Scenario

ICSU
International Council for Science

ICSU

Founded in 1931, the International Council for Science (ICSU) is a non-governmental organization representing a global membership that includes both national scientific bodies (120 National Members representing 140 countries) and International Scientific Unions (31 Members). The ICSU 'family' also includes 19 Interdisciplinary Bodies—international scientific networks established to address specific areas of investigation. Through this international network, ICSU coordinates interdisciplinary research to address major issues of relevance to both science and society. In addition, the Council actively advocates for freedom in the conduct of science, promotes equitable access to scientific data and information, and facilitates science education and capacity building. [www.icsu.org]

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Introduction

In 2010, ICSU launched a Foresight consultation exercise as part of the planning for its 6-year strategy, 2012-2017. The Foresight exercise focused on the organization and directions of international science in 2031 (the year of ICSU´s centennial celebration) and was deliberately designed to explore a longer-term horizon beyond the immediate strategic planning period. It was done in two parts:

Part 1[1] consisted of a broad consultation with the scientific community, in particular ICSU's national and union Members, to identify 'key drivers' that will shape international science over the next two decades. These drivers were then used to develop four plausible exploratory scenarios to explore how different factors may combine to influence the science landscape.

Part 2, which is the focus of this report, built on the work done for the exploratory scenarios, to develop a more aspirational 'success scenario'. An initial draft of this success scenario, including its potential implications for ICSU, was produced at a workshop[2] in 2011 and this was then refined after a series of consultations with the ICSU community. As a final step, it was 'road-tested' against the four exploratory scenarios that had been developed in part 1, which led to the identification of key challenges or tensions that ICSU is likely to face between now and 2031. Some potential responses to these challenges are included in this report.

The two reports are complementary and ideally should be read sequentially although they are written as 'stand alone' documents. The detailed rationale for the choice of a scenario approach to foresight is given in report 1 and will not be repeated here. However, it is important to emphasise that foresight scenarios, including the 'success scenario' that follows, are not designed to be predictions. One of the most common criticisms of foresight is that you cannot predict the future, which is absolutely true but also reflects a misunderstanding of what foresight is about. Building foresight scenarios is a way of combining current knowledge and trajectories with creative thinking and imagination to explore potential future pathways in a very complex world. It is highly unlikely that any of the four exploratory scenarios or the success scenario will be fully realised but elements of them are likely to occur in some combination. Having thought about these issues beforehand should enable ICSU as an organisation to be more agile and responsive. Knowing what our ideal 'success scenario' world would be like can help us to contribute better to realising at least a piece of that world.

1. ICSU (2011). ICSU Foresight Analysis Report 1: International science in 2031 – exploratory scenarios. International Council for Science, Paris; http://www.icsu.org/publications/reports-and-reviews/icsu-foresight-analysis/

2. The facilitated workshop took place in April 2011 and had ~40 participants, including the ICSU Committee on Scientific Planning and Review, Officers, Regional Committee chairs and Secretariat staff.

The Success Scenario

This scenario outlines a vision of what the international science landscape would be like in 2031 if it is optimally promoting progress in science and serving the needs of societies across the globe. It draws on the ideas and analysis that led to the development of four exploratory scenarios described in Report 1 of the ICSU foresight exercise. In particular, it uses the same 'drivers' which were identified after extensive consultation.

It is one of many potential scenarios that could be imagined and is not designed to be a prediction but rather a mechanism for exploring how we would like the future to be and how ICSU might positively influence this. It is deliberately designed to be aspirational and to some extent normative. At the same time, the essential elements should also be plausible and robust with reference to the previously developed exploratory scenarios.

Key Questions

Drawing on the exploratory scenarios and taking into account ICSU's current mission and vision, three key questions were defined at the outset of this exercise and helped determine the scope of the success scenario:

- **In what ways will scientific capability and resources, and the resulting benefits of science, be distributed among nations?**
- **To what degree will the scientific agenda be set by 'grand challenges'? Will these be global or driven by economic competitiveness?**
- **What role will scientific advice have in shaping governmental policy across a range of areas?**

Scenario Summary

It is 2031 and international scientific research is making significant inroads into tackling the global environmental and societal challenges that two decades earlier were threatening the future sustainability of the planet. The delays in achieving binding international agreements on reducing emissions and managing natural resources, mostly due to fear of economic consequences, have led to increasing reliance on science and technology to come up with efficient and affordable solutions. Science is universally valued and has played a leading role in the development of a fairer and more equitable global knowledge society. The continued rapid evolution of information and communication technologies, enabling full and open access to scientific information and data, has been instrumental. The scientific promise of countries such as China, India and Brazil, as well as South Africa and several of the 'Asian tigers' has been realized and, whilst the OECD countries are less predominant, they have largely maintained their historical strengths. Science policies and investment from foreign donors and national governments have led to the creation of centres of scientific excellence and strong scientific networks in regions and countries where science was previously neglected. International networks of cities, bringing together policy makers and academics, have developed around common challenges. These new centres and networks are playing an active part in coordinated global research initiatives that are providing technological solutions and policy options in areas such as climate change, disaster risk reduction, food, water and energy security, population growth, ageing and health. The historical divide between natural and social sciences has been overcome and different perspectives have been successfully integrated in a problem oriented approach to tackling global challenges. At the same time the traditional science disciplines have continued to evolve and new discoveries in fundamental science have attracted new generations of scientists and led to technological breakthroughs in areas such as energy, agriculture and medical care. In many of these areas, innovative public-private partnerships have enabled the development and adoption of beneficial technologies - even in countries where the immediate market benefits were limited. Earlier societal fears about the dangers of nanotechnologies and genetic engineering have proven to be largely ill-founded; this was assisted by the implementation of effective international regulations and standards with the support of enlightened industrial leaders. Trust in science has also been strengthened by a major international campaign, led by science institutions, to promote research integrity and address scientific misconduct. The relationship between science and the public has been positively influenced by changes in the teaching of science and, in particular, the engagement of active research scientists at all levels of education. Improved scientific literacy has benefitted from the full exploitation of Information and Communication Technologies and multi-media tools to communicate science and promote public engagement. In a world that is appreciative of science and in which scientists are sensitive to the needs of society, young people are attracted to scientific careers and funding for science has increased almost universally. Over the past two decades, ICSU, its Members and programmes, have all played a significant role in strengthening international science for the benefit of society.

Science is thriving and appreciated in all its diversity

By 2031 global science has played a significant role in helping to build a more sustainable world by working with other stakeholders to address the major challenges associated with sustainable development. 'Science' as represented by the S in ICSU is inclusive of the natural sciences, social sciences, medical sciences, engineering and humanities. And this science has been integrated with other relevant sources of knowledge to propose strategies for anticipating and responding to different combinations of environmental and societal change on multiple scales. At the same time the disciplinary basis of this integrated approach has been strengthened and 'blue skies' research is flourishing, leading to new technological breakthroughs that are being applied to improving human health and wellbeing.

Responding to societal challenges is a key part of research agendas

Strategic international cooperation in science is clearly focused on themes of a global nature. Earth system science and global sustainability provide a global framework for addressing issues such as population dynamics, water, food, energy and natural resources. The changing pattern of health risks and diseases, partly related to environmental change and migration, has brought trans-disciplinary research on human health and wellbeing, as well as study of intercultural relations, to the top of the international agenda.

Despite concerns at the outset within many parts of the scientific community, this focus on solutions to societal challenges did not result in a major shift towards 'applied' research only – an effective approach to addressing complex global challenges arose from the nexus between fundamental and applied science. Both proved to be necessary but on their own neither was sufficient. Disciplinary versus interdisciplinary science is no longer an issue with recognition that the boundary between discipline-focused work and interdisciplinary science has become artificial. This is reflected in the evolution of science policy and research and innovation systems, as well as the career choices and advancement of young investigators.

Universities have evolved to fully embrace their 'third mission' and many companies have similarly recognized the need to take corporate social responsibility more seriously, realizing that it also makes good economic sense in the longer term. Complex global challenges have acted as catalyst to promote interdisciplinary education and training opportunities. New University departments and research centres, often supported by public-private partnerships, are co-designing and producing research that provides solutions for local sustainability challenges.

Scientific capability and resources are a truly global asset

The promise of the 'BRIC' (Brazil, Russia, India and China) countries in terms of scientific strength has largely been realized and several other scientific powers have also come to the fore, including for example South Africa and South Korea. After an initial period of uncertainty and increased competition, the OECD countries have accepted the new multi-polar nature of the global scientific enterprise and embraced the benefits of cooperation. This cooperative spirit has also spread to many low-income countries, with donors recognizing the need to support their national efforts to strengthen scientific capacity. Overall this has resulted in a more balanced global scientific effort as more countries perceive the benefits of investing in science.

The nature of international cooperation has changed, with brain circulation replacing brain drain and countries being more willing to subsume some of their national interests to ensure the success of global and regional cooperative activities. A major driver in this changing landscape has been the recognition that no one country has the intellectual or financial resources to tackle the crucial scientific questions alone.

Interdisciplinary, global research is now an important complement to national and regional research programmes. However, the mutual feedback between these means that each of these levels is no longer viewed as exclusive. Integrated global research has attracted new funding from sources such as foundations and aid agencies and involved many of the countries traditionally weak in science. This cooperative spirit is evident as well in relation to the planning, location and financing of large scale and networked research infrastructures, which are more equally distributed across regions.

Policy-making is more participatory and open with science making a valued contribution

The international policy space has become more complex with a wider set of actors including national and international organizations, global firms and non-governmental organizations in addition to national governments. The problems to be tackled are also more complex, e.g. climate change is now accepted as just being one part of the sustainable development challenge. Despite this complexity, rather than the problems being treated in a piecemeal and fragmented way, there is now a much more holistic framing. New policy fora have emerged, including a reshaped United Nations with an emphasis on sustainable development and the Green Economy, flowing from Rio+20. The perceived failure of the climate negotiations in Copenhagen, in 2009 and the lack of impact of Rio+20, in 2012, led to a revision of the heavy, 'top down' approach of the UN and encouraged it to adopt a more flexible, facilitatory role. Regional and local actors and collaborations have become more important, since problems and required solutions vary between geographic areas.

New networks that are inclusive of government, the private sector and civil society now play a key role in addressing complex global issues. These new fora have brought in a wider range of scientific expertise, which initially led to increased conflict as opposing factions tried to muster science in support of specific agendas. This challenged science to set up more effective processes to ensure the consensus of the very best science was communicated to multiple stakeholders in a way that helps decision making.

Both scientists and policy makers have come to terms with dealing with risk and uncertainty but they continue to have differing conceptions of these. Nevertheless the use of science in evidence-based decision-making is now the adopted norm in policy circles.

New mechanisms have been developed for planning and funding science

Most countries around the globe have recognized the need for new knowledge and innovation to address the challenges associated with sustainable development. Governments have responded by investing significantly more funds in scientific research. Following an initial emphasis on strategic, often interdisciplinary, research, the value of 'blue skies' research was rapidly recognized and a more balanced continuum of research is now being supported.

Greater flexibility in international research cooperation is also encouraged by the availability of flexible funding from multiple sources including public/private partnerships, foundations and charitable donations. The majority of this funding is for globally relevant work, much of it trans-disciplinary. The new approach is symbolized by a Global Grand Challenges Science Programme in which each nation agrees to contribute a minimum of 1% of its public research budget and further contributions are received from the private sector and foundations. A carbon tax on polluting industries also helped to provide a revenue stream for this global fund in the early days. The fund supports collaborative international research projects with a focus on global sustainability challenges. Similar pooled international funding mechanisms have been developed to address other shared transnational challenges, e.g. in relation to disease epidemics.

In this new cooperative world, international science organizations have clarified their roles and remits and work in synergy with each other. There is much better coordination of funding facilitated by appropriate forms of international peer review. Platforms for debate amongst scientists and other stakeholders have been created, from which themes for global cooperation emerge. Developing countries and civil society are important contributors to these global priority-setting exercises.

Scientific integrity helps ensure public trust

Following a series of well publicized cases of scientific misconduct in many countries in the period 2010-2015, scientific institutions belatedly recognized the urgency of addressing the systemic problems that encouraged misconduct. The research assessment and incentive systems for science were revised with more emphasis on quality as opposed to quantity of publications. The responsible practice of science was recognized as vital to the integrity and public accountability of science. Education, training and mentoring for young scientists were adjusted to emphasize this. International principles for safeguarding scientific integrity have been widely adopted along with effective and transparent mechanisms to identify and deal with misconduct. The overall result is that scientific

misconduct has diminished and cases that do arise are dealt with effectively.

By 2031 a workable but fragile balance has been established between the necessary independence of science and its engagement with societal issues. Over the years there were several high profile international conflicts between scientific progress and/or advice and the attitudes of significant parts of society. A precautionary approach and over-regulation in some areas stifled innovation (e.g. GMOs in Europe), whereas a disregard for societal views led to the failed adoption of other innovations (e.g. for sustainable energy).

Addressing societal challenges required scientific organizations to tackle the 'mistrust' of science, which paradoxically had emerged in parallel with increased pressure from society for science to come up with quick fixes to problems. The inherent complexity of the science in areas such as earth system research and a failure to communicate and understand uncertainty also allowed for the denial or dismissal of unwelcome scientific findings. This was exploited by industry and other groups for their own interest and opened a space for pseudoscience. A key insight that helped to redress the balance was that science has a responsibility to engage with the public, but in so doing it must ensure that it maintains its own integrity and independence. A greater appreciation of societal dynamics by scientists coupled with a better understanding the scientific process across societies, have been important. The news media have become more reliant on impartial scientific expertise, after a number of sensational and misleading science stories led to public protests.

Public appreciation and engagement have become integral to the way science operates

Appreciation of science and public engagement with it are much improved. A higher level of science literacy has been achieved through a mix of measures around general education e.g. teaching critical thinking and better appreciation of risk and uncertainty. Initiatives to promote partnering between active research scientists and educators have been successfully implemented in many countries.

A wide variety of electronic and visual media is now routinely used to ensure the work of scientists is effectively communicated to public audiences. This has been complemented by opportunities for interested citizens to routinely contribute to the research process. Crowdsourcing is widely used and recognized as a very effective method for tackling scientific problems in a broad range of areas – from the theoretical through to the applied.

An important step in promoting public interest and engagement has been ensuring that scientific information is tailored to specific audiences, whilst at the same time making the whole process of science more open and accessible. Unraveling complex global issues in a way that the uncertainties are understood but do not undermine credible models and forecasts has been a particular challenge. In this context, the development of a cadre of international scientific champions or ambassadors who are inspiring communicators has been very significant. This has linked with the increased worldwide use of new social media, particularly by younger people. Scientists are now able to communicate directly with key audiences enabling them to take a proactive role in getting the excitement of science out to the world.

Communication is recognized as an essential element of a research career. Scientists have been incentivized to develop their presentation skills and to engage in science communication. This has involved rewards in careers and normalization of science communication as a core competence of researchers. Both public engagement with science and innovations in science education have been embraced by those countries that are new players in the international science scene. The old paradox that young people in countries with the strongest education systems were least interested in science has been turned around in many of these countries. Science is seen as an exciting and worthwhile and reward and career structures in science have been overhauled to make being a scientist an attractive career.

The role of ICSU

By 2031 ICSU has made a number of choices and taken actions in key areas, which have enabled it to play an influential role in realizing the Success Scenario:

Broadening the disciplinary base

ICSU's strength has continued to lie in bringing together different disciplines to effectively address interdisciplinary, global scientific issues. To ensure adequate disciplinary breadth for more complex programmes, the science base of ICSU has been expanded to include strong representation of health, engineering, humanities and social sciences. This has been achieved by targeted recruitment of relevant specialist bodies as either full or associate Members of ICSU, whilst at the same time building effective strategic partnerships with more broadly representative international organizations. All disciplinary based Member organizations have come to recognize their important role in contributing to ICSU's interdisciplinary initiatives and have broadened their remits to embrace this.

The relationship between ICSU and the International Social Sciences Council (ISSC) has been strengthened to the point where they now effectively function as single organization and speak with the same voice on many issues.

Asserting leadership in interdisciplinary global research

Research planning and coordination: ICSU became the lead 'go to' organization to plan and coordinate global interdisciplinary research focused on society's needs and challenges. It is seen as an independent platform able to bring together the science community, funders and other key stakeholders to co-design programmes, building on the success of the Future Earth: Research for Global Sustainability programme, 2013-2023.

The success of the co-design approach has provided improved access to funds for both the planning and implementation of new initiatives. A significant amount of this new funding has come from development aid agencies and in some cases this has been channeled via ICSU's Regional Offices. ICSU has established itself as a trusted 'intermediary agency' for the distribution of science funding from development aid agencies. Similarly, a number of private donors, particularly from Asia, have grown to see ICSU as an attractive and effective partner. The interest of these new donors was initially accompanied by a greater emphasis on results based management and impact assessment, which required a period of adaptation but is now fully integrated in ICSU's routine processes.

Promoting the importance of interdisciplinary global science: ICSU played the leading role in advocating for interdisciplinary, global research to national governments, and regional and international organizations. Its success in doing this has been the result of strengthened partnerships with its National Members and with research funding organizations.

Wise advice to policy makers: The relationship with society has also been enhanced by ICSU's insistence that the outcomes of international science are communicated in a way that can be readily understood and used by those working in policy. Influential guidelines on Working at the Science-Policy Interface were released by ICSU following a series of meetings with policy makers in 2014-2016

Science assessments: As the production of scientific information has expanded, the need for authoritative assessments of scientific evidence has also grown. ICSU's research initiatives have been explicitly designed to feed into global assessment structures – IPCC, IPBES etc. – and where such assessment structures have not existed, ICSU has advocated for them. ICSU has also developed a 'think tank' role, working with its Members and other organizations, to rapidly assess new areas of scientific advance that have implications for society.

Strategic planning and foresight: ICSU is recognized as a critical organization for setting the global scientific agenda. It's independence and unique ability to consult with the worldwide scientific community in conducting global foresight and forward looking exercises have been exploited in a series of influential studies. Many of the ICSU Membership have adopted foresight approaches to help them become more flexible and responsive.

Strengthening the Universality of Science

The Principle of Universality of Science as it was prior to 2011, i.e. focusing on the freedoms of scientists, has remained relevant. There have continued to be cases where the freedom of movement, association, expression or communication of scientists has been restricted or where scientists have been persecuted. ICSU's effectiveness in dealing with these cases has improved enormously as many Members have actively embraced promoting scientific freedom as part of their own missions and established the necessary structures to achieve this. This has enabled ICSU to take on a global monitoring and advisory role rather than an active intervention function.

ICSU has continued to expand the Principle of Universality to include responsibilities as well as freedoms. Maintaining the integrity of science was recognized as being critical to building an effective relationship between science and society, especially around global issues. ICSU played an active role in organizing a series of World Conferences on Research Integrity and the ICSU Members have helped ensure that the necessary national structures are in place to deal effectively with cases of scientific misconduct.

The Universality of Science now includes reference to values and principles that underpin the relationship between science and society and the responsibilities that scientists have with regard to this relationship. ICSU has been responsible for promoting discussion around these values in global and regional fora, engaging multiple stakeholders and including consideration of the role of academic science, business and military sectors.

Improving outreach and education

Addressing challenging global issues: ICSU recognised that its effectiveness in addressing societies' concerns about complex international science could be partly answered by ensuring effective outreach in the context of each of its programmes. As of 2012, the plans for all new initiatives had an outreach component embedded within them. This included identification of key audiences for each initiative and the development of mechanisms and materials to address these audiences. Over time, ICSU has established itself as one of the most reliable sources of scientific information on global issues and is a primary point of contact for the media in this regard.

Education materials and activities for schools developed: As ICSU's contribution to science education, activities and materials for school teachers have been prepared as an integral part of all ICSU's global research initiatives. These education projects were linked with the establishment of educator networks. This built on the experience and success of the International Polar Year and various other science years that had been led by the Unions. Working with its Unions and National Members, ICSU has actively promoted the involvement of practicing scientists in science education.

Communication of the results of research to international fora: ICSU now plays the central role in communicating the results of interdisciplinary global research to international fora. This follows its key role in Rio+20 in 2012 and Johannesburg+20 in 2022 and the setting up of new scientific assessment mechanisms such as the Intergovernmental Platform on Biodiversity and and Ecosystem Services (IPBES) and the virtual 'Science for global sustainability' knowledge gateway. The expanded membership and strengthening of social science has been important in ensuring the legitimacy and relevance of ICSU's communications in these fora.

Citizen Science and crowdsourcing have been actively promoted within ICSU programmes. This started with a meeting of ICSU's Unions to compare experiences across different disciplines, in particular astronomy, biosciences and mathematics, and then expanded to data collection and problem solving in several of the Future Earth projects. Working with partners, including Universities and research institutes, ICSU has produced a popular web portal for lay people who want to actively contribute to a number of research activities in the area of global sustainability.

Capacity building

Support for young researchers: Following up on the success of the Association of Polar Early Career Scientists (APECS) that was created as part of the International Polar Year, 2007-2008, subsequent ICSU initiatives developed similar self-support networks. The Future Earth young scientists' network, which was initiated with funding from ICSU national members, is a good example of this. These networks have been formally recognized as ICSU associates, which helped them attract financial support and ensure their longer term sustainability. Similar networks were promoted where necessary at the regional level.

Interdisciplinary training for young researchers: As part of its Initiative on Earth System Sustainability, 2012-2022, ICSU worked with funding agencies and university networks to encourage the development of international courses targeted at developing the ability of young researchers to conduct interdisciplinary research. These proved to be successful and popular and helped to develop many of the scientific leaders, who are involved in ICSU activities in 2031.

Connecting people: ICSU used its global and regional structures to establish and maintain comprehensive databases of individuals and institutions working on different global challenges. These were invaluable in identifying expertise for ICSU's own initiatives. They were also made openly available to the research community and formed the basis for the development of many new international science networks, both North-South and South-South.

Access to data and Information: The ICSU World Data System that was established in 2011 has gone from strength to strength. Its focus on long-term stewardship and data publication helped provide it with a unique quality stamp and has encouraged the world's leading data centres and services to join. New centres have been created in the developing world after donors and national governments were convinced of the importance investing in data infrastructure. The vision for a global open access library for scientific data is being realized in partnership with research funding agencies, research institutes, governments and development aid agencies. Linking source data to scientific publications "online" is now routine and ICSU has been at the forefront of this development because of the successful collaboration between its various interdisciplinary bodies dealing with data and information.

Evolving the organizational structure

An expanded Membership base – both in terms of countries and disciplines – has been accompanied by greater appreciation and awareness of the role of ICSU. At the national level, this has been greatly assisted by the role of the Regional Offices in effectively engaging – and providing a space for – less developed countries. The Unions have evolved considerably as new disciplines have developed and the importance of inter-disciplinary science has increased. The review of ICSU in 2014 emphasised the importance of the Unions in ICSU's interdisciplinary initiatives. Many Unions subsequently expanded their missions to explicitly include ensuring that the strengths of their disciplines were brought to bear on complex global challenges of importance to society. The Urban Health and Wellbeing initiative that was launched in 2013 provided a focus for many of the Unions to work together and develop their own trans-disciplinary activities. This has brought them closer to ICSU.

More flexible mechanisms for implementing new initiatives have been introduced. The Future Earth programme marked a move away from creating new standing structures with their own paying membership and relatively small and independent secretariats. The 'host country pays for all' model for supporting new initiatives also revealed its weaknesses, as ICSU's strategic influence lessened in the absence of any monetary contribution. Whilst one-off or short-term activities could be effectively implemented with support from single countries or donors, it was realized that a diversity of funding sources, including both host country funding and significant funding from other sources, was necessary to sustain a decadal initiative. Greater attention was given to funding plans and hosting structures during the design of new initiatives and the commitment of key donors was solicited up front. In some instances, the Future Earth model of co-design with funding agencies was extended to other activities.

An efficient head office structure has continued to play an important role in supporting the Executive Board and policy committees to establish global strategies and initiatives and coordinate regional activities. The scientific expertise in the Secretariat has been expanded to support the increased demand for global research initiatives. ICSU has implemented its own science policy fellowship scheme to support young scientists who wish to work on projects within the ICSU Secretariat in Paris and/or the Regional Offices. This has been complemented by secondments from Member organisations to create a more dynamic and flexible workforce. Communication activities have also been strengthened, in partnership with member organizations, to make maximum use of new media and information technologies, to ensure greater visibility for ICSU.

A strong regional structure has developed to help in implementing ICSU's global strategy and ensure that this strategy is responsive to the needs of less developed countries. ICSU found that it could adapt much more quickly to social, political and technological change and strengthen outreach to the new emerging science countries by working at the regional level. The regional Offices also opened up access to new funding sources, in particular Development donors, who came to identify ICSU as a trusted partner. Initially, this had created tensions as some

donors viewed the Offices as intermediary bodies for distributing their funds, a role which did not necessarily align with the operational and strategic requirements of ICSU. However, a common understanding was reached and the two different perspectives were combined, with the Africa Office, in particular, playing a key role in enabling access to donor funds for scientists in the region to address ICSU priorities.

Partnerships: ICSU built on its established position with the United Nations (as it moved to focus more on global sustainability and green growth) and strengthened its relationship with other relevant international and regional fora. ICSU took the lead in developing new global and regional alliances and networks that included researchers, funders and policy makers. As these networks were dynamic, ICSU's strength was its ability to keep to its mission but to be agile enough to work with these networks as they evolved.

Building on the relationships developed during Rio+20 and the early stages of Future Earth, several trusted industry partners, in particular from the insurance industry, have played a role in developing and supporting other ICSU activities. The articulation of a clear ICSU policy on working with industry, including issues such as dealing with conflicts of interest and public perceptions, was the foundation on which these mutually enriching partnerships could be built.

New Associates: There was recognition that one of ICSU's strengths lay in its ability to bring together many different organisations involved in international science. One mechanism for enabling some of these partnerships was to broaden its Associate membership by, for example, including funding agencies, university associations, research consortia and networks of early career scientists.

New funding: ICSU has secured a range of new funding sources. The importance of interdisciplinary global research has seen foundations, development aid agencies (and the new Global Grand Challenges Science Programme) supporting the development and implementation of ICSU initiatives. The new partnerships with industry, have also enabled access to funding and an ICSU Endowment fund has been established with major donations from a number of Asian companies who have an interest in green technologies and/or global sustainability. In the light of positive reviews in 2014 and 2024 that demonstrated value for money, Members have also continued to increase investment as dues and some have been persuaded to make additional 'voluntary contributions'.

Effective governance and champions: It was reinforced during the landmark external review in 2014 that, in order to maintain its legitimacy and authority, ICSU needed to be governed by recognised world leading scientists. At the same time it was recognised that the demand on such individuals was often excessive and proactive measures had to be taken by Members to ensure that the high quality of nominations for the Executive Board was maintained.

It was recognized also that a key to the development of successful initiatives was the greater involvement of champions, defined as respected scientists with an international worldview who had often crossed the line into policy circles. As well as identifying and co-opting existing champions, there was a need to nurture new leaders for the future. Members responded positively to identify outstanding experienced and early career scientists to be involved in ICSU's planning and review activities, both at global and regional levels. The contribution of these scientists to ICSU activities has come to be regarded very positively in individual and institutional research evaluation and accreditation processes. The ICSU alumni association, which was started in 2015, and includes all past and present ICSU Officers, reads like the 'who's who' of international science over the past three decades. These outstanding individuals have retained their affiliation to ICSU and helped to promote and attract funding for new initiatives and activities. They are coming together for the ICSU centenary event – the Past, Present and Future of Science and Society, in 2031.

The overall ICSU governance structure has remained largely unchanged, with an elected Scientific Board being responsible for implementing actions agreed by Members at the General Assembly. However, the disciplinary membership of this Board has broadened to reflect changes in institutional Membership and strategic priorities. The Committee on Scientific Planning and Review now includes a number of scientists from industry, the policy world and civil society, in addition to its traditional academic membership. General assembly meetings have evolved to include multi-stakeholder sessions and public-engagement activities in association with the host country.

Tensions/challenges and responses

By taking the six selected key areas for ICSU actions and 'road-testing' them against the four exploratory scenarios that were developed in part 1 of the ICSU foresight exercise, one can get a sense of the potential tensions and challenges that are likely to arise. Dealing with these tensions and challenges, if and when they arise, will be important for optimizing ICSU's performance over the next two decades.

Table 1 includes a summary of some of the key tensions and challenges that emerge when considering how ICSU can contribute towards its ideal vision, whilst taking into account the 'alternative realities' that were generated in the four exploratory scenarios that are described in the part 1 report. It also proposes some responses or mitigating actions that could be taken to dissipate these tensions and/or address the challenges.

In practical terms, table 1 was generated after a small workshop involving several of the foresight task-team members. During this workshop, the major strengths, weaknesses opportunities and threats (SWOT) for ICSU in each of the four exploratory worlds were re-visited. Each of the six key areas for ICSU action arising from the success scenario (see previous section) was then considered in the context of this SWOT analysis in each of the four worlds. A list of tensions or challenges that cut across all four worlds was generated. Finally responses or mitigating actions corresponding to each tension or challenge were proposed. These proposed responses or actions are equally applicable across all four exploratory worlds and represent key robust steps for ICSU to take in aiming towards the vision that is laid out in the 'success scenario'. They underpin many of the other ideas and suggestions that are proposed in the description of key areas in the previous section of this report.

Table 1 Roles, tensions and responses

Key Area	Tensions/challenges	Response/mitigation
Broadening the disciplinary base	History and membership are critical for legitimacy	Start with what we have and make sure it is sound
	Balancing science driven and policy driven actions	Need to monitor mission and balance over time
	Member resistance to full engagement with social sciences	Strengthen relationship with ISSC whilst engaging new social science union members
	Engineering and health sciences are as important as social sciences.	Identify and work with viable partners in the context of new initiatives.
	Does ICSU focus on solutions include a role in innovation and technologies?	Work with relevant Unions, re. new frontiers of technology development.
Asserting leadership (authority, legitimacy and relevance)	Visibility is critical whatever happens	Work with Members and Interdisciplinary Bodies to raise ICSU's profile
	Competition exists, e.g. IAP and IAC, and ICSU cannot lead on everything. Should there be a single voice?	Be clear on own role/strategy and develop strengths and synergistic partnerships. Members need to share similar clarity on roles and expectations. If enthusiasm develops amongst Members for merger/rationalization then ICSU should actively engage in the discussions.
	Must be able to meet the needs of whatever World develops but mechanisms are slow and rigid.	Foresight tools can help develop institutional flexibility Scope, with Members, the requirements for a 'rapid response' mechanism (for what and for whom?)
	Maintaining independence whilst informing key policy and business stakeholders	Develop and adopt clear and transparent 'rules of engagement'.
	Have strong UN links but role of UN versus other policy-making forums is evolving.	Clarify role of ICSU, versus its own programmes and 'competitors' in different global and regional policy fora. Map strategic targets and partners and work with interested national Members.
Strengthening Universality	Must have BRIC countries and new emerging economies fully engaged	Closely monitor ICSU committee membership and hosting of new initiatives
	Least developed countries need to be represented in/by ICSU	Regional Office focus on needs of LDCs, with Dev agency support
	Ensuring data and information access is fundamental	Maintain strong strategic links and coordination with World Data System, CODATA and INASP
Improving outreach and education	Need to engage support of National and Union Members	Work with Members to monitor changing needs and expectations

Key Area	Tensions/challenges	Response/mitigation
	Use of state of the art information and communication technologies	Communication strategy has major focus on use of web and social media
	Tension between democratization of science and quality assurance	Quality assurance and peer review (in various forms) embedded in all activities
	Main actors in science education are at national and local level	Develop and facilitate partnerships with educator/teacher networks
Capacity Building	Regional structure is important but needs to develop reputation	Regional-global ('one ICSU') identity must be promoted
	Potential for substantial development agency funding but may not be equally distributed nor sustainable	Need to understand and align ICSU and donor agendas and think through core and 'soft' funding implications at outset.
Evolving the organizational structure	Need both strong national and union Members	ICSU must accept increased responsibility for the strength of its Membership, e.g. in selecting new members
	How to better involve Higher Education Institutions and research performers?	Develop partnerships and use Associate membership status more strategically
	Need individual and institutional representation	Need to carefully select and monitor committee membership and balance.
	Where does Europe/N. America fit with regional structure/emphasis?	Monitor closely and ensure integration of regional office actions into global agenda.
	Central versus regional distribution of resources may create tensions	'One ICSU' with single global strategy and over-arching governance must over-ride any regional differences in access to resources
	Mission drift danger in seeking and accepting funds from Aid donors and private foundations	Must maintain substantial un-earmarked dues income stream
	Increasing demands from members and other donors to demonstrate impact and value for money versus 'lean and mean' operating requirements	Introduce impact assessment plans into the design of new initiatives from the outset and allocate/request associated resources
	Any growth of ICSU needs to be sustainable and carefully planned	Growth for growth's sake needs to be avoided even if resources become available. Decisions on permanent versus temporary staffing need to take account of long-term income projections.

Moving Forward

The mantra for foresight practitioners is that "the process is as important as the product". To this end, ICSU has attempted, within the limit of available resources, to consult with as wide a constituency as possible in developing the exploratory scenarios in the previous report and the success scenario that is described here. Hopefully, the outcomes reflect the strength and breadth of this consultation and provide some consensus on a vision for international science and for ICSU in 2031. The future impact of this exercise depends on how much those who have contributed to it are willing and able to pick up and run with some of the thinking and ideas that it has generated. This starts 'internally' with the ICSU Executive Board, policy committees and Secretariat, in Paris and regionally. However, the real impact will come if it has 'buy in' from the ICSU's interdisciplinary bodies, National and Union Members and partners. In that sense the foresight exercise is only the start of an ongoing and iterative process. We may only be able to judge the full implications of this in 2031 in a world that will surely be quite different to anything that we can imagine now.

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Task Team

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