Review of CODATA, the Committee on Data for Science and Technology

Report to the ICSU Committee on Scientific Planning and Review

ICSU

International Council for Science

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ICSU – International Council for Science

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 17 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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Preface

In 2012, and in accordance with the ICSU Strategic Plan II, 2012-2017, the ICSU Committee on Scientific Planning and Review (CSPR) commissioned a review of the performance and future strategic remit of CODATA, the Committee on Data for Science and Technology. The ad-hoc Review Panel appointed by CSPR for the purpose carried out its work between July 2012 and mid-2013. This, the report of that Panel, was duly examined by CSPR at its 26th meeting on 26-27 September 2013.

CSPR discussed the content of the Report, and found itself in broad agreement with the views expressed within. It decided to endorse the recommendations of the Review Panel directed towards CODATA and authorized the publication of the Report as it stood. However, in the case of Recommendation 13, it concluded that the wording addressed to ICSU itself was perhaps in need of modification. While it supported very much the addressing of data and information issues within the various research programmes of ICSU, the systematic granting of ex-officio membership of the respective Scientific Committees to CODATA was considered inappropriate. In addition, whilst there was certainly strong support for the idea that CODATA and WDS should work more closely and strategically together in the future, the suggestion that they should necessarily merge into a single Interdisciplinary Body was considered to be too prescriptive and it felt that other organizational options and models needed to be explored.

At its 110th Meeting on 5-6 November 2013, the ICSU Executive Board endorsed the conclusions of CSPR, along with the slight reservations described above; it decided to submit the Report for the attention of the ICSU 31st General Assembly in Auckland, New Zealand in August-September 2014.

CSPR takes this opportunity to express its appreciation of the work generously and diligently carried out by the Review Panel members during the course of 2012-13.

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Executive Summary

In accordance with the ICSU Second Strategic Plan 2012-2017, the Committee on Scientific Planning and Review (CSPR) set up an ad-hoc Panel to carry out a review of the Committee on Data for Science and Technology (CODATA). The Panel had two meetings, the first at the ICSU Secretariat in Paris in July 2012, the second during the 23rd International CODATA Conference and 28th General Assembly in Taipei in October-November 2012. This Report of the Review Panel is based upon written documentation, responses of members of the ICSU and CODATA families to questionnaires, and interviews of current Officers and Executive Committee of CODATA as well as leading individuals from the data and information community.

One of the goals of ICSU´s *Strategic Plan for 2006-2011* was a coordinated, global approach to data and information. This was to be spearheaded by CODATA, and the organization was encouraged to develop a long-term strategy of its own, giving special attention to the needs of developing countries.

In response to this, CODATA formulated its *Strategic Plan for 2006-2012*, stating its mission as being "to strengthen international science for the benefit of society by promoting improved scientific and technical data management and use". Three major cross-cutting initiatives were launched: the Global Information Commons for Science Initiative; Scientific Data across the Digital Divide Programme; and Advanced Data Methods and Information technologies for Research and Education.

The tradition of strategic planning and priority-setting is thus relatively new to CODATA, and the newly approved *Strategic Plan for 2013-18* only its second. Nevertheless, CODATA has created coherent and significant strategic documents, despite some challenges in engaging the wider membership in the process.

Both Strategic Plans are in good agreement with the priorities of ICSU itself and the recommendations for CODATA stated in ICSU´s strategies. Likewise, the recommendations of successive ICSU strategic committees on information and data have been taken into account in the planning process.

The Strategic Plans reflect the ambition of CODATA to be at the forefront of new developments in their field and science in general. The major initiatives proposed in the two successive plans focus on important issues within the broad scope of the CODATA mandate. They are widely applicable across multiple disciplines and pay attention to the needs of the developing world. However, integrating top-down strategic planning with the traditional *modus operandi* of CODATA – bottom-up Task Group proposals and their biennial evaluation at the General Assembly – is an ongoing challenge.

For CODATA to assume an international leadership role in the field of scientific data and information, the visibility of CODATA needs to be improved. Much of the excellent work CODATA carries out is not duly acknowledged. It is important to ensure that CODATA gains proper credit for its various contributions, which would then increase the visibility and credibility of the organization, and would facilitate future tasks and collaboration.

There is no doubt that the biennial International Conferences represent one of the most important and valuable of CODATA´s activities, although they need to be made more attractive not only to data professionals but also to the wider scientific community and the private sector. CODATA and WDS will jointly sponsor the biennial Conferences hereon, an initiative that can only be welcomed as a means of increasing the impact of the events, and bringing the activities of the CODATA and WDS to a greater audience. Pooling intellectual and financial resources with WDS in the planning and

organization of the Conferences will be clearly advantageous to both. Improving the possibilities for young investigators, especially from developing countries, to participate should be a high priority, as should an effective and rapid dissemination of the presentations made at the conferences themselves, through webcasts and the like.

The founders of CODATA envisioned Task Groups as a key mechanism for bringing together experts from a range of countries and different disciplines to address specific issues of interest to the scientific and technical community. The principal Task Group activity is organizing workshops and seminars at which the substantive issues related to the aims of the Task Group are discussed. While these events might be useful and stimulating for the participants, the wider purposes of CODATA are not served if the outcomes of such workshops are not effectively distributed. The selection procedure is democratic and dynamic, and provides opportunities for new ideas being developed from bottom up.

While the CODATA Constitution allows for Working Groups to set up by the Executive Committee as tools for strategic activities, these seem not to have been effectively deployed.

The *Data Science Journal* is a peer-reviewed, open access, electronic periodical set up by CODATA in 2001 to publish papers on the management of data and databases in science and technology. Although a pioneer at that time, today the *Data Science Journal* finds itself competing with an increasing number of peer-reviewed, open access e-journals. Feedback from the CODATA and ICSU memberships on the journal ranges from lukewarm to the strongly negative, and it is clear that in its current state it cannot be considered an effective channel of communicating scientific information. CODATA itself is aware of the precarious situation of the journal and has started exploring options for the future, including co-publication with an established publishing house.

In the *Strategic Plan for 2006-2013*, the digital divide receives special attention as one of the three main initiatives – to be addressed by a specific suite of activities aimed at making critical scientific data and associated tools and resources related to sustainable development widely accessible in developing countries. However, the role of CODATA in education and capacity-building has been rather modest, even though there is a recognized need for such activities. Suggestions are made as to how CODATA could develop, together with ICSU and its major integrated science programmes, educational activities that focus on data and information

Despite attempts at recruitment, the number of National Members currently stands at only 21 compared with ICSU´s 120, and it seems that CODATA has not been able to convince current and potential national members of the benefits and value-for-money that the organization offers. Convincing arguments and clearly described benefits need to be articulated to provide a firm basis for the recruitment of new paying members.

CODATA has a very modest Secretariat, but one that is doing an excellent job in supporting the Officers, the Executive Committee and the Task Groups, as well as preparing for the biennial CODATA conference.

Since the finances of the organization are almost entirely dependent upon the dues paid by National Members, the total CODATA annual budget is small; it is nevertheless handled very competently.

Despite the constraints, CODATA is well placed to meet the challenges and opportunities being presented by the major new interdisciplinary research initiatives that are being developed, and the data and information technologies which serve them. It should be encouraged to do so through progressively greater collaboration with other like-minded organizations, and especially WDS.

Joint strategic planning activities between CODATA and WDS, and joint preparations for the biannual conferences, need to be initiated forthwith, and they should be seen as part of a process leading to the eventual bringing together of the two into a single Interdisciplinary Body of ICSU.

Recommendations

Having taken into consideration the strengths, challenges and opportunities shown by, and presented to, CODATA, the Review Panel makes the following recommendations:

1. CODATA should consider carrying out a web-based "visioning process" by soliciting proposals for a very limited number of the most important issues in the data and information field in the coming decades.

2. CODATA should establish, together with WDS, a permanent Joint Strategic Planning Committee.

3. CODATA needs to carry out an analysis of the effectiveness of its methods of communication to the scientific community.

4. CODATA should set up a permanent Joint Programme Committee with WDS to raise the profile of the (joint) biennial conference by inviting top keynote speakers from beyond the 'CODATA family', promoting the participation of young scientists, opening the programme to related fields (e.g. IT, computer science), improving the visibility and impact of the proceedings, and engaging the IT industry.

5. Rather than requiring all Task Groups to seek renewal every two years, CODATA should set up standing committees on certain long-term key issues such as Fundamental Physical Constants, Data Quality and Access, and others determined on the basis of current strategic priorities.

6. The CODATA Executive Committee should pursue active negotiations with established open access publishers to create a partnership that would strengthen the status of the *Data Science Journal* and ensure a role for CODATA in developing publication practices particularly suitable for data science.

7. CODATA should develop an action plan for capacity building in collaboration with WDS and ICSU´s Regional Offices, with the eventual goal of setting up new data centres in the developing world and thus filling significant gaps in global coverage.

8. CODATA needs to reconfigure its website in order to improve both its usability and information content.

9. CODATA needs to actively recruit both mid-career and young data scientists to its governance and Task Group activities.

10. Since the data and information stage is crowded with actors large and small, with varying interests and agendas, it would be useful for CODATA to conduct an analysis of the field to better define its own niche and potential areas of impact, to avoid unnecessary duplication of effort, and to promote cooperation instead of competition while improving its own visibility. Such a mapping exercise, if published, would also be of great benefit to the broad scientific community.

11. Encouragement should be given to the setting up of national and union data committees, preferably with a mandate to interact with both CODATA and WDS.

12. CODATA should explore possibilities of strengthening its financial base, not only by recruiting new national, institutional and individual members but also by collaborating with funding and developmental agencies as well as private industry.

13. ICSU should recognize the growing importance of data and information for science by appointing an *ex officio* representative of CODATA to the Scientific Committees of all its research programmes, and by consolidating and strengthening its own organizational structure, ultimately within a single Interdisciplinary Body for data and information. [1]

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[1] See Preface for the decision of CSPR on Recommendation 13.

1. Introduction

In accordance with its Statutes, the International Council for Science (ICSU) conducts periodic external reviews of its programmes and committees, and the Scientific Interdisciplinary Bodies (IBs). One such IB is the Committee on Data for Science and Technology (CODATA) founded in 1966. In the Strategic Plan of ICSU for 2012-2017 a review of CODATA was scheduled for 2012-2013; this document is the Report of the Review Panel set up by the ICSU Committee for Scientific Planning and Review (CSPR) for the purpose.

1.1 Background – the data and information environment and ICSU

1.1.1 Priority Area Assessment

ICSU had been involved in stimulating and coordinating scientific data and information since the 1950s when the World Data Centres (WDCs) were established as part of the International Geophysical Year of 1957-58. By the concluding years of the second millennium and the opening of the third, it was universally recognized that data and information were the essential building blocks of the scientific endeavour. The technologies for the generation of data and information, as well as their management and dissemination, had been rapidly developing, and the needs of science itself were changing. Accordingly, ICSU recognized scientific data and information as a priority area in the run-up to the development of its first Strategic Plan for the years 2006-2011.

In 2003 ICSU's CSPR appointed an international panel of independent experts to perform a Priority Area Assessment (PAA) on Scientific Data and Information (ICSU, 2004): an operation that would assess the strategic issues in this area and review ICSU's current activities. The assessment focused primarily on the needs of science and did not seek to address the issues surrounding the provision and communication of scientific data and information for use by policy makers, industry and society as a whole. Subjects to be addressed included the respective roles of the public and private sectors in data issues, the need for professional data management, standardization in metadata, as well as interoperability, equitable access to data and information, the digital divide, and intellectual property rights.

The PAA recognized that ICSU had played a central role in the development of interdisciplinary and internationally coordinated research programmes in global environmental science; there was now, it felt, a need for an equally strong role in establishing an international infrastructure and capacity for scientific data and information management and access that would meet the needs of scientists in all countries and protect the interests of current and future generations of scientists. In short, it strongly recommended that ICSU assume an international leadership role in identifying and addressing critical policy and management issues related to scientific data and information, and that it create a new global framework for data and information policy and management. The essence of the development of this global framework was to be the closer coordination, and in some instances the transformation, of ICSU's current scientific data and information activities.

While it was not within the remit of the PAA to carry out an in-depth review of the individual ICSU bodies, the Panel did look at the activities and achievements of the main actors in the data and information arena: CODATA, the International Network for the Availability of Scientific Publications (INASP), the International Council for Scientific and Technical Information (ICSTI), the International Federation for Information Processing (IFIP), the WDCs, the Federation of Astronomical and Geophysical Data Analysis Services (FAGS), the global observing bodies and the then ICSU Committee on the Dissemination of Scientific Information (CDSI).

The Panel made many recommendations (well over fifty) based on its broad review of the various ICSU bodies and activities, but arguably just two are of special relevance to this present exercise. First, it proposed that CODATA should develop a clear long-term strategy that focused on key international data management and policy issues, giving special attention to the needs of developing countries. Second, it recommended that the infrastructure made up of FAGS and the WDCs be updated and revised to take account of new technologies and capabilities, and thus better serve the needs of existing and newly developed research programmes.

The recommendations of the PAA were duly taken into consideration in the drafting of ICSU's first *Strategic Plan 2006-2011*, and the specific actions proposed included responses to the two recommendations described above. A third action involved the creation of an ad-hoc strategic committee to oversee the development of ICSU's new international framework on data and information.

1.1.2 Strategic Committee on Information and Data

The Strategic Committee on Information and Data (SCID) was established by decision of the 28th ICSU General Assembly in 2005 and would meet three times during the months that followed. Taking the PAA as its point of departure, the Committee considered input from CODATA, FAGS and the WDCs, as well as information on major international data and information initiatives of strategic importance to ICSU. Its recommendations were presented as part of the SCID Report to the ICSU CSPR (ICSU, 2008).

Whilst recognizing that CODATA had its own Membership, governance and dues structure independent of ICSU, SCID recalled that it was an ICSU Interdisciplinary Body and should be an important component of the implementation of ICSU's strategy. It recommended that CODATA focus on the three main initiatives identified in its draft Strategic Plan 2006-2012 developed in response to the PAA – the Global Information Commons for Science Initiative (GICSI), the Scientific Data across the Digital Divide (SD³) programme, and Advanced Data Methods and Information technologies for Research and Education (ADMIRE) . This would require closer alignment of the implementation mechanisms of CODATA (task groups and working groups) with the strategy, and close working links with the proposed new World Data System (WDS) to be formed from the WDCs, FAGS and other state-of-the-art centres and services (see below). The Committee felt that WDS would be informed by CODATA's expertise on data policy and best practice; and CODATA itself would be strengthened by exposure to the operational challenges facing the data centres and services. SCID raised the possibility and set out the advantages of WDS becoming involved in the biennial conferences organized by CODATA in the future.

1.1.3 Strategic Coordinating Committee on Information and Data

In response to one other SCID recommendation, ICSU established an ad-hoc Strategic Coordinating Committee on Information and Data (SCCID) for a period of three years to provide broad expertise and advice in this area. The Committee's terms of reference included the development of a coordinated strategy for training and capacity enhancement in data and information stewardship with a particular emphasis on the developing countries and involving CODATA, WDS and other relevant Interdisciplinary Bodies, the provision of strategic advice for WDS and the continued development of CODATA, and the promotion of international discussions on key data and information issues including global access. After four meetings, the Committee produced its interim (and, as it turned out, final) report to the ICSU CSPR in April 2011 (ICSU, 2011), a document that contained 14 recommendations to improve universal and equitable access to data and information for science. Of these, the following made specific reference to CODATA:

- *CODATA should consider as the theme for its 2012 biennial conference how data science can support the delivery of the science goals of the major ICSU Earth System Research for Global Sustainability initiative and the Planet under Pressure conference organized by ICSU's Global Environmental Change programmes planned for March 2012 in London.*

- *Both the CODATA and the World Data System biennial conferences should include forums for data professionals to share experiences across a range of science disciplines.*

- *ICSU should exploit more fully the expertise in data standards already present in CODATA, the WDS and in its Scientific Union Members to assist in the definition and maintenance of high level data standards appropriate to meet both disciplinary requirements and overall science interoperability standards.*

- *ICSU needs to use CODATA, the WDS and the National and Union Members in a coordinated way to improve access to data and information in less economically developed countries.*

- *The WDS should be the natural home for science in-reach activities and should work with CODATA on raising visibility of data and information management by scientists.*

1.2 World Data System

The World Data System (WDS) was established by the 29th ICSU General Assembly in 2009. WDS essentially builds on the 50-year legacy of the former ICSU World Data Centres (WDCs) and former Federation of Astronomical and Geophysical data analysis Services (FAGS), and aims at a transition from existing stand-alone services to a common, globally interoperable, distributed data system that exploits emerging technologies and incorporates new scientific data activities. WDS is striving to become a worldwide **'community of excellence'** for scientific data that will ensure the long-term stewardship and provision of quality-assessed data and data services to the international science community. Its objectives are to:
- enable universal and equitable access to quality-assured scientific data, data services, products and information;
- ensure long-term data stewardship;
- foster compliance to agreed-upon data standards and conventions; and
- provide mechanisms to facilitate and improve access to data and data products.

WDS is governed by an international Scientific Committee, supported by an International Programme Office set up in Tokyo and hosted by the Japanese National Institute of Information and Communications Technology (NICT). The Terms of Reference of the Scientific Committee stipulate that WDS should develop close links and cooperation with CODATA.

WDS is in the process of establishing a membership base in the data and information community. As of 1 February 2013, WDS has 47 Regular Members, 3 Network Members (representing groups of data centres), 3 Partner Members (providing funding or support), and 9 Associate Members (interested but not directly supporting organizations).   Regular Membership includes numerous former WDCs and members of FAGS, and many other data centres, services and organizations have joined the WDS, have expressed interest in doing so, or are in the process of accreditation. Particular efforts are being made to expand both the geographical and disciplinary coverage of WDS.

The criteria for membership are designed to provide a transparent and objective base for the evaluation and accreditation of candidate organizations as well as for periodic assessment of WDS Members and overall performance of the system. This procedure is designed to ensure the trustworthiness of WDS Members' data and data products in terms of authenticity, integrity, confidentiality and availability.

CODATA and WDS clearly enjoy a good working relationship at the level of their Secretariats. Nevertheless, interaction could be made more systemic and thus more effective, and some suggestions are made to this effect in what follows.

1.3 The CODATA review process

Membership of the ICSU ad-hoc Review Panel was established by CSPR on the basis of nominations made by National Members, International Union Members and Interdisciplinary Bodies following a call put out in April 2012. A list of members of the Review Panel is given as Appendix 1, and the Terms of Reference of the Panel, as approved by CSPR are set out in Appendix 2.

The first meeting of the Panel took place in Paris on 30-31 July 2012. Participants discussed the Terms of Reference of the Review, and benefited from a preliminary presentation on CODATA by its Executive Director, as well as teleconference interaction with the CODATA Secretary-General. The Panel determined its methods of work, and developed a limited number of simple questionnaires, whose content was slightly modified according to type of recipient (see Appendix 3), to be sent out electronically to the entire ICSU Membership and to Members of CODATA. The online survey was dispatched on 22 August 2012 and closed on 5 October 2012. A total of 241 e-mails were sent out and 41 completed questionnaires were received back. A summary of responses from the various ICSU and/or CODATA constituents is given in Appendix 4.

Members of the Review Panel were also provided with documentation relating to the past and present work of CODATA, and information on its governance and financial affairs was kindly made available by the CODATA Secretariat.

The main documents consulted by the Review Panel are listed under References.

It was agreed that the Panel would hold a second meeting within the framework of the upcoming 23rd International CODATA Conference which was to be hosted by the Academy of Sciences located in Taipei on 28-31 October 2012, and immediately followed by the CODATA 28th General Assembly on 1-2 November 2012. This allowed Panel Members to not only experience the major scientific event organized periodically by CODATA first hand but also be present at the meeting of its main governing and decision-making body. They interviewed the current Officers and Executive Committee of CODATA, three of its past-Presidents, officers of the WDS and leading personalities from the data and information community.

On the final day in Taipei the Panel Members deliberated over all the inputs and opinions gathered from the various sources, and arrived at a general consensus regarding the Panel's main approach to enable a first version of its draft report to be completed. Members further refined the draft report subsequently through electronic communication.

The Review Panel would like to take this opportunity of thanking all those individuals who gave freely of their time, advice and opinion during the preparation of this Review.

1.4 History of CODATA[2]

The rapid expansion of science and development of automated means of measurement led, in the early 1960s, to concern among leading physical scientists that much of the data being accumulated could not be safely stored and/or retrieved and might therefore be lost to later research. A group of "founding fathers" from the USA, UK, Germany, Japan and the USSR proposed to ICSU that a new organization be set up to improve the management and preservation of scientific data and to bring together interested groups from around the world. Thus in 1966 the 11th ICSU General Assembly approved the founding of CODATA, assigning to it a mission much the same as it has today.

Following an early preparatory phase, mechanisms of governance and function were set up in the early 1970s that have largely been preserved. The CODATA Constitution recognized National and Union Members as well as Co-opted organizations. The hallmark biennial conferences were started in 1968, at which time the first four Task Groups also became active, including one on Fundamental Physical Constants that is still active today (a list of recent and current Task Groups may be found in Appendix 4).

The main achievements of CODATA in the 1970s include a key role in providing definitive values for fundamental constants, key thermodynamic data, and chemical kinetic data for atmospheric modeling, as well as broadening its disciplinary base to geosciences and biosciences, addressing the data needs of developing countries together with UNESCO, and expanding membership to 16 countries and 17 unions.

During the 1980s the transition of CODATA to broader disciplinary participation continued, and important operational projects were launched, including the Hybridoma Data Bank, the Microbial Strain Data Network, and the CODATA Referral Database. Collaboration with other organizations increased, especially within the ICSU and UN spheres, and four new member countries from Asia were admitted. The decade was characterized by a rapid expansion in modern information technologies.

The development of the Internet during the 1990s gave vastly expanded possibilities for the data community but also presented significant challenges for data quality and stewardship. Historians characterize this decade as one of strong scientific activities, stable membership, and adequate finances.

During the first decade of the third millennium, CODATA played a significant role in major international events or programmes such as the World Summit on the Information Society (WSIS), the International Polar Year (IPY) and the Group on Earth Observations (GEO), and started to address the problem of the digital divide, especially in Africa. Otherwise, this period was described in words similar to those applied to the preceding one, i.e. vigorous scientific activity, stable membership, adequate finances, and untold thousands of hours of volunteer time on the part of highly skilled experts.

Lide and Wood (2012) includes an interesting quote from Frederick Rossini, considered a prime mover in the foundation of CODATA, who envisioned "an array of World Centers of Numerical Data for Science and Technology, covering each area of science, and appropriately tying in with the Central Office of CODATA as a hub." This vision did not materialize for CODATA but has done so for another ICSU Interdisciplinary Body: the WDS.

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[2] To celebrate the first 45 years of CODATA, an evolutionary account of the organization covering the years from 1966 to 2010 has been published, *CODATA@45Years* (Lide and Wood, 2012), and this is an invaluable source of historical information on the organization.

2. Strategic planning and priority-setting

In keeping with the Priority Area Assessment (ICSU, 2004) recommendation that ICSU assume an international leadership role in scientific data and information matters, ICSU´s *Strategic Plan for 2006-2011* (ICSU, 2005) set the goal of facilitating a coordinated global approach to data and information. This was to be spearheaded by CODATA, and CODATA was encouraged to develop a long-term strategy of its own, giving special attention to the needs of developing countries.

In response to these developments, CODATA formulated its *Strategic Plan for 2006-2012* (CODATA, 2005), stating its mission as being "to strengthen international science for the benefit of society by promoting improved scientific and technical data management and use". Three major cross-cutting initiatives were launched:

1. Global Information Commons for Science Initiative (GICSI)
2. Scientific Data across the Digital Divide Program (SD^3)
3. Advanced Data Methods and Information technologies for Research and Education (ADMIRE).

The strategy also proposed strengthening CODATA´s own institutional capacity by expanding membership in all categories, securing finances through externally funded projects and a Gift and Endowment Fund, as well as strengthening the Secretariat. To focus and improve its existing portfolio of activities, the Task Groups and Working Groups, as well as editors of the *Data Science Journal* (DSJ), were encouraged to contribute more effectively towards the three main initiatives, new Committees or Working Groups were proposed for data policy and technology, and the need for more effective outreach to the scientific community through both printed and electronic means was emphasized.

SCID (ICSU, 2008) recommended that CODATA focus on the three major initiatives, and this it felt would require closer alignment of the implementation mechanisms (Task Groups and Working Groups) with the strategy, and close working links with the new WDS.

Towards the end of the first strategic period came the report of SCCID (ICSU, 2011a), which contained several recommendations relevant to CODATA. These included better coordination and closer collaboration between CODATA and WDS, as well as using the biennial conferences as a means by which data science may play a bigger part in the delivery of the scientific goals of ICSU´s scientific programmes and activities (e.g. in global environmental change research) and a forum for data professionals to exchange views.

On the basis of a review of the first strategic period and the recommendations of SCCID, a new *Strategic Plan for 2013-2018* was developed by the CODATA Executive Committee (EC) and circulated among the membership for comments. The plan was examined at the 28th General Assembly in Taipei in November 2012 and approved in principle (CODATA, 2013).

Three new major initiatives were proposed, partly based on the previous ones:

1. Policy and Institutional Frameworks for Data
2. Frontiers in Data Science and Technology
3. Data Strategies for International Science

Key issues under initiative 1 include open access, intellectual property, and changes in the ways in which data are gathered, managed, analysed, preserved, and made accessible not only by scientists but also by many other stakeholders. A major tool for implementing this initiative would be a proposed new Data Policy Committee. Under initiative 2, data citation standards and practices and nanomaterials are mentioned, both of them already on CODATA´s agenda. Initiative 3 would imply closer collaboration with ICSU´s current and future research programmes, such as the Future Earth initiative and the Integrated Research on Disaster Risk (IRDR) programme, to ensure sound data management and infrastructure in a timely manner to meet desired objectives such as open access. This new strategy was approved by the CODATA membership in Taipei.

2.1 Observations of the Review Panel

In order to broaden the participation in the priority-setting process, and to energize the scientific community beyond its core group, CODATA might consider a "visioning process" by soliciting proposals for a very limited number (say 2-3) of the most important issues to be addressed in the data and information field in the coming decades. Such an exercise was carried out by ICSU in 2009 to define the Grand Challenges in Global Change Research and led to the Future Earth initiative. Experience from this relatively simple web-based process was overwhelmingly positive and could serve as a model for a similar project by CODATA (possibly in collaboration with WDS).

> **Recommendation 1.** CODATA should consider carrying out a web-based "visioning process" by soliciting proposals for a very limited number of the most important issues in the data and information field in the coming decades.

Global information commons for science (GICSI), one of the three main initiatives for the first strategic period, was launched in 2005 and was recognized as a CODATA achievement in the list of initiatives in the "WSIS Golden Book" published following the Second (Tunis) Phase of the World Summit on the Information Society (WSIS, 2005). A Task Group was approved in 2008 to take the agenda forward. CODATA was a partner in organizing several international conferences and workshops mainly dealing with open access to data, contributed to the drafting of OECD principles and guidelines for access to data obtained with public funding, played a significant role in the GEO Data Sharing Task Force (co-chair in 2009-2011) and is co-chair of the ongoing Data Sharing Working Group (2011-15).

However, CODATA does not always get the credit it deserves. For example, neither CODATA nor ICSU is listed as a participating organization of WSIS and CODATA only receives a half-sentence mention in the official final documents. Neither is the Task Group on GICSI mentioned in the documentation of the European Union-funded COMMUNIA Network on the Digital Public Domain, nor in the OECD Principles and Guidelines document (OECD, 2007) that CODATA helped to develop. CODATA is not among the 60-plus Participating Organizations of GEO, although ICSU and several others of its interdisciplinary bodies are (and notably WDS as of November 2012). Exhaustive detective work failed to locate the final version of the White Paper on GEOSS data-sharing principles, but the draft version (September 2008) did at least reflect – and was largely the result of – the significant role played by CODATA.

The second main initiative within the period of the first Strategic Plan, SD[3], was meant to make critical scientific data and associated tools and resources related to sustainable development widely accessible in developing countries. A Task Group (currently: Preservation of and Access to Scientific and Technical Data in/for/with Developing Countries – PASTD) has been functioning since 2002. The main activities have involved organizing conferences, workshops and training events, mostly in collaboration with a range of partners (scientific organizations, UN and development agencies,

NGOs, universities, and so on); this again makes it difficult to assess CODATA´s specific contribution. CODATA's Young Scientist Working Group (recently re-established as the Early Career Working Group) has been active in involving a wide range of early-career scientists in CODATA conferences and other events, and in drawing attention to their roles and needs with respect to the evolution of data science. Overall, however, it must be said that capacity building has not received great attention on the CODATA agenda.

The acronym of the third initiative within the first strategic period, ADMIRE, stands for Advanced Data Methods and Information Technologies for Research and Education, the idea being to strengthen linkages between the computer science community involved in data mining, data integration, artificial intelligence, and other techniques with particular scientific areas where such approaches could be especially valuable, including materials science, the geosciences, astronomy, ecology, and genetics. Achievements listed under this umbrella include the work of the CODATA-ICSTI Task Group on Data Citation Standards and Practices, such as unique digital identifiers, as well as a workshop on Developing Data Attribution and Citation Practices and Standards, in collaboration with the US National Committee for CODATA. It is not clear whether contacts with the computer science community have been established.

In addition to the three main initiatives, the 2006-2012 strategy listed a number of other proposals to expand the scientific, technical, and institutional capacity of CODATA. These will be addressed later in the Report (under Organization and Governance). There was also a stated goal to strengthen the contribution of Task Groups, Working Groups, and the *Data Science Journal* to the main strategic initiatives.

Most of the new strategic initiatives proposed for 2012-2018, and the specific issues to be addressed as part of them, have been or are currently on the CODATA agenda. Thus they represent only a modest level of ambition and present no new exciting visions to strengthen the influence and broaden the scope of CODATA. To oversee the implementation of the strategic goals, to monitor key policy developments, to liaise with CODATA members, and to advise the broader scientific community on data issues, the strategy proposes the establishment of a permanent Data Policy Committee. This is a positive development, but could be taken a step further with the additional development of a joint (CODATA-WDS) strategic body having a broader mandate covering all of the issues in the data and information field that require attention from either organization. The latter committee would provide a formal mechanism through which the already good working relationship between CODATA and WDS might be built upon and new avenues for joint activities identified and explored.

> **Recommendation 2.** CODATA should establish, together with WDS, a permanent Joint Strategic Planning Committee.

2.2 Strengths

Both Strategic Plans are in good agreement with the priorities of ICSU itself and the recommendations for CODATA stated in ICSU´s strategies. Likewise, the recommendations of both SCID and SCCID have been taken into account in the planning process.

The Strategic Plans reflect the ambition of CODATA to be at the forefront of new developments in their field and science in general. The major initiatives proposed in the two plans focus on important issues within the broad scope of the CODATA mandate. They are widely applicable across multiple disciplines and pay attention to the needs of the developing world.

2.3 Challenges

There is an obvious difficulty in integrating top-down strategic planning with the traditional *modus operandi* of CODATA: bottom-up Task Group (TG) proposals and their biennial evaluation at the General Assembly. Input from the members to the setting of strategic goals appears to be unenthusiastic, as is the case with ICSU itself. Although there may be some guidance for topics of TGs, their matching with the strategic goals seems to occur rather by chance than design. The proposals should provide an explanation as to how the TG activities would contribute to the specific aspects of CODATA´s mission, initiatives/objectives, but the six evaluation criteria make no mention of the overall strategy. Since 2006, 10 TGs have been launched, two of which have already been terminated, but fitting even half of them under the strategic framework requires a broad interpretation of the initiatives. Of course, not all TG activities need to be wholly subject to the strategic aims of the organization.

For CODATA – and ICSU as its parent organization – to assume an international leadership role in the field of scientific data and information, the visibility of CODATA needs to be improved. One cause of the problem may be that most of CODATA´s activities are implemented in collaboration with other, more visible partners, and also that the individuals representing CODATA may wear other hats and be identified with other organizations. Thus it does seem that much of the excellent input CODATA makes is not duly acknowledged.

It should perhaps be noted in passing that the *Strategic Plan for 2006-2012* is not a document that is easy (or even possible) to identify on, and download from, the CODATA website, and this may be a reflection on a lack of reference made to it on a regular basis during programme implementation.

Finding effective distribution channels for the deliverables that CODATA and its Task Groups generate is another strategic challenge. Ideas are developed, problems are addressed, solutions are worked out, and recommendations are made usually in workshops and conferences, and delivered to the wider public through conference proceedings, journal articles (printed or electronic), position papers, and so on. While 'live' meetings are often creative and useful, the benefits will be limited to the participants if the presentations and outcomes are not shared.

> **Recommendation 3.** CODATA needs to carry out an analysis of the effectiveness of its methods of communication to the scientific community.

3. Performance

The Constitution of CODATA specifies its mission ("to strengthen international science for the benefit of society by promoting improved scientific and technical data management and use") and four goals as well as ten specific actions to be pursued to achieve the mission. The *Strategic Plan for 2006-2012* defines the three major new initiatives (discussed above),as well as six measures to focus and improve the existing portfolio of activities, and seven ways to expand CODATA´s own scientific, technical, and institutional capacity. The Review Panel has attempted to evaluate to what extent and how successfully these goals and specific action plans have been addressed. Furthermore, it has analysed the feedback from ICSU and CODATA Members as well as ICSU´s Interdisciplinary Bodies and Scientific Associates.

3.1 CODATA activities and deliverables

3.1.1 International CODATA Conferences

There is no doubt that the biennial International CODATA Conferences represent one of the most important and valuable of CODATA´s activities. First begun in 1968, these events are hosted by a succession of volunteer National Members, the latest conference to be held being the 23rd Conference hosted in October 2012 by the Academy of Sciences located in Taipei. Since 1974 the conferences have been convened in tandem with the CODATA General Assembly.

The International CODATA Conference is the preferred forum for many data professionals to present and discuss their achievements and problems, and there seems not to be much competition for this status. Attendance rates have ranged between 200 and 400 per event (just over 600 being the record) inclusive of local participation. These must be considered rather modest when compared with the work put into organizing each event. Many opinions were expressed to the Review Panel that the conference could and should be developed into an even more significant event on a global scale. Efforts could be made to attract an even larger and more multidisciplinary audience from among, for example, IT professionals, computer scientists and those with commercial interests. A large well-organized conference would also have the potential to strengthen CODATA´s finances.

Improving the possibilities for young investigators, especially from developing countries, to participate should be a high priority and needs to be taken into account in the choice of venue, programme planning, and the exploration of financial support with development and funding agencies. Another priority is to effectively and rapidly disseminate the presentations made at the conferences themselves, through webcasts and the like.

It has been agreed between CODATA and the ICSU World Data System (WDS) that the two bodies will jointly sponsor the biennial Conferences hereon, beginning with the 24th meeting being planned for New Delhi, India, in 2014. This initiative can only be welcomed as a means of increasing the impact of the event, and bringing the activities of the CODATA and WDS to a greater audience. Pooling intellectual and financial resources with WDS in the planning and organization of the conferences will be clearly advantageous to both.

> **Recommendation 4.** CODATA should set up a permanent Joint Programme Committee with WDS to raise the profile of the (joint) biennial conference by inviting top keynote speakers from beyond the 'CODATA family', promoting the participation of young scientists, opening the programme to related fields (e.g. IT, computer science), improving the visibility and impact of the proceedings, and engaging the IT industry.

3.1.2 Task Groups

The founders of CODATA envisioned Task Groups as a key mechanism for bringing together experts from a range of countries and different disciplines to address specific issues of interest to the scientific and technical community. Modest seed funding for travel was to be provided by CODATA, and a prescribed output was expected. The first four Task Groups were established after the 1968 CODATA Conference. New Task Groups are established, or the two-year mandates of existing ones renewed, at each General Assembly. Proposals are prepared by each Group or would-be Group, and these are evaluated by three referees; all such submissions are considered by the CODATA Executive Committee, and recommendations made to the Assembly for approval by vote. The application forms request a definition of the deliverables that are supposed to be produced. The deliverables listed by the currently active Task Groups include the following:

- o Self-organized workshops, meetings, seminars, conferences
- o Training courses, best practice demonstrations
- o Presentations at meetings organized by stakeholder groups/organizations
- o Books, white papers, articles, conference reports published in printed form
- o Electronic publications in the *Data Science Journal*, CODATA Newsletter or other e-forums
- o Databases, repositories
- o Consultations with decision-makers

The principal Task Group activity is organizing workshops and seminars at which the substantive issues related to the aims of the Task Group are discussed. While these events might be useful and stimulating for the participants, the wider purposes of CODATA are not served if the outcomes of such workshops are not effectively distributed. The main channels for such distribution are CODATA´s own *Data Science Journal* (see below), other professional publications, and the websites of CODATA, Task Groups or partner organizations. Whatever the forum, the crucial issue is its impact and visibility. Since data and information are becoming increasingly important in all fields of science, attempts should be made to reach outside the immediate community of data professionals. Debate on novel and cross-cutting issues should be initiated and encouraged in general scientific arenas such as the meetings of the American Association for the Advancement of Science (AAAS), the European Open Science Forum (ESOF), *Nature* and *Science*. On occasions where meetings are organized in partnership with others, due recognition of CODATA input should be ensured in the final documentation.

Given that the call for new Task Groups or renewal of the current ones mainly reaches individuals and organizations already involved with CODATA, there is a risk of inbreeding and failure to infuse new ideas and new individuals to enrich the portfolio of activities. The current application form does request an explanation as to how the TG activities would contribute to specific aspects of CODATA´s mission and initiatives/objectives, but none of the six criteria used to evaluate TG proposals makes any mention of a contribution to the overall strategy's being a plus in the evaluation. The result is that several of the Task Groups appear far from the strategic objectives and do not give an impression of a focused organization. The CODATA Task Groups active since 2000 are listed in Appendix 5.

One of the original four Task Groups, the Task Group on Fundamental Physical Constants remains active to this day, and has become an authoritative voice for the global physical sciences community. It has recently become an official member of the Consultative Committee for Units (CCU) of the International Committee for Weights and Measures (CIPM) and is currently providing input and is

slated to provide data to the CCU for a major change in the International System of Units (SI). This Task Group is a flagship activity of CODATA and should be protected, while room needs to be left for fresh ideas and openings by means of other TG initiatives.

In addition to Task Groups, the CODATA Constitution allows for Working Groups, set up by the Executive Committee, to be used as a tool for strategic activities, but these seem not to have been effectively deployed.

> **Recommendation 5.** Rather than requiring all Task Groups to seek renewal every two years, CODATA should set up standing committees on certain long-term key issues such as Fundamental Physical Constants, Data Quality and Access, and others determined on the basis of current strategic priorities.

3.1.3 Data Science Journal

The *Data Science Journal* is a peer-reviewed, open access, electronic journal set up by CODATA in 2001 to publish papers on the management of data and databases in science and technology. Data science was then seen to be emerging as an important component of the information revolution. It was felt that a new journal would provide an international focal point for this work, and experience had shown that a journal would allow individual researchers to feel part of, and nurture, a scientific community.

At the time of the journal's establishment, no international journal existed that covered the topics associated with the collection, evaluation, analysis, dissemination and use of scientific data, especially on a multi-disciplinary basis. The proposed journal was to be a unique publication facilitating the development and sharing of new knowledge about all aspects of scientific and technical (S&T) data. Today, the *Data Science Journal* has passed its tenth anniversary, and from being a pioneer in its category it now finds itself competing with an increasing number of peer-reviewed, open access e-journals.

The scope of the journal includes descriptions of data systems, their publication on the internet, applications and legal issues. Most of the sciences are covered, including the physical sciences, engineering, the geosciences and the biosciences, along with agricultural and the medical sciences. The journal publishes data or data compilations, provided that the quality of data is excellent or if significant efforts are required in compilation. It claims to publish online simulation, database and other experiments, intending to overcome the inherent limitations of traditional, static print journals, thereby adding a new dimension to the communication and exchange of data science results and educational materials. Annual volumes have usually contained 20-30 papers making up 220-270 pages. In recent years the journal has included materials presented at various data conferences and workshop events, and this has tended to mask a rather low rate of normal paper submission (30-40 papers annually over recent years, with relatively high rejection rates and only 6-8 published). An analysis of recent authorship suggests that the majority of authors are located in the Asian region. Some issues around delays in editorial processing have been reported. The journal is currently hosted in Japan, use being made of the J-Stage (Japan Science and Technology Information Aggregator, Electronic) publication platform provided by the Japanese Government free of charge through CODATA Japan; however, it is directly accessible from the CODATA website.

The performance of the journal is difficult to assess, because it is not one of the 12,000 top-tier international and regional journals covered by the *Thomson Reuters ISI Web of Knowledge*, it does not have a measurable impact factor and the number of citations to its articles is unavailable. The

Review Panel has not been able to obtain information on the journal's readership or the number of visits to its website over the longer term, but the number of articles accessed electronically per month during 2012 is reported to be steady at 525-550, with the number of monthly downloads of articles totaling 2000.

Feedback from CODATA and ICSU membership on the journal ranged from lukewarm to the strongly negative. It is clear that in its current state the journal cannot be considered an effective channel of communicating scientific information, and exhorting CODATA members and Task Groups to favour it over other publishing options may be doing a disservice to the community.

The problems and challenges faced by the journal cannot be solved by the highly dedicated but voluntary and part-time editors with meagre resources. Examination of its Audited Accounts over recent years shows that CODATA is devoting funds of the order of US$11,000 to the journal annually. While these amounts are certainly modest in publishing terms, they are not insignificant when viewed in the context of the yearly budgets of CODATA as a whole.

How to transform the journal so as to give it realistic opportunities of being the pre-eminent peer-reviewed, open-access periodical in the field of data and information once again is clearly a major challenge for CODATA. The Review Panel is in no position to offer ready-made solutions to the dilemma faced by CODATA in this regard, but a thorough evaluation of the options is necessary, keeping in mind that in any case it is in the interest of CODATA to retain a significant role in developing publication policies and practices for scientific data.

CODATA itself is aware of the precarious situation of the *Data Science Journal* and has started exploring options for the future. The 28th General Assembly of 2012 declared itself especially excited about the potential for enhancing the visibility and stature of the *Data Science Journal* by partnering with a major publisher such as Nature Publishing Group, Wiley-Blackwell, or the Public Library of Science (PLOS). The General Assembly invited the Executive Committee to work with the CODATA five-member Journal Working Group to define basic and desired criteria for such a partnership and then initiate more direct discussions with interested publishers, bearing in mind the need for flexibility in financial models for readers and authors. The Executive Committee was authorized to determine how the journal would be published for the next four years.

> **Recommendation 6.** The CODATA Executive Committee should pursue active negotiations with established open access publishers to create a partnership that would strengthen the status of the *Data Science Journal* and ensure a role for CODATA in developing publication practices particularly suitable for data science.

3.1.4 Education and capacity building

The role of CODATA in education and capacity-building has been rather modest, even though there is a recognized need for such activities, spelled out for example by the SCCID. In the *Strategic Plan for 2006-2013*, the digital divide receives special attention as one of the three main initiatives – to be addressed by a specific suite of activities aimed at making critical scientific data and associated tools and resources related to sustainable development widely accessible in developing countries. The Task Group for Preservation and Archiving of Scientific and Technical Data in Developing Countries has conducted one workshop on the Open Knowledge Environment in developing countries, and is planning to continue these events, as well as showcase best practice workshops together with partner organizations.

On the basis of a review of science education, the ICSU General Assembly in Rome (2011) decided that the educational mission should be incorporated into all of ICSU´s research programmes, rather than the setting up of a separate educational initiative. In line with this decision, CODATA could develop, together with ICSU and its specialized science programmes, educational activities that focus on data and information – which are an essential part of those programmes anyway. For example, CODATA could offer to organize and hold a series of educational and training seminars or workshops for Future Earth in developing countries. Some of these could focus on issues related to data access and the analysis of large-scale databases; others on issues related to data management training. If Future Earth is to be a truly international endeavour, it will need the active participation of scientists from around the world, and CODATA could contribute significantly to that goal through its sponsorship of such workshops. Another example is the collaboration with the Integrated Research on Disaster Risk (IRDR) programme, on which a memorandum of understanding has already been signed. Through such approaches CODATA could leverage efforts in order to have a marked impact on education.

In July 2012 CODATA collaborated with the Chinese Academy of Sciences in organizing an international training workshop on Scientific Data Management and Sustainable Development in Beijing, and has also invited participants from developing countries to some of its seminars held in the context of larger meetings. However, a serious and coherent initiative to build capacity has not yet materialized, and the potential of collaboration with ICSU´s Regional Offices is still to be exploited. Thus the recommendation of the ICSU General Assembly to give special attention to the needs of developing countries has not yet been fulfilled.

> **Recommendation 7.** CODATA should develop an action plan for capacity building in collaboration with WDS and ICSU´s Regional Offices, with the eventual goal of setting up new data centres in the developing world and thus filling significant gaps in global coverage.

3.1.5 Outreach and communications

In line with the stated mission of CODATA to strengthen international science for the benefit of society, the Global Information Commons for Science Initiative (GICSI) arising from the second phase of the World Summit on the Information Society (WSIS) in Tunis in November 2005, was developed to 'improve understanding and increase awareness of the societal and economic benefits of easy access to and use of scientific data and information, particularly those resulting from publicly funded research activities'. However, the recipients of this increased awareness have not been clearly defined, and contacts with potential end-users or stakeholders appear to be rather weak. In particular, although policymakers and the private sector are potentially interested in scientific data and information issues, they are not among the listed collaborators of CODATA and do not benefit from participation in the conferences.

Although direct contacts with international policymakers are lacking, CODATA has links with organizations that do have an influence in the policy arena, for example OECD and GEO/GEOSS. CODATA has taken the lead in the establishment and further application of the GEOSS data-sharing principles. Among the more scientifically oriented organizations, CODATA has very good collaboration with the International Council for Scientific and Technical Information (ICSTI) as part of the Task Group for Data Citation Standards and Practices, and the two organizations are represented at each other's General Assemblies. A number of other organizations were mentioned in this context in the *Strategic Plan for 2006-2012*, but it is not clear what forms the projected collaboration with the InterAcademy Panel (IAP), the Academy of Sciences for the Developing World (TWAS) or UNESCO have taken.

Overall, the channels of communication of CODATA are lacking in efficiency and visibility. The CODATA website has received rather heavy criticism from respondents to the questionnaire sent to members of CODATA and ICSU, reflects badly on the organization, and it is in need of revision and redesign.

> **Recommendation 8.** CODATA needs to reconfigure its website in order to improve both its usability and information content.

3.2 Observations of the Review Panel

In addition to the observations related to the specific activities of CODATA discussed in the chapters above, the Review Panel has attempted to sound out the views of the scientific community on data and information issues and the role of CODATA.

Among CODATA´s many interest groups, those having most at stake are individuals belonging to the data science community. Judging by the atmosphere and the discussions at the biennial conferences, the attendees represent a rather closely-knit community, and seem generally quite satisfied with the way CODATA operates. However, there is no way of evaluating to what extent they represent the rapidly expanding ranks of data professionals, many of whom may not even be aware of the existence of CODATA.

CODATA is aware of the need to increase the involvement of individual scientists and data professionals in its work. The General Assembly of 2012 decided to establish two new membership categories, and one of these concerns *At-large members* – individual scientists, experts and other professionals having an interest in data science and a desire to work with CODATA in support of CODATA's mission.

Another way of getting involved with CODATA is via Task Group activities. The members of these groups tend to be respected senior professionals and scientists, although recently there has been a serious attempt made to involve younger scientists.

> **Recommendation 9.** CODATA needs to actively recruit both mid-career and young data scientists to its governance and Task Group activities.

In preparing for its new strategic plan, CODATA conducted a survey among its own membership, i.e. National and Union Members, to solicit views about the previous plan. According to the report, respondents were generally positive about the overall direction of the strategic initiatives. However, 'a number of members' commented on lack of specificity concerning implementation, and on a failure to link with Task Group or national member activities. It also became apparent that the membership was generally not sufficiently aware of CODATA activities.

The Review Panel also approached CODATA members with a simple questionnaire, which was sent to 41 recipients (those which were not also Members of ICSU itself). It received a modest response (28.8 %) and the results thus must be interpreted cautiously. One reason for the seeming indifference may be that many countries lack a national committee to deal with data and information issues. Among the most significant and best appreciated achievements of CODATA mentioned were the biennial conferences, the championing of open access, contributions to work on fundamental constants, and raising awareness of the importance of data stewardship. Suggestions as to how CODATA might serve the membership better included the greater

involvement of young scientists, increasing its visibility, more cooperation with IT professionals and funding bodies, and strengthening the CODATA Secretariat.

The wider ICSU community represents another important group of stakeholders of CODATA. The Review Panel sent questionnaires to all ICSU National Members, International Union Members and Interdisciplinary Bodies asking about attitudes towards data and information issues, relevance of an interdisciplinary body of ICSU in the area, awareness of CODATA´s strategic priorities, and suggestions for the most significant issues that CODATA should address. The response rate was limited, especially among National Members, but there was a consensus among the respondents concerning the growing importance of data and information issues, and the need for ICSU to have an organizational structure to deal with these. The individual responses ranged from a simple 'yes', through 'a growing need' to 'essential'.

On the question of familiarity with CODATA and its programmes there was less clarity from the respondents. Over 70 percent of the organizations that replied said that they were aware of CODATA's strategic priorities; however, some questioned their relevance, some said the priorities were confused and others that they had difficulty finding them on the CODATA website.

Topics that were mentioned in response to the final question on each survey — 'What do you consider to be the most significant issues in the data area that CODATA addresses or might address?' – were numerous and varied. They are listed in Appendix 4. The subject evoked most frequently (by 12 respondents) was that of data accessibility.

Beyond the ICSU family, there is a wide world of individual scientists, research groups and institutes, data professionals, data repositories, national and international organizations involved with data-related issues, public and private funding agencies, and probably a number of other actors that can be considered as stakeholders in data and information issues. There is, unfortunately, no currently identified plan to assess what their views on the relevance and visibility of CODATA might be.

> **Recommendation 10.** Since the data and information stage is crowded with actors large and small, with varying interests and agendas, it would be useful for CODATA to conduct an analysis of the field to better define its own niche and potential areas of impact, to avoid unnecessary duplication of effort, and to promote cooperation instead of competition while improving its own visibility. Such a mapping exercise, if published, would also be of great benefit to the broad scientific community.

3.3 Strengths

CODATA played a leading role in the early history of the Open Access movement and should be credited for the OECD guidelines published in 2007 and based upon the principles approved by the representatives of the OECD countries in 2004. Its role in drafting the GEOSS data-sharing principles was also significant. These activities should be built upon.

The biennial CODATA conferences are the most significant forum for data professionals to meet and discuss progress and problems in the field, and have the potential for even greater global impact. The diversity of conference locations encourages and facilitates improved regional attendance, and allows CODATA to place emphasis on developing countries.

The Global Information Commons for Science Initiative provides a concept and a platform for advancing the principle of open access, and has already proved useful, for example in microbiology. It will also hopefully provide a solution to the problems of the data legacy of the International Polar Year (IPY), in close cooperation with WDS.

CODATA has been able to characterize the new "data profession" and its role in the modern scientific enterprise. It has also highlighted the problems in professional recognition and career development of young data professionals.

3.4 Challenges

The effective pursuit of the CODATA strategic goals based largely on the Task Group approach seems almost an impossibility, and in any case a very slow process. A balance between top-down and bottom-up initiatives needs to be achieved.

It is important to ensure that CODATA gains proper credit for its various contributions, which would then increase the visibility and credibility of the organization, and would facilitate future tasks and collaboration.

Although the CODATA biennial conference is already an important event, it needs to be made more attractive not only to data professionals but also to the wider scientific community and the private sector.

The *Data Science Journal* is in need of a transformation in order to make it, once again, the pre-eminent peer-reviewed, open access journal in the field of data and information, breaking new ground in data publication.

4. Organization, governance and resources

Although CODATA is classed as an Interdisciplinary Body (IB) of ICSU, it is an independent legal entity under French law with its own membership and budget. The Constitution of CODATA, broadly based on that of ICSU, provides the statutes and by-laws that guide its organization and governance. Compared with other ICSU IBs, CODATA has a Constitution that could be regarded as a somewhat organic document in that amendments have been approved at practically every successive CODATA General Assembly. A certain degree of oversight is exercised by the Executive Board of ICSU, including ratification of amendments to the Constitution.

Until the 28th General Assembly in 2012, CODATA had five categories of members specified in its Constitution. Its Membership thus was made up of 19 National Members representing a country or "a definite territory" (usually by a science academy or research council), 2 Associate Members (equivalent to national members but lacking the resources to pay the appropriate dues), 16 Union Members from among ICSU´s 31 Scientific Unions, 3 Co-opted Members (ICSU-affiliated organizations involved wholly or predominantly in work covered by the mission of CODATA), and Regional Members, currently none. In addition, there are 20 Supporting Organizations divided into three classes (organizations supporting the mission of CODATA and paying required but very modest dues).

At the General Assembly in Taipei two new categories of membership were approved in an attempt to broaden membership: *Affiliate Members* (organizations and individual institutions that will pay dues), and *At-large Members* (individuals interested in the work of CODATA, also paying dues). The former *Supporting Organizations* are to be encouraged to become Affiliate Members.

The General Assembly (GA) is the highest decision-making body of CODATA; it is convened every two years and held in connection with the major biennial conference. Its main functions of the GA are to elect the Officers and the Executive Committee, deliberate on membership issues, approve strategy, and decide upon new Task Groups or the continuation of existing ones. Each Member can designate a Delegate to participate in decisions and voting. The newly agreed Affiliate and At-large members are to be represented by delegates of their choice (one for every five Affiliates, and one for every 10 At-large members).

Between the GAs, the business of CODATA is transacted by the rather large Executive Committee consisting of six Officers (President, Past President, two Vice-Presidents, Secretary-General, and Treasurer) plus eight ordinary members. For service as Officer or Executive Committee member, participation in CODATA activities of at least three years is required, and the combined term limit is 10 years.

4.1 Observations of the Review Panel

4.1.1 Membership

Despite attempts at recruitment, the number of National Members currently stands at only 19 compared with ICSU´s 120 National Members. Furthermore, the level of engagement of both the Union and the National Members is variable. While, for example, the US National Committee for CODATA is effectively coordinating important activities, many other countries and Unions have no such committee and appear dormant. Membership strategy was discussed at the General Assembly

in Taipei in 2012, but while the two new additional categories may create more interest in CODATA, they will hardly improve the financial situation significantly. The proposed new membership structure, with six categories, has also become quite complicated, and may prove burdensome for the Secretariat.

The national membership of CODATA is somewhat shaky, as exemplified by the out-and-back-in decisions of Australia and the UK, and the current Associate Membership status of France and Germany. Such membership stances can hardly be explained by insufficient funds being available; rather, it seems that CODATA has not been able to convince current and potential national members of the benefits and value-for-money that the organization offers. Given the growing importance of data and information for scientists in all countries, convincing arguments and clearly described benefits should be articulated to provide a firm basis for the recruitment of new paying members. The visibility of the organization is crucial for any such efforts. In addition, efforts need to be made to foster the setting up of national and union committees for data and information among the existing membership.

Recommendation 11. Encouragement should be given to the setting up of national and union data committees, preferably with a mandate to interact with both CODATA and WDS.

4.1.2 Governance

In its interactions with the Secretariat, the Secretary-General, the Executive Committee, and the General Assembly, the Review Panel received a favorable impression of the governance functions of CODATA and the good atmosphere prevailing in the organization. The main activities of CODATA occur "bottom-up" within the Task Groups. The process of application, peer review, and approval at the biennial GA is democratic and scientifically valid but not particularly efficient.

WDS is a co-opted member of CODATA and is thus entitled to send a Delegate to the latter's GA, but this relationship is not reciprocal, and the level of contact, while currently good, is not sufficiently formally structured to develop effective interaction options.

4.1.3 Secretariat

CODATA operates from a single office located within the ICSU premises in Paris. Considering the breadth of its mission, CODATA has a very modest Secretariat, with one full-time Executive Director and two part-time support staff members (one of whom is in Australia); these limited human resources no doubt set strict limits as to what the organization can undertake. Nevertheless, it is clear to the Review Panel that the Secretariat is doing an excellent job in supporting the Officers, the Executive Committee and the Task Groups, as well as preparing for the biennial CODATA conference and General Assembly. One area that would definitely need emphasis is effective communication, both of an in-reach and outreach nature, but this would require at least one additional full-time person, and have significant budgetary implications.

4.1.4 Finances

Since the Union Members of CODATA are not required to pay dues, the finances of the organization are almost entirely dependent upon the dues paid by National Members. A need to reform the dues structure has been recognized since 2006, and moves are ongoing as to how to achieve this. The 28th General Assembly directed the EC to appoint a committee with the objective of preparing a national structure that would bring the dues into alignment with the accepted GDP values for implementation in 2014 and maintain alignment for subsequent years. It further tasked the

Committee to consult with National Members and define an approach to transition from the existing national dues structure to a new one within four years.

The total CODATA annual budget, at around US$ 325,000, is small, and this is one reason for the limited human resources at the CODATA Secretariat. Nevertheless, the modest financial resources have been very competently handled by the Treasurer and the Executive Director despite turbulent international financial times, and they are to be commended for even having been able to make provision for a Reserve Fund.

An essential resource for CODATA activities is the external funding of Task Groups. This comes from a variety of sources, including funding agencies and private foundations but mainly from partnering organizations in the form of grants or in-kind support for personnel, meetings, travel, etc. There is no ready source of precise figures on this funding, but on the basis of renewal applications it is possible to conclude that the total amounts vary significantly between Task Groups. The Data Citation Standards and Practices Task Group reports in excess of US$ 500 000 and the Fundamental Constants Task Group over US $ 250 000, whereas several groups either do not indicate the amounts of promised support or we may conclude that the amounts are trivial. The success of a Task Group in securing external funding depends to some extent on the efforts of the group but probably more on the willingness of partnering organizations to contribute.

Membership strategy is obviously central to strengthening the financial base of CODATA itself, and success in this area requires a clearer articulation of the benefits accruing from membership. Other potential sources of revenue include the funding agencies, of which many seem to be in the process of discontinuing their direct support to research groups for maintaining databases, and the private sector, which has an interest in access to scientific data and information for its own R&D but whose numbers also include providers of hardware and software needed by the data community.

> **Recommendation 12.** CODATA should explore possibilities of strengthening its financial base, not only by recruiting new national, institutional and individual members but also by collaborating with funding and developmental agencies as well as private industry.

4.2 Strengths

The Secretariat is very effective considering its size and resources, and supports not only administration but also the substantive activities of CODATA, and notably the organization of the biennial conferences and other international events.

Although there are problems with the Task Group approach to strategic positioning, the selection procedure is democratic and dynamic, and provides opportunities for new ideas being developed from bottom up.

CODATA's depth of expertise in data issues gives credibility for creating effective partnerships, although the disciplinary breadth is not as large as might, at first glance, be envisioned.

Attempts at having a broad geographic representation in governing bodies and Task Groups have been successful.

4.3 Challenges

After almost a half-century of existence, CODATA is at risk of becoming inbred and averse to undertaking critical and future-oriented steps to develop its activities with the changing times. The

membership base is relatively narrow from both geographic and disciplinary viewpoints, and is in need of expansion. The National and Union Members of CODATA need to be energized, particularly in countries where a National or Union committee for data and information does not exist.

Relatively few early career data scientists are involved in CODATA activities, and therefore the crucial issue of career prospects and advancement in the various data fields may not receive sufficient emphasis.

Additional resources are required to allow strategic activities and strengthening of the position of CODATA in the data and information field.

4.4 Concluding comment

At the risk of repeating what was said at the very beginning of this Report, the Review Panel is convinced of the crucial role played by data and information management in the pursuit of science and technology. The international leadership role to be played by ICSU and its constituent bodies in all this cannot seriously be questioned. With its proven track record and the strengths described above, CODATA is well placed to meet the challenges and opportunities being presented by the major new interdisciplinary research initiatives that are being developed, and the data and information technologies which serve them. It should be encouraged to do so through broader strategic planning and progressively greater collaboration with other like-minded organizations, and especially WDS.

5. Recommendations for ICSU

The need for global strategic leadership in data and information issues is now even more obvious than a decade ago, when the Priority Area Assessment recommended that ICSU assume this role. There is no other international scientific organization that could be a credible competitor in this field.

In order to assure that problems in data and information are dealt with efficiently, the Scientific Committees of all ICSU´s major research programmes should have an *ex officio* representative appointed by CODATA.

Joint strategic planning activities and joint preparations for the biannual conferences on the part of CODATA and WDS should be strongly encouraged, and seen as part of a process leading to the eventual bringing together of CODATA and WDS into a single Interdisciplinary Body of ICSU. There is no reason to doubt that theoretical or policy issues and practical data science could be catered for within the same organization, in much the same way as three of the founding unions of ICSU and Union Members of CODATA have brought together the pure and applied aspects of their respective disciplines successfully over several decades. An external evaluation of ICSU itself is to be conducted in the near future and may provide additional guidance on developing the internal structures of ICSU, including those dealing with data and information.

> **Recommendation 13.** ICSU should recognize the growing importance of data and information for science by appointing an *ex officio* representative of CODATA to the Scientific Committees of all its research programmes, and by consolidating and strengthening its own organizational structure, ultimately leading to a single Interdisciplinary Body for data and information. [3]

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[3] See Preface for the decision of CSPR on Recommendation 13.

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Appendix 2 Terms of Reference for the Review of the Committee on Data for Science and Technology (CODATA)

Purpose and objective of the Review

The Committee on Data for Science and Technology (CODATA) is an Interdisciplinary Body of ICSU set up in 1966 to improve the quality, reliability, management and accessibility of data of importance to all fields of science and technology. In line with the recommendations from various strategic reviews, CODATA has been engaged in recent years in addressing issues of high priority to ICSU, especially at the data management and policy levels. These have included representation of the scientific community at the World Summit on the Information Society (WSIS), the development of data-sharing guidelines for the Global Earth Observation System of Systems (GEOSS) and support for polar data management. CODATA has a central role to play over the coming six years in addressing the recommendations from the ad-hoc Strategic Coordinating Committee on Information and Data (SCCID), and the earlier ICSU Priority Area Assessment of Scientific Data and Information, and in helping to address the data challenges faced by ICSU's new interdisciplinary initiatives, e.g. on disaster risk and global sustainability. In this context, the ICSU Strategic Plan II, 2012-2017 foresees (p. 34) a dedicated review of the performance and future strategic remit of CODATA during 2012-2013.

The Review will examine the links between CODATA, ICSU, the ICSU National and International Scientific Union Members and ICSU's other Interdisciplinary Bodies. It will focus on both internal and external interactions, and have, as its overriding objective, an evaluation of the extent to which CODATA: (a) adds value to the scientific and technological data and information arena, and to the national programmes that contribute to it, and (b) helps the scientific community address key data-related challenges facing science today and in the future.

Organization and methodology of the Review

A Review Panel made up of individuals familiar with ICSU, its organization, activities and programmes, and with current and future data challenges, will be established by ICSU's Committee on Scientific Planning and Review (CSPR) to carry out a review of the performance and future strategic remit of the Committee on Data for Science and Technology (CODATA). The Review Panel will consist of five to six members, one of whom will be a serving member of the CSPR. The Chair of the Panel will be named by the CSPR.

To initiate the review process, the Panel will be provided with background information by the ICSU and CODATA Secretariats in Paris. The latter will also assure access to the CODATA archives, including copies of all reports and volumes published over the past five years. Any electronic consultation thought necessary among ICSU family members will be carried out by the ICSU Secretariat on behalf of the Review Panel.

The Panel will meet either electronically or in person with officers of the CODATA Executive Committee and Secretariat to discuss the review objectives and process. The review is also expected to gain benefit from the holding of the 23rd CODATA International Conference on 28-31 October 2012 in Taipei.

In carrying out the Review, the Panel will be expected to:

1. Assess the strategic planning and objectives of CODATA

This assessment should:
(a) assess how CODATA strategies are established, priorities are set, topics for activities are selected, and the role Members and the Executive Committee play in these processes; and
(b) establish the extent to which CODATA's objectives and stakeholder expectations are taking into account advances in data collection, handling and management capabilities and needs, and other factors of concern to the international scientific community.

2. Evaluate the recent performance of CODATA

This should include:
(a) an assessment of: (i) the extent to which CODATA is meeting its strategic objectives and stakeholder expectations, (ii) the impact of CODATA on the broader scientific community, and (iii) other CODATA significant accomplishments;
(b) identification of the key audiences for CODATA activities, and an evaluation as to whether CODATA is successfully reaching them with its outputs, and whether the activities fulfil the needs of those audiences; and
(c) an assessment of the extent to which CODATA involves a geographically wide community of research scientists and institutions, including those of the less developed countries, and is able to attract the interest of young scientists.

3. Assess organization and governance mechanisms

This should be based on consideration of:
(a) CODATA's organizational and management structure and its relationship to CODATA's ability to perform to the level expected;
(b) CODATA's funding strategy to implement its scientific agenda and to develop future activities; the role of the Executive Committee in attracting supplementary funding; and
(c) competition and cooperation with other ICSU bodies and scientific organizations with respect to donor funding, time of volunteer scientists, and the attention of policy makers – and the relative scarcity of these three resources.

4. Identify the inherent challenges and make recommendations on the future evolution of CODATA

These might include:
(a) the challenges encountered by CODATA in meeting its objectives and the expectations of its stakeholders, including the broader user community;
(b) the relevance of CODATA's mission to its Members, ICSU and the broader scientific community;
(c) the levels of visibility and communications efforts of the organization;
(d) the readiness and ability of CODATA to address the relevant recommendations from the ad-hoc Strategic Coordinating Committee on Information and Data (SCCID); and
(e) CODATA's overall positioning to collaborate with the other main actors in the science data community in a rapidly changing data and information environment.

Workplan and timeframe

Following the approval of the Terms of Reference for the review by CSPR (March 2012), nominations for membership of the Review Panel will be sought among the ICSU family. CSPR will be consulted on these nominations electronically and the Review Panel will be established, and its Chair named. The Panel will begin its work in July, meeting with officers of the CODATA Executive Council and the Executive Director as appropriate. The main work of the Review Panel, including data collection and analysis, will take place during the period July 2012-April 2013. The draft report on the strategic review is expected to be prepared by the Panel by April-May 2013, and the revised report submitted to ICSU by 31 July 2013, for presentation to the 26th Meeting of CSPR in September 2013.

Key milestones

Approval of ToRs of the Review	March 2012
Appointment of Review Panel	May 2012
First meeting of Panel	Late June 2012
Information gathering	June-September 2012
23rd CODATA Conference, Taipei	28-31 October 2012
Draft report discussed with CODATA	April-May 2013
Revised report submitted to ICSU	31 July 2013
Examination of Report by CSPR	September 2013

24 April 2012

Appendix 3   Review questionnaires

QUESTIONNAIRE TO ICSU MEMBERS

(National Scientific Members and International Scientific Unions)

Name:

Organization:

Email address:

What importance does your organization attach to data issues in science, and do you have a committee or commission devoted to them?

Is it relevant for ICSU to have an interdisciplinary body responsible for data issues?

Are you aware of the strategic priorities of CODATA, and do you consider them relevant to the work of your organization?

What do you consider to be the most significant issues in the data area that CODATA addresses or might address?

QUESTIONNAIRE TO ICSU SCIENTIFIC ASSOCIATES AND PARTNER ORGANIZATIONS

Name:

Organization:

Email address:

What importance does your organization attach to data issues, and do you have dedicated activities in this area?

Has your organization worked with CODATA in the past 10 years? If so please give brief details

Are you aware of the strategic priorities of CODATA, and do you consider them relevant to the work of your organization?

What do you consider to be the most significant issues in the data area that CODATA addresses or might address?

QUESTIONNAIRE TO ICSU INTERDISCIPLINARY BODIES & JOINT INITIATIVES

Name:

Organization:

Email address:

What importance does your organization attach to data issues, and do you have dedicated activities in this area?

Has your organization worked with CODATA in the past 10 years? If so please give brief details

Are you aware of the strategic priorities of CODATA, and do you consider them relevant to the work of your organization?

What do you consider to be the most significant issues in the data area that CODATA addresses or might address?

QUESTIONNAIRE TO CODATA MEMBERS

Name:

Organization:

Email address

Are you aware of CODATA's current strategic objectives, and are you in agreement with them? Do you think they are realistic in the light of the organization's resources?

How relevant or important do you consider the strategic priorities of ICSU to be in relation to CODATA's own strategy?

Do you think that the Task Group activities should be linked with the strategic priorities of CODATA?

What would you regard as the most significant achievements of CODATA?

How would you rate the value of the specific 'products' of CODATA (task team and working group activities; data journal; conference) and their impact?

Are you satisfied with the governance mechanisms of CODATA, or how might they be improved?

What do you see as the overall value of CODATA membership to your organization and the community it serves?

What, if anything, could CODATA do to serve you better?

Appendix 4   Summary of responses to questionnaires

The numbers of Questionnaires dispatched electronically to Members of the ICSU family and CODATA Members are set out below, along with rates of response. Overall, the response was disappointing, especially from National Members of the ICSU family.

Organization contacted	Number of questionnaires dispatched	Replies received	Response rate (%)
ICSU National Members	120	11	9.2
ICSU International Scientific Unions	31	11	35.5
ICSU Scientific Associates and Partners	22	3	13.6
ICSU Interdisciplinary Bodies and Joint Initiatives	32	5	15.6
CODATA Members *	41	11	28.8

*Those who are not ICSU National Members

Summary of comments made

The great majority of respondents underscored the importance to be attached to data issues in science. Approximately 50% of their number said that their organization had one or more committees with a focus on data. Many of those who said they did not have a formal committee with such a focus still identified specific ways in which their organizations worked with data.

In response to the question as to whether ISCU should have an interdisciplinary body responsible for data issues the Questionnaire elicited a unanimously affirmative response from the ICSU Scientific Unions, National Members, Scientific Associates and Interdisciplinary Bodies and Joint Initiatives. The individual responses ranged from a simple 'yes', through 'a growing need' to 'essential'.

On the question of familiarity with CODATA and its programmes there was less clarity from the respondents. Over 70 percent of the organizations that replied said that they were aware of CODATA's strategic priorities; however, some questioned their relevance, some said the priorities were confused and others that they had difficulty finding them on the CODATA website.

Items that are summarized below are from the responses to the last question on each survey — 'What do you consider to be the most significant issues in the data area that CODATA addresses or might address?' The numbers refer to the individual responses (the texts of which may be consulted on Member Zone of the ICSU website) but serve here merely to indicate the degree of interest in each particular topic.

Data Citation (12)

Increase international visibility of data and data management policies (32)

Standardization of Terminology, metadata and protocols (33, 37)

Interoperability Challenges (10, 12, 37)

Data accessibility (1, 4, 6, 7, 8, 10, 11, 20, 24, 27, 31, 33)

Data interpretation and dissemination (26)

Publication accessibility (2, 8)

Data Management (16)

Intellectual Property (11, 17, 20)

On-line tools for sharing data (23)

Global Commons (23)

Data quality review (3, 33)

Guidelines for data collection (26)

Consultation services (3)

Data mining (9, 27)

Link with Decision sciences (10)

Link with Health data (10)

Defining science and data and their relationship (11)

Capacity building in developing countries (24, 25)

Archiving data (1, 11, 25, 37)

Cu ration of Data (25)

Big Data (11)

Domain standards (8, 12, 33)

Fundamental constants (5)

Chemical structures (8)

GEO data sharing principles (24)

Sharing lessons learned across disciplines (13, 33)

Public engagement with Science (23)

Training Programs /education, young scientists (2, 33, 35)

Coordination (35, 36)

Coordination with IT (36)

List of member contact and addresses (34)

Networking (17)

<u>With respect to Task Groups:</u>

Extensive array of task groups (16)

Emphasis on social scientific (16)

Environment (19)

Earth Observing/GEOSS (11, 39)

Earth System Grid Federation (ESGF) (28)

History/ Philosophy of science and technology (2)

Microbiology (33)

Polar Information Commons (33)

COMMUNIA (European Thematic Network on the Public Domain and the Public Divide) (33)

<u>Data Science Journal:</u>

Overhaul journal editorship towards serious scholarly journal (40)

<u>Conference ideas:</u>

Overall conference to make increasingly dynamic and increase new data science ideas (40)

<u>Visibility:</u>

Visibility with funding agencies and define roles and responsibilities of data archiving, sharing (37)

History of contribution of CODATA to data issues – "see excellent report CODATA @ 45 years on" (33)

Visibility within ICSU (30)

<u>Challenges:</u>

Duplication of efforts (16)

Relationship with WDS (29, 33, 39)

Strengthen secretariat (39)

<u>Nothing specific:</u>

 (15, 18, 21, 22, 36, 38)

<u>Unique opportunities:</u>

International forum (39)

<u>Specific comments from CODATA members:</u>

The Review Panel analysed the comments from current CODATA Members separately. It was clear from these responses that these organizations greatly valued their relationship with CODATA and that the advantages included increased access to forums for interacting with colleagues both nationally and internationally and across disciplinary groups.

 In response to the questions about linkage with strategic goals responses did vary. Several respondents discussed the challenges and opportunities of balancing the bottom-up and top-down strategies in developing goals and support for activities.

CODATA Members emphasized the tremendous number of activities and productive interactions that were accomplished with a very very small budget.   This fiscal reality was obviously significant in identifying new Task Group areas.

Despite acknowledged success in increasing the visibility of CODATA, some Members believe that greater visibility can be achieved. Several members identified key areas in need of attention; these include journal activities and planning, as well as governance. Defining the relationship between CODATA and WDS was also discussed and the need for coordination highlighted.

Appendix 5   CODATA Task Groups active since 2000

General Data Issues

Asian-Oceanic Data Sources	1987 – 2008
Comparative Mathematical Methodologies of Data Handling and Knowledge Extraction	1999 – 2002
Data at Risk	2011 –
Data Citation Standards and Practice	2011 –
Data Sources for Sustainable Development in SADC Countries	2007 – 2012
Virtual Laboratories in Earth Physics and Environmental Sciences	2003 – 2006
Data Information and Visualization	1997 – 2006
Global Information Commons for Science Initiative – EU activities	2009 –
Global Roads Data Development	2011 –
Preservation of, and access to, S&T Data in/for/with Developing Countries	2003 –
Linked Open Data for Global Disaster Risk Research	2013 –

Geosciences Data

Comprehensive Information System on Natural Disaster Mitigation	2007 – 2008
Data on Natural Gas Hydrates	2001 – 2010
Earth and Space Science Data Interoperability	2009 –
Octopus: Mining Space and Terrestrial Data for Improved Weather, Climate and Agricultural Predictions	2013 –

Life Sciences Data

Anthropometric Data and Engineering	2005 –
Biological Collection Data Access/Observation and Specimen Records	2003 – 2010
Global Species Data Network	2001 – 2008
Advancing Informatics for Microbiology	2013 –

Physical Sciences Data

Exchangeable Minerals Data Representation to Support Scientific Research and Education	2007 –
Fundamental Physical Constants	1969 –
Low Dimensional Materials and Technologies Network	2005 – 2006
Standardization of Physico-Chemical Property Electronic Data Files	1999 – 2002

ICSU
International Council for Science

Strengthening international science for the benefit of society