

*Committee on Data for Science and Technology
International Council for Science*

CODATA Strategic Plan 2006-2012

Public Review Draft

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Preface

This draft *CODATA Strategic Plan 2006-2012* has been developed at the request of the CODATA General Assembly in 2004 and in response to a recommendation from the International Council for Science (ICSU) as outlined in the *ICSU Strategic Plan 2006-2011*.

Created by ICSU in 1966 as an interdisciplinary body focused on scientific and technical data, CODATA has established itself as an influential voice in national and international policy regarding scientific data management and as a focal point for international, cross-disciplinary collaboration and communication on key data issues. CODATA, through its Task Groups and other focused activities has made significant contributions not only to the improvement of scientific data development, analysis, and visualization in key fields, but also to the overall advancement and application of science internationally. At the two meetings of the World Summit for the Information Society (WSIS) in 2003 and 2005, CODATA led the effort to ensure strong recognition of the role of science in the development and continuing evolution of the Information Society, and championed the need for open access to scientific data and information for all.

In 2003-04, ICSU conducted a Priority Area Assessment (PAA) on Scientific Data and Information which included a detailed review of the ICSU bodies focused on scientific data and information. The PAA recommended that “CODATA should develop a clear long-term strategy that focuses on key international data management and policy issues, giving special attention to the needs of developing countries.” (ICSU, 2004: 30). It recommended improving communication between CODATA and ICSU and other ICSU bodies as well as expansion of CODATA’s membership. The PAA also endorsed CODATA’s WSIS activities.

The PAA report was approved by the ICSU General Assembly in October 2005, and its main recommendation regarding CODATA was incorporated into ICSU’s *Strategic Plan 2006-2011*. Specifically, ICSU decided to encourage CODATA to “develop a long-term strategy, giving special attention to the needs of developing countries” (ICSU, 2006: 40).

In response to these concerns, CODATA established a Strategic Planning Committee in early 2005 to begin development of a Strategic Plan, taking into account both the recommendations of the ICSU PAA and the simultaneous strategic planning efforts of ICSU. This committee benefited greatly from a “Response to the ICSU Priority Area Assessment on Scientific Data and

Information” prepared by Ray Norris, Brian McMahon, and Krishan Lal in October 2004. The initial draft of the Plan also incorporated many thoughtful inputs from CODATA’s Executive Committee members and staff and from various CODATA national committees and union representatives. This version of the Plan now reflects changes based on the resolutions of the 25th General Assembly in Beijing, China in October 2006 and on discussions at the 52nd Executive Committee meeting in March 2007.

Comments, suggestions, and specific editorial suggestions are welcomed at this stage from all members of the CODATA “family.” It is expected that a final version of the Plan will be prepared by the CODATA Executive Committee after receipt of inputs from ICSU, and that this version will be sent to the CODATA membership for formal approval.

Executive Summary

CODATA, as an interdisciplinary body of ICSU focused on scientific and technical data, affirms its commitment to the long-term vision articulated by ICSU of a “world where science is used for the benefit of all, excellence in science is valued and scientific knowledge is effectively linked to policy-making.” CODATA is committed to the principle of “universal and equitable access to high quality scientific data and information” and in particular to the goal to “facilitate a coordinated global approach to scientific data and information that ensures equitable access to quality data and information for research, education and informed decision-making” (ICSU, 2006). CODATA is committed to tackle issues related to the *Digital Divide*.

This *CODATA Strategic Plan* articulates CODATA’s overall approach and specific plans to meet this goal during the period 2006-2012. The Plan reviews the major obstacles to universal and equitable access to data and assesses the potential role of CODATA in overcoming these obstacles. The Plan proposes a new CODATA mission statement, identifies key priorities for CODATA’s scientific agenda, and also recommends organizational changes to improve CODATA’s capacity to carry out its agenda.

Specifically, this Plan recommends the following new CODATA mission statement:

The mission of CODATA is to strengthen international science for the benefit of society by promoting improved scientific and technical data management and use.¹

The Plan also recommends that CODATA pursue three major initiatives over the next 6 years:

- 1) ***The Global Information Commons for Science Initiative (GICSI)***. Launched by CODATA and several partner organizations at the second phase of WSIS in Tunis, GICSI represents an innovative effort to accelerate the development and “scaling up” of global open-access scientific data and information resources. GICSI will promote full and equitable access to scientific data in key policy arenas and among major stakeholders in the world’s diverse scientific community. Through both “bottom up” and “top down” efforts, GICSI will

¹ This new mission statement has been approved at the 25th CODATA General Assembly in Beijing in October 2006.

help create a tangible, shared *information commons for science* containing valuable scientific data, information, tools, and other resources accessible to all.

- 2) ***The Scientific Data across the Digital Divide (SD³) Program.*** To address the pressing needs of developing country scientists, students, and applied users for scientific data related to sustainable development, CODATA will develop a specific program of activities aimed at making critical scientific data and associated tools and resources related to sustainable development widely accessible in developing countries. As part of this effort, CODATA will work with several major international scientific data management activities such as the Global Earth Observing System of Systems (GEOSS), the International Polar Year (IPY), the electronic Geophysical Year (eGY), the Global Risk Identification Program (GRIP), the ICSU World Data Centers, and the Global Biodiversity Information Facility (GBIF) to make their data more accessible and usable for sustainable development. CODATA will develop selected partnerships with key development agencies, nongovernmental organizations, universities, research institutes, and other groups to further this effort. A new opportunity in this regard is the United Nations Global Alliance for Information and Communications Technologies and Development (GAID), an open, multi-stakeholder forum that brings together governments, international organizations, civil society, the private sector, media and other stakeholder constituencies in a common effort to better harness ICT for advancing development.
- 3) ***Advanced Data Methods and Information technologies for Research and Education (ADMIRE).*** Another key area where CODATA could have both a significant technological and institutional impact is in the application of advanced data mining and integration techniques in research, education, and other applications. ADMIRE will seek 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. One activity currently under development is participation in a project to address the multicultural and multilingual aspects of accessing, exploiting, using, and re-using digital content in Europe. ADMIRE will also address both technical and institutional issues related to long-term stewardship and accessibility of data. The new framework programme (FP7) for research of the European Commission could provide additional funding opportunities for this initiative.

In order to successfully carry out these three initiatives, CODATA will need to expand its own scientific, technical, and institutional capacity in several ways:

- 1) Strengthening of its national and union membership, both by expanding membership to new countries, unions, and interdisciplinary bodies and by helping to energize existing members and help and support of ICSU would be sought, whenever necessary;
- 2) Expansion of the number and breadth of Supporting Organizations and other partners to include the key data and research centers, organizations, and networks that engage many data-oriented scientists and data professionals, especially those focused on areas critical to sustainable development and those located in developing countries;
- 3) Development of an “Associates Program” to encourage individual scientists and data professionals from around the world to become active, long-term contributors to CODATA activities;
- 4) Establishment of an International Data Academy to provide a select expert pool of data information and knowledge scientists who can be called upon for advice on data issues;
- 5) Expansion of externally funded activities that permit CODATA to develop concrete products and services, involve key stakeholders, hire additional staff or consultants when needed, and increase its visibility and impact;
- 6) Establishment of a Gift and Endowment Fund to provide CODATA with a stable and flexible source of income; and
- 7) Strengthening of the CODATA Secretariat.

Hand-in-hand with these efforts, CODATA must also focus and improve its existing portfolio of activities, coordinate its activities with ICSU and other key partners, and increase its flexibility and responsiveness to ongoing, rapid changes in data management, technology, and policy. In particular, CODATA will:

- 1) Encourage the CODATA Task Groups and Working Groups and the editors of the *CODATA Data Science Journal* to make substantial contributions to GICSI, SD³, and ADMIRE in their areas of activity;
- 2) Participate actively in the planned ICSU *ad Hoc* Strategic Committee on Information and Data (SCID) and possible follow-on Scientific Data and Information Forum (SciDIF) and develop cooperative agreements and reciprocal memberships with key partners;

- 3) Appoint a new Data Policy Committee or Working Group of the Executive Committee charged with monitoring of international data policy issues and recommending CODATA responses in a timely manner;
- 4) Establish a new Technology Committee or Working Group of the Executive Committee charged with developing a plan for introducing new technologies that can facilitate CODATA's work and its interactions with the broader scientific community;
- 5) Establish an *ad hoc* Committee of the Executive Committee charged with reevaluating CODATA's dues structure and suggesting modifications or alternative approaches for consideration at the 2008 General Assembly; and
- 6) Improve the CODATA's outreach to the broader scientific community through a coherent program of publications, Internet-based services, selective participation in key scientific activities, and interactions with key scientific publications.

A number of these actions have already been initiated by the CODATA General Assembly and the CODATA Executive Committee.

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1. Introduction

The ways in which scientists collect, create, transform, analyze, visualize, and manage data are evolving rapidly. Most data are now “born digital” and exist only in electronic form in computer systems or on digital media. In some fields, scientific discoveries are made primarily by processing vast amounts of data, detecting subtle trends, patterns, or interconnections across time, space, and diverse phenomena. In others, scientists apply sophisticated mathematical theories and methods to transform, visualize, analyze, and model data, often integrating data from very diverse disciplines and measurement systems. In the social sciences, scientists have the potential to tap increasingly detailed and complex databases on human activities and behavior, ranging from travel patterns to consumer transactions to real-time surveys. Indeed, the ability of non-scientists to contribute directly to scientific endeavors is increasing, whether through use of idle personal computers or direct observation of disparate phenomena by sophisticated personal digital assistants or cell phones.

The burgeoning diversity, complexity, and volume of data of direct or potential use to the scientific community pose a unique set of challenges to 21st century science. What is the potential of these data to advance scientific understanding, especially in areas of importance to human health and well-being and the long-term sustainability of the environment? To what degree is it important to capture and store these data in ways that preserve their scientific value for future research? Are current tools for capturing and managing data sufficiently robust to ensure future data quality and accessibility? To what extent should non-digital data be “rescued” in order to improve their accessibility and ensure their preservation? What should be done about the large amounts of digital data developed by individual scientists—many of whom may be nearing retirement—that are not yet adequately archived and documented? How can we utilize new forms of scientific collaboration (e.g., grids and virtual laboratories) and new approaches to scientific communication (e.g., interactive journal articles and blogs) to facilitate universal and equitable access to scientific data?

These are just a few of the many pressing data-related questions facing the scientific community that CODATA has attempted to address through its diverse activities. Over the past decade, CODATA Task Groups have tackled questions of data comparability, interoperability, quality, documentation, preservation, access, visualization, analysis, and cross-disciplinary integration in fields ranging from physics and chemistry to genetics and anthropometry. CODATA’s open access,

online *Data Science Journal* represents a major effort to improve the quality and recognition of “data science” and to make understanding of advances in data science accessible to all disciplines and scientists around the world.

A key role played by CODATA at both national and international levels is in the arena of data policy. Scientists have long recognized the value of open access to scientific data, as embodied in the ICSU Principle of the Universality of Science. In practice, open access to data must be balanced by concerns about national security, intellectual property (IP) rights, and privacy and confidentiality, which in many instances have their own benefits for scientific research (e.g., in the willingness of survey respondents to provide candid and truthful responses about sensitive issues). Specific data policies set the stage for the short- and long-term accessibility of data for research, education, and other applications, the private versus public returns on investment from research, the ability of scientists to obtain the resources they need to continue their research, the viability of many information-oriented sectors of the economy, the ability of developing countries to access data needed for development, and the ability of humanitarian organizations to utilize data in planning and implementing relief efforts.

CODATA took a lead role in highlighting the importance of scientific data and information in the successful development of the Information Society at the World Summit on the Information Society (WSIS) events in 2003 and 2005 and promoted the continuing need for open access to data. CODATA has argued forcefully against copyright protection for databases that simply collect and arrange factual information within the European Community and at the World Intellectual Property Organization (WIPO), and has contributed to efforts by the Organisation for Economic Co-Operation and Development (OECD) to develop guidelines for access to scientific data and information produced by publicly funded research (OECD, 2007). At the national level, CODATA’s national committees have strongly influenced national data strategies, for example, the U.S. Global Change Research Program Data Policy (<http://globalchange.gov/policies/diwing/>), the *National Consultation on Access to Scientific Research Data* in Canada (Strong and Leach, 2005), and China’s recent major commitment to scientific data sharing at both national and international levels (Xu, 2006). CODATA’s role in promoting open access to data at the international level has been recognized by the U.S. National Science Foundation (NSF) in its *Cyberinfrastructure Vision for 21st Century Discovery* (US NSF, 2007).

Nevertheless, despite this recent record of accomplishment, CODATA needs to do much more. The overall open access movement within the international scientific

community is faced with significant challenges from increasing trends towards protection of IP rights, growing national security pressures, new ways to compromise privacy and confidentiality, and rapid technological and institutional change. Individual disciplines, countries, and organizations are dealing with the problems they face in different ways, raising the potential for confusion, inefficiency, inequity, and permanent loss of critical data. The so-called “digital divide” between developed and developing countries continues to increase in many ways, increasing the handicaps that scientists in developing countries face in trying to advance not only their own research agendas but also the application of science to pressing problems of sustainable development. The ICSU PAA on Scientific Data and Information has also identified more than 50 actions needed to address key data needs and priorities, many of which are in CODATA’s area of concern and expertise.

It is therefore very timely for CODATA to take stock of its current portfolio of activities and initiatives, assess the most pressing needs related to scientific data and its own ability to meet these needs, and develop a coherent strategy for action over the next six years. CODATA’s strategy needs to be well coordinated with the ICSU Strategic Plan, recognizing CODATA’s particular capabilities and areas of experience and the complementary roles to be played by other ICSU bodies and other scientific organizations around the world. The strategy must also address core CODATA organizational principles and approaches, identifying areas where improvements in infrastructure, processes and procedures, membership, and financial sustainability can be made to increase the success of CODATA’s strategic initiatives and improve CODATA’s overall effectiveness and sustainability.

2. CODATA Strengths and Weaknesses

An essential element in the development of a useful and realistic strategic plan is a candid assessment of an organization’s strengths and weaknesses. This permits efforts to address specific weaknesses through internal changes or external partnerships—or, in some cases, allows organizations to avoid strategic approaches that would be likely to fail due to such weaknesses. Better understanding of CODATA’s strengths and weaknesses can help clarify the most appropriate roles for CODATA to take on in collaboration with ICSU and other groups, and ensure that expectations of what can be accomplished are realistic.

CODATA’s strengths lie in its cross-disciplinary focus on scientific data, its broad international and multi-disciplinary membership, and the active participation of individual scientists affiliated with its members. CODATA is fortunate to have an

efficient and effective Secretariat that has been able to strengthen ties with the ICSU Secretariat in recent years and support a wide range of scientific events and outreach activities. CODATA has a number of strong national committees that actively support the international organization. Over the years, CODATA has developed a solid reputation for certain of its activities, such as the periodic revision of the fundamental physical constants. Several CODATA task groups have played key roles in the development of major international data initiatives in areas such as biodiversity and Information Society technologies. Task groups are developed as grassroots efforts, selected through a democratic, peer-review process, and reviewed on a regular basis. CODATA's *Data Science Journal*, though still in its early stages, has helped raise the awareness of the scientific community of the importance of cross-disciplinary sharing of data theory, methods, and experience. CODATA's biennial conference has grown in size and impact, serving as a unique international forum for the advancement of data science across an expanding range of scientific disciplines. CODATA's ability to tap leading international experts on data policy has been instrumental in its efforts to promote open data access.

Nevertheless, it is important to recognize that CODATA relies mainly on *voluntary* efforts by individual scientists, most of whom are directly affiliated with a national committee or scientific union. With only two part-time staff members in its Secretariat, and only a few paid staff among all of the national committees combined, CODATA is currently limited in terms of available human resources to expand its activities and pursue new initiatives. The effectiveness of the Secretariat is very dependent on the time and support provided by the Officers, who are also volunteers with other professional commitments. The reliance on voluntary help, though advantageous in many ways, can also introduce distortions in the levels of participation of different groups, for example, younger scientists or scientists from developing countries, who are less likely to have the discretionary time and resources to participate in CODATA activities than more established developed country scientists.

Moreover, for the most part, the data and research centers that actually produce, manage, and disseminate scientific data around the world are only indirectly represented by CODATA's member organizations. These data and research centers employ many of the data-oriented scientists and data management professionals who could be an extremely valuable and motivated source of talent for CODATA. It is not clear to what degree this community is even aware of CODATA's existence, let alone willing to contribute to CODATA activities.

As recognized in the PAA report, CODATA also has gaps and weaknesses in its existing membership. CODATA does have active national members from Brazil, Canada, China, India, Japan, Nigeria, Poland, Russia, Senegal, South Africa, South Korea, the Ukraine, the United States, and other countries, and has made some recent gains in membership (e.g., Georgia and Ireland). However, the membership situation in western Europe and the lack of members from many parts of the developing world are important deficiencies. Gaps also exist in the representation of the Earth, social, and medical sciences among the member Unions.

The gaps in national membership are of particular concern because CODATA's financial sustainability is currently dependent almost entirely on the dues paid by the national members. Unlike other scientific societies that provide specific services to individual scientists in return for dues, or that publish scientific journals that charge libraries and others substantial subscription fees, CODATA does not now have a steady source of alternative income. Its commitment to open access data and journals precludes raising funds from the *Data Science Journal* beyond cost recovery.² Scientific unions are not assessed dues, and the number of dues-paying Supporting Organizations has decreased over time.

In recent years, CODATA has been able to supplement its budget through external funding such as grants from ICSU to support WSIS activities and the Task Group on Natural Gas Hydrates. CODATA also collaborated with an independent auditing firm to conduct an external review of the Global Biodiversity Information Facility (GBIF). However, at present the type and level of external funding are not sufficient to support a long-term expansion of the CODATA Secretariat, nor to serve as the basis for CODATA's long-term financial stability.

Another important weakness is that CODATA's current organizational structure limits its flexibility to respond quickly to time-sensitive issues and to adapt quickly to changing needs. Although CODATA's existing Task Group structure does provide a good mechanism for new initiatives, it can take several years for a Task Group to form and become productive. CODATA's General Assembly only meets every other year, and its Executive Committee only meets once a year. As volunteers, CODATA's officers and Committee members must juggle their own work and personal time commitments against CODATA's ongoing needs.

Finally, it is surprising that CODATA itself has not taken greater advantage of advances in information technology and the Information Society to facilitate its

² At present, the *Data Science Journal* is available for free on the Internet and therefore requires a small annual subsidy.

own activities. Although individual scientists involved with CODATA are well versed in state-of-the-art data management and computer science methods, CODATA presently lacks the capacity and resources to implement a full range of supporting services for data and information sharing, community interactions, and organizational management. The shift of the *Data Science Journal* to the Japan Science and Technology Information Aggregator, Electronic (J-STAGE) platform for online journals in early 2006 was a first step in this direction. CODATA should be able to use its strength in international collaboration and networking to marshal the support and resources needed to address this weakness.

3. CODATA's Scientific Mission and Agenda

CODATA's long-standing mission statement, established in a strategic planning meeting held in 1994 (Lide, 1995), was:

The mission of CODATA is to enhance the accessibility and promote the intelligent exploitation of data in the conduct of science and technology. CODATA seeks to become the central focus within ICSU, as well as the link between ICSU and the international scientific and technological communities, on matters concerning the organization, management, quality control, and dissemination of data from all scientific and technological disciplines. By bringing data experts together with scientists from the various disciplines, it will encourage and facilitate the application of modern information technology to all aspects of data management (Lide, 1995).

There appears to be general agreement that this mission statement needed to be updated and condensed to reflect CODATA's overall role and strategic directions. Moreover, as an interdisciplinary body of ICSU focused on scientific and technical data, CODATA's mission should also be consistent with ICSU's Mission Statement (see Appendix A) and with ICSU's vision of a "world where science is used for the benefit of all, excellence in science is valued and scientific knowledge is effectively linked to policy-making." In particular, CODATA is most certainly committed to the principle of "universal and equitable access to high quality scientific data and information" and supports the goal identified in the *ICSU Strategic Plan* to "facilitate a coordinated global approach to scientific data and information that ensures equitable access to quality data and information for research, education and informed decision-making" (ICSU, 2006).

With this in mind, the following updated CODATA mission statement has been proposed and adopted by the CODATA General Assembly:

The mission of CODATA is to strengthen international science for the benefit of society by promoting improved scientific and technical data management and use.

Scientific Agenda

CODATA's scientific agenda in recent years has primarily followed two tracks:

1. Disciplinary or cross-disciplinary activities focused on specific scientific topics or problems, such as developing taxonomies, integrating disparate sources of data, and applying new data methods or technologies; and
2. Data policy initiatives related to open access, data restrictions, and the role of data in the information society.

Initial discussions regarding the draft report of the PAA on Scientific Data and Information raised the following topics as key issues for CODATA's future scientific agenda (Norris *et al.*, 2004):

1. Full and equitable access to scientific data;
2. Monitoring and development of intellectual property rights to scientific data;
3. Long-term preservation of, and access to, scientific data;
4. Interoperability and data storage/exchange standards;
5. Data quality, validation and authentication; and
6. Capacity building, especially in the developing world.

Subsequent discussions identified several additional potential topics:

7. The role of new technology in data science and education;
8. The transformation of scientific data into knowledge;
9. Professional data management/professional development issues; and
10. Public education and awareness.

Clearly, topics 1 and 2 are central issues for both ICSU and CODATA, where CODATA has already established a strong track record. Topic 3 on long-term preservation and access has been the focus of at least one major Task Group effort, but is also of primary concern to the ICSU World Data Centers and other organizations around the world. Topic 4 on interoperability and data standards is of high interest to the scientific community, but CODATA has arguably had a limited role to date in this arena; other organizations such as the International

Standards Organisation (ISO) have substantial activities in most areas of standards development related to data. Topic 5 poses a difficult set of challenges, since evaluation of data quality varies across disciplines and depends in part on data usage; however, CODATA may be able to make both technical and organizational contributions on such topics as establishing agreement on data provenance and attribution.

Topic 6, capacity building, is an area where ICSU has strongly recommended leadership by CODATA, and where needs are substantial. CODATA has some comparative advantages in this arena, such as the involvement of many developing country scientists from Brazil, China, India, and South Africa who may be well positioned to assist scientists in the least developed countries of Africa, Asia, and Latin America.

Topic 7 on the role of new technology in data science and education ties in closely with topic 6, but also has applications in both developed and developing countries. Topic 8 on the transformation of data into knowledge also supports capacity building, especially with regard to the use of scientific data in decision making on sustainable development. These are both areas where CODATA may be able to tap the wealth of experience available in its member nations and unions to support technology and knowledge transfer across the digital divide.

Topic 9 on professional data management and related professional development issues was a significant finding of the PAA on Scientific Data and Information that underscores the potential role of CODATA as an organization capable of promoting professional data management as both a valuable function and a valued career in science. This also ties in with the more general need for activities addressing topic 10, public outreach and awareness on scientific data issues, especially with regard to the use of scientific data in decision making.

One approach to strategic planning would simply be to rank these ten topics in terms of priority and select the highest priority activities as the focus of strategic efforts, based on available resources. However, this approach does not take into account potential overlap and synergies between these topics. Moreover, there may be specific individuals and groups within CODATA for whom the lower priority topics are of primary interest, whose interest in contributing might therefore be limited.

Instead, we believe that identifying a small number of *cross-cutting* initiatives has the best potential to successfully address key elements of the scientific agenda. Such initiatives should synergistically address several of the major topics

identified above, providing flexibility across scientific disciplines and encouraging cross-fertilization, collaboration, and innovation.

Another consideration in developing these initiatives is coordination with planned ICSU strategic activities. In particular, ICSU's *Strategic Plan* outlines a number of current and planned international research initiatives in which the scientific community have key roles and where science data management may be of particular importance:

1. The Global Earth Observation System of Systems (GEOSS);
2. The International Polar Year (IPY);
3. Natural and human-induced environmental hazards and disasters;
4. Follow-up to the Millennium Ecosystem Assessment;
5. International Science Panel on Renewable Energy;
6. Human Health; and
7. Emerging scientific areas such as nanosciences and nanotechnology, molecular biosciences, and transgenic crops and animals.

CODATA has already collaborated with ICSU on some of these initiatives or has activities of its own relevant to them. For example, CODATA has participated actively in planning for the IPY Data and Information Service. A CODATA officer served on ICSU's *Ad Hoc* Scoping Group on Natural and Human-Induced Environmental Hazards in 2005. CODATA has also taken a prominent role in helping to define practical steps towards implementing the GEOSS data sharing principles, in part as an element of ICSU's participation in GEOSS.

4. Planned CODATA Strategic Initiatives

In light of the complexity of the issues described above, CODATA needs to define a relatively simple and understandable structure for its strategic activities. This plan describes three main strategic initiatives designed to focus CODATA's efforts over the period 2006-2012:

1) The Global Information Commons for Science Initiative

Based on experience gained during preparations for the second phase of WSIS, CODATA has already begun to develop a significant cross-cutting strategic effort, the Global Information Commons for Science Initiative (GICSI). Taking advantage of the unique opportunity represented by the WSIS meeting in Tunis in November

2005, CODATA formally launched GICSI with several partner organizations.³ GICSI is now an official follow-up activity of WSIS, listed in the WSIS “Golden Book” developed by the International Telecommunication Union (ITU).

GICSI represents an innovative effort to accelerate the development and “scaling up” of global open-access scientific data and information resources. Specific objectives of GICSI are to:

- 1) 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;
- 2) Identify and promote the broad adoption of successful institutional and legal models for providing open availability on a sustainable basis and facilitating reuse of scientific data and information;
- 3) Encourage and help to coordinate the efforts of the many stakeholders in the world’s diverse scientific community who are engaged in devising and implementing effective approaches to attaining these objectives, with particular attention to the circumstances of the developing as well as the developed countries; and
- 4) Promote all of the objectives of the Initiative through the development of an online “open access knowledge environment”.

GICSI addresses the overall topic of promoting full and equitable access to scientific data, building on the resources and innovative energy of the broad open-access science community. Through both “bottom up” and “top down” efforts, GICSI is helping to create a tangible, shared information commons for science containing valuable scientific data, information, tools, and other resources accessible to all. GICSI is also helping to address other topics of concern to CODATA, including long-term data access, IP rights, data interoperability, data quality, capacity building, and the role of new technology.

Organizations that have been involved in the early stages of GICSI are ICSU, the International Council for Scientific and Technical Information (ICSTI), the

³ The original ideas for the Global Information Commons for Science Initiative were presented in articles by Reichman and Uhler (2003) and David and Spence (2003). These ideas were more fully fleshed out following an international workshop at UNESCO Headquarters in Paris on 1-2 September 2005 on “Creating the Information Commons for Science: Toward Institutional Policies and Guidelines for Action” (see: <http://www.codataweb.org/UNESCOmtg/index.html>).

International Network for the Availability of Scientific Publications (INASP), and the ICSU World Data Centers (WDCs). The Science Commons, a subsidiary of the Creative Commons, has emerged as a key partner in GICSI due to its mutual interests and its experience with the “contractually constructed commons” approach. Collaboration has also been established with the InterAcademy Panel on International Issues (IAP), the Academy of Sciences for the Developing World (TWAS), the Organisation for Economic Co-operation and Development (OECD), and the United Nations Economic, Scientific, and Cultural Organisation (UNESCO). CODATA, working closely with the US National Committee, has begun to seek funds for this initiative from key foundations and agencies.

2. The Scientific Data across the Digital Divide (SD³) Program

The need for better scientific data to support sustainable development—including poverty reduction, disaster mitigation, reduction of stress on natural resources, and transitioning to renewable energy resources—has never been greater. The scientific community has a vast array of data and tools, ranging from remote sensing and historic hazard data to ecological models and genetic databases to poverty maps and public health datasets, that are not yet available to and usable by trained developing country scientists and practitioners.

CODATA has the opportunity to facilitate the application of scientific data and associated tools to problems of sustainable development in the developing world, and in particular to support training, networking, and technology transfer to developing country scientists. As part of several ongoing or planned international initiatives, CODATA will develop specific activities aimed at making critical scientific data and associated tools and resources related to sustainable development widely accessible in developing countries.

Initial examples of such activities are:

1. Active participation in GEOSS, e.g., in the area of identifying steps required to further the practical application of agreed GEOSS data sharing principles, including assessment of options to overcome barriers to data sharing and access for the targeted GEOSS societal benefit areas and for those addressing the needs of developing countries;⁴
2. Active involvement in the Global Risk Identification Program (GRIP), a new initiative by the United Nations Development Program (UNDP) and the

⁴ GEO 2006 Work Plan item DA-06-01

Provention Consortium to improve the evidence base for disaster risk management at global, national, and local levels;⁵

3. Support for the electronic Geophysical Year (eGY) and International Polar Year (IPY), specifically in the area of data policy, access, and stewardship issues, to ensure that Earth and social science data collected and integrated during these initiatives are made widely accessible and usable for all; and
4. Possible implementation of the CODATA-ICSTI Portal on Permanent Access to Scientific Data, with the specific aim of providing developing country scientists with easier access to a wide range of data and information resources concerned with scientific data management.

It is expected that several current Task Groups, as well as possible new Task Groups, will be interested in supporting these activities and/or suggesting additional initiatives within the SD³ initiative.

Over time, CODATA should aim to expand its efforts into additional areas, such as collaboration with ICSU and other organizations on follow-up to the Millennium Ecosystem Assessment; collaboration with GBIF, Diversitas, the Inter-American Biodiversity Information Network (IABIN), and other biodiversity organizations on biodiversity data management; and direct collaboration with the World Bank, UNDP, and other development agencies on poverty and development data needs. In this vein, it is important for CODATA to cultivate selected partnerships with key development agencies, nongovernmental organizations, universities, research institutes, and other groups to develop and expand the SD³ Program. A new opportunity in this regard is the United Nations Global Alliance for Information and Communications Technologies and Development (GAID), an open, multi-stakeholder forum that brings together governments, international organizations, civil society, the private sector, media and other stakeholder constituencies in a common effort to better harness ICT for advancing development. The Chinese Academy of Sciences, for example, has initiated a new GAID activity known as e-SDDC, the Global Alliance for Enhancing Access to and Application of Scientific Data in Developing Countries.

One benefit of this approach is that these initiatives may be able to mobilize external resources to support specific needs. For example, negotiations have been initiated with GRIP to provide CODATA with the incremental funding needed to complete specific tasks of mutual interest. CODATA has begun to explore possible

⁵ <http://www.proventionconsortium.org/?pageid=32&projectid=3>

national sources of funding for its work in support of GEOSS. If these initial activities prove to be successful, it is anticipated that longer term funding commitments may be possible.

3. Advanced Data Methods and Information technologies for Research and Education (ADMIRE).

CODATA has a strong track record in the arena of developing and applying new data processing, management, and analysis approaches in new areas of science. As science has increasingly moved from a “data poor” to a “data rich” world, new techniques have emerged for processing vast quantities of heterogeneous data, identifying and extracting relevant or desired data from large data holdings, and integrating diverse data sets in creative ways. Such e-science/cyberinfrastructure approaches have great potential in both research and education and in supporting development of new “Information Society” applications of scientific data and knowledge.

The ADMIRE initiative will build on past CODATA activities in this arena including the Task Group on Virtual Observatories and the TELEBALT and related projects carried out in collaboration with EDNES. The initiative will seek 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. One specific activity currently under development is participation in a project to address the multicultural and multilingual aspects of accessing, exploiting, using, and re-using digital content in Europe. ADMIRE will also address both technical and institutional issues related to long-term stewardship and accessibility of data. It is expected that the new framework programme for research of the European Commission (FP7) could provide additional multi-year funding opportunities for this initiative.

5. Strengthening CODATA’s Capacity

In order for CODATA’s strategic initiatives to succeed, CODATA must take immediate steps to strengthen its own scientific, technical, and institutional capacity. These can be categorized into six main groups:

- 1) *Strengthen CODATA’s National and Union Membership.* CODATA needs to work aggressively to address current membership problems, including efforts to revitalize the participation of current members as well as attract new members.

A key step is to document the benefits of CODATA membership in more detail, emphasizing CODATA's recent accomplishments, its important role in key international initiatives, its extensive international participation, and its strategic goals and plans. In some cases, CODATA should explore the formation of national CODATA committees outside of the traditional national Academy of Science. Some of the Scandinavian countries that have strong interests in sustainable development and strong ties with ICSU may be worth approaching. Drawing on the help of existing active national committees has worked well in the past and may prove useful in the future. As suggested by the PAA report, ICSU may be able to help with some existing and potential national members. Collaboration with the new ICSU Regional Offices may also benefit efforts to extend membership to countries within the same region.

CODATA should also explore ways of expanding its membership in Africa and other developing regions. This could include development of regional membership organizations that would include representation from multiple countries. Funding should be sought to support greater participation of developing country scientists in a range of CODATA activities, including the CODATA Conference and General Assembly, Task Groups, and strategic initiatives. Another issue to address is the dues structure, which at present appears to discourage membership by developing countries in CODATA even at the level of Associate National Membership. One short-term possibility is to solicit contributions from developed country members to cover the dues of developing country members.

- 2) *Expand the number and breadth of Supporting Organizations and other partners.* As noted previously, many data centers, data-oriented research centers, and data-focused organizations and networks are only indirectly represented through CODATA's existing membership structure. Yet these organizations, and their employees, represent a major and largely untapped constituency and source of support for CODATA. Unfortunately, CODATA's current Constitution provides no specific benefits for Supporting Organizations, other than a loose association with CODATA. Short of a Constitutional amendment, CODATA could take steps to create and document the benefits of becoming a Supporting Organization, and work aggressively to recruit such organizations. In addition to the modest financial benefit that this might entail in terms of added dues, expanding the overall CODATA constituency in this manner would be invaluable in terms of expanding the potential pool of data scientists and experts who could contribute to CODATA activities and strengthening CODATA's ability to interact with, and represent, the international data community on issues of common interest.

Example organizations and networks of this type include the international agricultural research centers that make up the Consultative Group on International Agricultural Research (CGIAR), the ICSU World Data Centers, the International Institute for Applied Systems Analysis (IIASA), the United Nations Environment Program (UNEP) Global Resource Information Database (GRID) centers and the UNEP World Conservation Monitoring Centre (WCMC), the International Association for Social Science Information Services & Technology (IASSIST), the International Federation of Data Organisations for the Social Science (IFDO), the Council of European Social Science Data Archives (CESSDA), the Electronic Resource Preservation and Access Network (ERPANET), the Global Spatial Data Infrastructure (GSDI) Association, and the International Steering Committee for the Global Map (ISCGM). Many relevant centers and networks also exist at the national level. For example, within the U.S., potential Supporting Organizations include the NASA Distributed Active Archive Center (DAAC) Alliance, the NASA Earth Science Information Partner (ESIP) Federation, and the National Oceanic and Atmospheric Administration (NOAA) data centers. Other possibilities include the UK Digital Curation Centre, the Finnish Environment Institute, and the Norwegian Geotechnical Institute. Some steps in this direction have already been taken by actively involving representatives of these centers in CODATA activities, e.g., several WSIS-related meetings and the CODATA Conferences, and by making direct contact as opportunities arise. It may also be worth exploring the possibility of attracting private sector organizations to become supporting organizations.

- 3) *Develop an "Associates Program."* Another limitation of CODATA's current structure is that individual data scientists and experts have only a small number of ways to remain active participants in CODATA activities: they can be members of active CODATA Task Groups or Working Groups, they can serve as officers or Executive Committee members, they can participate as designated representatives of member organizations, or they can participate as members of national committees.⁶ In addition, once every two years, they can participate in the CODATA Conference. Once a term of appointment ends, or a Task Group or Working Group dissolves, their formal affiliation with CODATA also ends. This limits the pool of available people to help with CODATA activities and fails to take advantage of the potential cumulative development of a large, international community of data professionals who identify themselves with CODATA, and CODATA's goals and objectives, on an ongoing basis.

⁶ Moreover, some national committees rotate their membership on a regular basis.

CODATA thus needs to develop some type of “Associates Program” that would allow individuals to begin and continue their involvement with CODATA in an informal manner. Such a program would promote continuity and provide a communication channel for all those involved with CODATA. It could provide a new mechanism for involving younger scientists in CODATA activities, for building grassroots support for CODATA membership in countries or unions that are not presently members, and for reaching out to developing country scientists and students. CODATA would need to define the benefits of becoming a CODATA Associate, including tangible services (e.g., discounted registration fees, print versions of the CODATA newsletter, enhanced access to online services). CODATA could also consider collecting annual dues to help make the Program at least self-supporting (preferably with appropriate discounts or waivers for Associates from low-income countries, students, and partner organizations).

In the long run, it is possible that a CODATA Associates Program could become an important mechanism for professional development. For example, it could become a venue for professional training, certification, and recognition that could help strengthen the overall role of professional data management in science.

- 4) *Establish an International Data Academy.* Since its establishment over 40 years ago, a large number of data experts from different scientific disciplines have been formally involved in the CODATA family. Unfortunately experience shows that when their formal links with the organization expire, CODATA also loses their expertise and guidance. Further there are many highly prestigious data experts in the world who for whatever reason are not formally part of the CODATA structure. Globally this group of people has the potential to provide a rich, prestigious and highly skilled “think tank” on data that CODATA could tap for advice and guidance.

To this end CODATA proposes creating an International Data Academy that will provide such a structure. In short, the objective of the Academy is to create a select expert pool of data information and knowledge scientists who can be called upon for advice on data issues of the day. This will strengthen CODATA’s role as a leading authority on data issues on the international stage. It is envisaged that a small working group will be appointed to draft the operational guidelines for the Academy, including membership criteria.

- 5) *Expand externally funded activities.* CODATA clearly needs to broaden its financial base to provide for longer-term sustainability. Seeking external funding is one way to increase CODATA’s scientific and technical capacity, as

well as its visibility and impact. Of course, CODATA typically must compete for funds with other organizations. In an era of ever tightening research budgets, it is usually necessary for organizations to invest significant resources into proposals with no certainty regarding the results. Nevertheless, CODATA does have a number of comparative advantages that may be important in certain cases. For example, it can tap a wide range of data expertise from around the world at relatively low cost. The CODATA Secretariat itself operates with very low administrative overhead and with a high degree of efficiency. As part of the ICSU family, CODATA has a degree of scientific prestige and independence that few other organizations can match.

Despite these advantages, CODATA must still proceed carefully in its fund raising activities, recognizing that it has limited capacity to develop and submit proposals on an ongoing basis. The best strategy may be to work to identify key programs and program managers with strong interest in data issues at key institutions, agencies, and foundations. Working with CODATA's partners, it should then be possible to submit focused proposals for specific activities that help to meet objectives of mutual interest. The *ad hoc* Funding Committee established by the Executive Committee in 2005 should be expanded and given a specific charge to explore funding opportunities with member and partner organizations on an ongoing basis.

Another important aspect of external fund raising is to ensure that Task Groups that are able to raise matching funds utilize the CODATA Secretariat whenever possible or work out alternative ways for CODATA to receive some return on its investment in their work. This should become a requirement for renewal.

- 6) *Establish a Gift and Endowment Fund.* As an additional approach to diversifying and stabilizing its financial base, CODATA should create a gift and endowment fund and populate it initially with a small amount of discretionary or surplus operating funds if possible. Once established, CODATA could then explore ways to generate endowment funds, e.g., by designating some proportion of its dues or Associates Program income or by soliciting donors for cash, assets, or even bequests.
- 7) *Strengthen the CODATA Secretariat.* All of the activities mentioned above will require substantial coordination and initiative to achieve. Although the current Secretariat is highly efficient and effective, there are clearly limits to what can be expected from two part-time staff members. CODATA needs to explore options for expanding the human resources available to the Secretariat, not only by raising additional funding for staff, but also through increased

collaboration and cooperation with other groups (e.g., national committees, unions, supporting organizations, and networks of volunteers) and through selective use of consultants and possibly secondments and visiting scientist arrangements.

6. Implementing the Strategic Plan

In the immediate future, CODATA can take several concrete steps to implement the Strategic Plan and increase its probability of success. In particular, CODATA must focus and improve its existing portfolio of activities, coordinate its activities with ICSU and other key partners, and increase its flexibility and responsiveness to ongoing, rapid changes in data management, technology, and policy. More specifically, CODATA will:

- 1) Encourage the CODATA Task Groups and Working Groups and the editors of the *CODATA Data Science Journal* to make substantial contributions to GICSI, SD³, and ADMIRE in their areas of activity. This could be added as a requirement in future Task Group and Working Group application materials.
- 2) Participate actively in the planned ICSU *ad hoc* Strategic Committee on Information and Data (SCID) and possible follow-on Scientific Data and Information Forum (SciDIF) and develop cooperative agreements and reciprocal memberships with key partners. For example, CODATA has discussed reciprocal membership with GBIF as an initial step towards increased collaboration. As recommended by ICSU, CODATA also needs to explore ways to improve coordination and collaboration with the ICSU World Data Panel, which has recently gained new leadership. CODATA participated in a major conference of the WDC Directors in May 2007 and has encouraged WDC involvement in the GEO data policy activity.
- 3) Appoint a new Data Policy Committee or Working Group of the Executive Committee charged with monitoring of international data policy issues and recommending CODATA responses in a timely manner. The current *ad hoc* arrangements are inadequate for rapid and effective responses; this issue needs to be handled by a dedicated group of experts under the supervision of the Executive Committee.
- 4) Establish a new Technology Committee or Working Group of the Executive Committee charged with developing a plan for introducing new technologies that can facilitate CODATA's work and its interactions with the broader scientific community. This Committee could take on an

ongoing role if appropriate in overseeing implementation of the technology plan and in planning for future enhancements.

- 5) Establish an *ad hoc* Committee of the Executive Committee charged with reevaluating CODATA's dues structure and suggesting modifications or alternative approaches for consideration at the 2008 General Assembly. This committee should evaluate options and make recommendations regarding ways to: *a*) reduce the barriers to membership on the part of developing countries; *b*) correct imbalances in the current dues structure (which is tied to ICSU's dues structure); *c*) deal with problems arising from fluctuating exchange rates; and *d*) increase CODATA's financial stability and sustainability.
- 6) Improve the CODATA's outreach to the broader scientific community through a coherent program of publications, Internet-based services, and selective participation in key scientific activities. Of particular importance would be strengthening ties with key scientific publications such as *Science* and *Nature*. The editorials published in *Science* prior to the two WSIS events are examples of this type of high-impact outreach (Lubchenco and Iwata, 2003; Iwata and Chen, 2005). Outreach to other data oriented communities, such as the geospatial and social science data communities, could also be valuable. Inviting key groups to contribute articles or organize special issues of the *Data Science Journal* could be one element of this effort.

7. Measuring Success

Preparing a strategic plan is only one step in a long process of rethinking objectives and approaches and implementing change, both internal and external. To succeed, a strategic plan must reflect a shared consensus on actions to be taken, but at the same time, it should be flexible enough to evolve and respond as needed to changing conditions.

At the CODATA General Assembly in 2012, what will be the measures of success or failure of this strategic plan?

Clearly, some aspects of the plan will be straightforward to assess. Will CODATA's membership have grown significantly? Will its financial base be more diverse and sustainable? Are new mechanisms in place to reach CODATA's wider constituency in data science and technology? Has the concept and practice of open access to scientific data significantly expanded?

Less tangible will be whether CODATA has succeeded in its overall mission to strengthen international science through better scientific and technical data. Data quality is difficult to measure quantitatively, and the impact of better coordination can be hard to distinguish. The tensions between open access and data restrictions will undoubtedly continue, requiring CODATA to be vigilant even if substantial progress towards openness is made. Certainly, one would hope to see much wider use of scientific data and information in the developing world, facilitated through such initiatives as GEOSS, GRIP, and the eGY. However, the emergence of a true global information commons in support of science may take more than 5-6 years, even in the Internet age.

In summary, this Strategic Plan lays out some initial directions and changes for CODATA for the next few years that will need to evolve over time. The plan should be a living document: revisited, revised, and updated if needed by the CODATA Executive Committee and at each upcoming General Assembly. CODATA needs to incorporate strategic thinking and planning into its day-to-day business; it should not store its plan in a dusty archive, waiting to be reviewed and renewed every decade or so.

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Acronyms and Abbreviations

ADMIRE	Advanced Data Methods and Information technologies for Research and Education
CAS	Chinese Academy of Sciences
CESSDA	Council of European Social Science Data Archives
CGIAR	Consultative Group on International Agricultural Research
CODATA	Committee on Data for Science and Technology
DAAC	Distributed Active Archive Center
eGY	electronic Geophysical Year
ERPANET	Electronic Resource Preservation and Access Network
ESIP	Earth Science Information Partner
GAID	Global Alliance for ICTs and Development
GBIF	Global Biodiversity Information Facility
GEOSS	Global Earth Observing System of Systems
GICSI	Global Information Commons for Science Initiative
GRID	Global Resource Information Database
GRIP	Global Risk Identification Program
GSDI	Global Spatial Data Infrastructure
IABIN	Inter-American Biodiversity Information Network
IAP	InterAcademy Panel on International Issues
IASSIST	International Association for Social Science Information Services & Technology
ICSTI	International Council for Scientific and Technical Information
ICSU	International Council for Science
ICTs	Information and Communication Technologies
IFDO	International Federation of Data Organisations for the Social Science
IIASA	International Institute for Applied Systems Analysis
INASP	International Network for the Availability of Scientific Publications
IP	intellectual property
IPY	International Polar Year
ISCGM	International Steering Committee for the Global Map
ISO	International Standards Organisation

ITU	International Telecommunication Union
J-STAGE	Japan Science and Technology Information Aggregator, Electronic
NASA	National Aeronautics and Space Administration (U.S.)
NGOs	nongovernmental organizations
NOAA	National Oceanic and Atmospheric Administration (U.S.)
NSF	National Science Foundation (U.S.)
OECD	Organisation for Economic Co-Operation and Development
PAA	Priority Area Assessment
SCID	Strategic Committee on Information and Data
SciDIF	Scientific Data and Information Forum
SD ³	Scientific Data across the Digital Divide
TWAS	Academy of Sciences for the Developing World
U.S.	United States
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Economic, Scientific, and Cultural Organisation
URL	Uniform Resource Locator
USNC	U.S. National Committee
WCMC	World Conservation Monitoring Centre
WDC	World Data Center
WIPO	World Intellectual Property Organisation
WSIS	World Summit on the Information Society
WWW	World Wide Web

Appendix A: ICSU Mission Statement

In order to strengthen international science for the benefit of society, ICSU mobilizes the knowledge and resources of the international science community to:

- Identify and address major issues of importance to science and society.
- Facilitate interaction amongst scientists across all disciplines and from all countries.
- Promote the participation of all scientists—regardless of race, citizenship, language, political stance, or gender—in the international scientific endeavour.
- Provide independent, authoritative advice to stimulate constructive dialogue between the scientific community and governments, civil society, and the private sector.

Source: http://www.icsu.org/5_abouticsu/INTRO_IntroMiss_1.html