Science and Technology for Sustainability in Asia: The Agenda of the Science Council of Asia

Dr. Mohd Nordin Hasan & Tan Sri Datuk Dr. Omar Abdul Rahman
Academy of Sciences Malaysia

About the authors

Dr. Mohd Nordin Hasan

Fellow, Academy of Sciences Malaysia (ASM)

Educational Background

Bachelor of Agricultural Science (Honours), University of Malaya, 1971
Doctor of Philosophy, University of London, 1974

Professional Career

1983-2003 Professor, Universiti Kebangsaan Malaysia
2003-2006 Adjunct Professor, Autralian National University / President, Environmental Management and Research Association of Malaysia / Theme Leader, Ecosystem Status Indicators, Commission on Ecosystem Management, IUCN The World Conservation Union

Tan Sri Datuk Dr. Omar Abdul Rahman

Founding President and Senior Fellow, Academy of Sciences Malaysia (ASM)

Educational Background

Bachelor of Veterinary Science, University of Sydney
Ph. D. University of Cambridge

Professional Career

Senior Research Officer, Veterinary Research Institute, Ipoh Malaysia
Founding Dean of Veterinary Medicine and Animal Sciences, Universititi Pertanian Malaysia (UPM)
Science Advisor, Prime Minister's Department Malaysia
Founding Fellow, Islamic Academy of Sciences
Fellow, Third World Academy of Sciences
President, Federation of Asian Scientific Academies Societies (FASAS)
Chairman, Commonwealth Partnership for Technology Management (CPTM)
Past President, Science Council of Asia
Executive Chairman, Kumpulan Modal Perdana Sdn Bhd, Malaysia

Science Council of Asia (SCA):
was established in May 2000 among 10 Asian countries for the purposes: to exchange information on current status of science; to promote collaboration and cooperation in a wide range of field of science in the region. Now with membership of 19 organizations of 11 countries SCA works together for Sustainable Development: A Prosperous, Harmonious and Greener Asia. The members are shown at the last part of this booklet.

Foreword

It is my great pleasure to publish this booklet, the first report of the SCA Joint Projects, *Science and Technology for Sustainability in Asia: The agenda of the Science Council of Asia*.

The Science Council of Asia (SCA), founded in 2000, brings together scientists and scientific organizations from all academic fields, including the cultural and social sciences as well as the natural sciences, technology, and health care, to achieve the following aims:

- To exchange information among Asian countries on the current status of science;
- To promote collaboration and cooperation in a wide range of fields in the sciences in the Asian region;
- To deepen understanding and trust among scientists in Asia.

The SCA Joint Projects are research projects on scientific issues promoted by two or more researchers under the leadership of anchor organization of member countries. The objective of the projects are i. to share experiences, ii. to promote collaboration, and iii. to achieve common goals of the SCA.

Susainability Science anchored by Academy of Sciences Malaysia is one of the authorized SCA Joint Projects at the first annual SCA conference in May 2001 and this booklet is its first output. Currently, we have more than 10 projects proposed by member countries and it is expected that we will have some more outputs and policy recommendations from these on-going projects. I believe, through these activities, the SCA will be able to solidify its reputation as a leading scientific organization in the Asian region to contribute Sustainable Development to a Prosperous, Harmonious and Greener Asia.

July 2005

Kiyoshi Kurokawa
Secretary General
Science Council of Asia

Science and Technology for Sustainability in Asia: The Agenda of the Science Council of Asia

By

Mohd Nordin Hasan and Omar Abdul Rahman
Academy of Sciences Malaysia

1. INTRODUCTION

The quest for sustainable development poses new challenges to the scientific community and society. The transition to sustainability requires knowledge from scientific research and use of technologies in ways that are more policy relevant so as to be able to suggest solutions to sustainability issues based on a consideration of comprehensive sets of factors, driving forces and contexts. The expertise of many different disciplines, professions and communities must come together to generate the knowledge to address this challenge and our understanding of human and natural systems have to go beyond the current boundaries of natural and social science.

Many believe that the challenges posed by the need to develop sustainaby far outstrips the capacity of the science and technology community and society to forge effective and comprehensive responses (ISTS 2002). Owing to this scientific and technology organizations worldwide are committed to the development of science and technology for sustainability.

The Science Council of Asia (SCA) resolved at its inaugural meeting in 2001 to initiate work to meet these challenges and to lay the basis for the development of theoretical and practical frameworks for the effective application of science and technology in the transition to sustainable development in Asia. The SCA fully recognise that although there are many global initiatives in science and technology for sustainability, the way forward is not necessarily the same for all countries and regions of the world.

The SCA programme of work on science and technology for sustainability in Asia was adopted at its inaugural Board Meeting and Annual Conference in Bangkok, Thailand in 2001. The programme is a core activity of the SCA, and will continue to be so until the year 2006. It is spearheaded by the Academy of Sciences Malaysia and is at the end of its third year of implementation that may be considered as the end of its first phase of implementation. To make further progress in the ensuing two years additional resources and commitment from the SCA and its partners will be required. This report gives an account of the achievements of the project to date by highlighting the major outputs and outcomes of the project. Next steps for its successful completion are suggested at the end.

2. OUTPUT 1: A VISION OF SUSTAINABLE DEVELOPMENT IN ASIA

One of the earliest output from the SCA project on science and technology for sustainability is a vision of sustainable development in Asia. This was first enunciated at the Inter Academy Panel (IAP) *International Conference on Transitions to Sustainability in the 21st Century: The Contribution of Science and Technology* held in May 2000 in Tokyo. The vision statement then consisted of two elements of sustainability *viz.* prosperity and environmental soundness and was

stated as "A Prosperous and Greener Asia". Since then this vision has been refined to include a third dimension crucial for sustainability in Asia i.e. peace and security. The current vision of sustainability in Asia is that of a "Prosperous, Harmonious and Greener Asia" (Omar Abdul Rahman and Mohd Nordin Hasan 2003).

The SCA initiative on science and technology for sustainability provides a strong reason for countries in Asia to work closely together towards sustainable development. Principle 9 of the Rio Declaration on Environment and Development recommends that States should cooperate to strengthen endogenous capacity-building for sustainable development by improving scientific understanding through exchanges of scientific and technological knowledge, and by enhancing the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies.

Exchange of information on the current status of science among Asian countries, promoting collaboration and cooperation in science in the Asian region, and advancement of mutual understanding and trust among scientists in Asia are the key purposes for which the SCA was formed. These principles are enshrined in the SCA's Statutes. Initiating a joint project on science and technology for sustainability not only meet the aims and purposes of establishing the SCA but also by focusing on the subject of science (knowledge) for sustainable development, there is the opportunity to ensure that the SCA's main aims are congruent to that of the Rio Principles on sustainable development.

The SCA's commitment to its role in promoting sustainable development is Asia is captured in *The SCA Resolution on Sustainable Development in Asia* adopted in May 2002 by the Board of the sCA (see Annex 1). From this Resolution it can be seen that it is the SCA's

view that countries of Asia must consider sustainable development as an imperative in order to revive economic development, improve quality of life and achieve a balanced growth with social equity. It is thus an initiative that is holistic and chooses to address not just the achievement of economic growth, but also the equitable distribution of peace, health and prosperity within and between generations. It is also concerned with the creation and maintenance of environmental conditions that will secure sustainability of Asia's natural resources and ecosystem goods and services in the long-term. Thus, the vision of a prosperous, harmonious and greener Asia captures the long-term goal of development in the entire region.

3. OUTPUT 2: NEEDS AND CORE QUESTIONS IDENTIFIED

The SCA acknowledges that the alarming trend towards increasing environmental degradation and social and economic vulnerability currently observed in Asia must be reversed. This will require major advances in our ability to analyse, understand and predict the behaviour of complex self-organizing systems that is the *milieu* within which we live and develop.

There is also the need as identified by other groups working on sustainability (Corell 2002, ICSU 2002, Clark and Dickson 2003) to be able to characterize the irreversible impacts of interacting stresses acting on the economic, social and ecological fronts. For too long a mono-dimensional reductionist approach has been used in researching and understanding the causes and effects of economic, social and environmental stress independently. In the transition to sustainability there is strong need to tackle problems and issues at multiple scales of organization, and to benefit from the perceptions and understanding of the many stakeholders and social actors with

their divergent expectations of development. A better general understanding of the complex dynamic interactions between society and nature is required for sustainable development.

To better the understanding of sustainability in Asia and elsewhere in the world, a set of fundamental core questions need to be asked. A workshop of leading natural and social scientists held in Friiberg in 2000 sought to address methodological, epistemological, and ontological shortcomings of existing approaches to science (Clark and Dickson 2003). They also expressed concern for our ability to understand vulnerability, resilience, adaptation as they relate to present day societies. Additionally they raised the issues of the need to define the boundaries that set limits to which nature-people systems can be challenged, and of the nature of existing incentive and operational systems and their ability to guide the transition to sustainability. Finally we ought to be able to find means by which research planning, monitoring, assessments and decision support can be better integrated into management and learning systems.

Much was gleaned for the SCA Joint Project on science and technology for sustainability from new and emerging initiatives that aimed to develop "sustainability science" as the unifying framework for the new enterprise of science upon which sustainable development is anchored (Kates et al 2000). The key amongst these was the series of regional workshops held around the world that were meant to broaden and deepen the agenda for science and technology for sustainability funded by the Packard Foundation. Each workshop sought to engage both the environment and development communities from the natural as well as the social sciences, and involved the participation of scholars as well as practitioners. The workshops also sought to examine multiple sectors of human activity

and their interactions, the influence of spatial and temporal scales and the need to combine knowledge and action.

The workshop in Asia was held in Chiang Mai. A summary of the insights developed from this Southeast Asian Workshop is given in Annex 2. The Workshop specifically drew attention to the need to approach research from a multi-scalar and interdisciplinary perspective, and of the need to incorporate sustainability issues within current research, development, training and education programmes (Labelle 2000).

A synthesis workshop that combined the findings of all the regional workshops (Corell 2002) identified the following common concerns (see http://sustainabilityscience.org/ists/synthesis02/ists_regws_synthesis_020503.pdf)

Scale matters: Geographical scales are particularly critical, vulnerabilities, resilience, and sensitivities are very scale dependent.

Recognition of temporal scales must be improved: Adaptive capacity is fundamentally dependent on the time scale.

Regionally-specific sectors matter: Each region or locale has specific sectoral issues of critical importance, e.g., water, human health and well-being, food availability and agriculture, coastal margins, etc.

Role of institutions and infrastructure critical: The issues of enabling institutions and infrastructure are particularly critical in developing countries. It is likely, too, that there will need to be changes in the more highly economically developed countries as well.

Information technology can enable: A range of issues have been raised, from the internet to monitoring and data/information systems, -- all being seen as critically important to further S&T for sustainability.

Traditional or user/local knowledge must be used: New strategies must be developed to incorporate "traditional" or "local" knowledge into the S & T process and the use of concepts such as co-production of knowledge is essential.

Understanding resilience and adaptive capacity vital: Understanding and developing methodologies to estimate or project adaptive capacity is essential as well as strategies for enhancing the resilience of local institutions and communities, particularly in the context of urbanization and demographic shifts, globalization of markets, global/local environment change, and human well-being.

Gender issues must be addressed: Gender issues are critically important and should be addressed in the context of equity, roles in S & T, education, employment, access, etc.

Broader research agenda must be redefined: There appears to be a need to re-articulate the broader issues of anchoring the S&T agenda concerning the human condition while conserving the basic life support systems and biotic diversity of the planet.

Dialogue must be more effective: Major new efforts should be made to enhance the quality and effectiveness of the dialogue between scientists and decision makers, with a focus on enhanced decision support systems for public policy and citizen awareness.

As can be seen, these conclusions do not focus only on the process of knowledge creation in the form of scientific research and its technological embodiments, but include also recommendations for institutional adjustments and innovations. It is obvious from these conclusion that there are very strong grounds for undertaking a regional, scale-dependent initiative in Asia because as noted by the global synthesis workshop, sale matters, regionally-specific sectors matter and that the role of institutions and infrastructure is especially critical in developing countries (Corell 2002).

The substantive focus of science and technology in the work needed to promote sustainable development will have to be on the complex, dynamic interactions between nature and society ("socio-ecological" systems) in a place-based or enterprise-based context as noted by ICSU in its report *Science and Technology for Sustainable Development: Consensus Report and Background Document Mexico City Synthesis Conference,* ICSU Series on Science for Sustaianble Development No. 9 (ICSU 2002). The basis for this is the fact that many of the assumptions on which science is conducted has been challenged and that analyses on a single scale, cause, or hypothesis is inadequate and needs to be replaced by an integrative approach assuming multiple scales, causes and hypothesis.

4. OUTPUT 3: OTHER INITIATIVES IN ASIA CATALOGED

As part of the SCA joint project, similar initiatives undertaken by other organizations in Asia were reviewed and documented. Such a review is vital so as to be able to harness the energies of as many Asian entities as possible in the formulation of a future agenda for the promotion of science and technology for sustainability in Asia as a whole under the auspices of the SCA.

In South Asia, the Tata Energy Research Institute consultation (TERI Report No. 2002 UI21) identified, documented, and suggested ways of enhancing industrial transformation research for sustainability that are being undertaken in South Asia (TERI 2002). The major research imperatives critical to addressing concerns regarding such transformations were categorized into technological interventions, social and health issues, and governance. Synergies in industrial transformation research were deemed possible in the energy, industry, and agriculture sectors, and the development of specific case studies allow for the lessons learned to be translated across the regions. Furthermore, the complementarity of research, regulatory regimes, and finance to all initiatives in the transition to sustainability was seen as vital in understanding fully the interrelationships among the stakeholders.

The priorities identified for South Asia overlaps that identified by SCA. The need to understand complex society-environment interactions, identify driving forces for change, and explore development trajectories that have a significantly smaller burden on the environment while addressing concerns regarding the economic development in the region has also been made the focus of future work in South Asia.

In East Asia, the Science Council of Japan (SCJ) and its partners has explored through an international conference and within the context of science and technology for sustainability, the important links between energy and sustainability science. It recognizes that the way society meet its needs for energy in future is central to sustainability. It views “sustainability science” as a solution driven, integrative science that is focused on nature-society interactions. These interactions must be understood in order to improve the efficiency of

energy markets, reform the power sector, mobilize capital, increase support for research and innovation and promote international collaboration (SCJ 2003).

The SCJ envisaged that the science and technology community will endeavour to close the gap between knowledge and action on sustainable energy through a programme of dialogues involving all stakeholders and disciplines of knowledge. It emphasized the need for a common language, the need to bridge the gap between industrialized and developing countries, and of the need to connect science and analysis to real world policy and action. International collaboration in these activities was considered vital and they consider it essential to improve capacity for research and innovation in developing countries (SCJ 2003). It was reiterated that the SCJ was committed to the promotion of sustainability in general and science for sustainable energy strategies in particular, for many years to come.

Momentum to link education for sustainable development with initiatives to enhance science and technology is also growing in Asia. At a meeting of the Ubuntu Declaration Group in Tokyo it was decided to request UNESCO to include more linkages between S&T and Education for Sustainable Development (SD) initiatives and to promote institutional development in Asia. The SCA is a signatory organization of the Ubuntu Declaration. The Declaration is cognizant of the fact that integrated solutions for sustainable development depend on the continued and effective application of science and technology, and that education is critical in galvanizing the approach to the challenges of sustainable development (see Annex 3). Within this context, more recently there has been a move to link the work of the SCA with that of the Open University of the Netherlands that is also seeking ways of operationalising the Ubuntu Declaration. The SCA and

the Open University of the Netherlands are organizations with a common goal *viz.* to establish centres of excellence in education on sustainable development. The SCA must adopt two key decisions. First it must identify more partners in Asia to participate in the SCA-led initiative to establish a network of centres of excellence in science and technology for sustainability and second together the goup will have to further develop content for the SCA-led initiative on education for sustainable development in Asia.

5. OUTPUT 4: FUTURE ACTIVITY IDENTIFIED

In the first three years, the SCA Joint Project on Science and Technology for Sustainability has achieved many general objectives. It has:

- Harnessed the current state of knowledge and understanding of the scope and coverage of the field of science and technology for sustainable development;

- Identified priority training and education opportunities that must be developed to enhance the capacity of institutions to pursue renewal in the practice of science and technology for sustainable development; and

- Obtained tangible directions for shifting the research agenda towards placed based policy relevant issues and challenges.

Other than these general outputs, the SCA Plan of Action on Science and Technology for Sustainability given in the next Section is a very significant and direct output of this Joint Project. This Plan of Action is needed to take the Project further and to make substantive

advances in developing the empirical foundation of science and technology for sustainability. Guided by the SCA resolution on sustainable development and the knowledge and experience gained in the first three years of this Project, the plan of action shold be implemented over the remaining duration of the Project. This plan takes into account not only the outcome of the SCA Joint Project but also the findings of the Mexico City Synthesis Conference on Science and Technology for Sustainable Development, reports related to the initiative on science and technology for sustainable development, and the outcome of discussions involving the SCA and the UNU on the Ubuntu Initiative of the UN. The Ubuntu initiative aims to develop a strategic alliance between the world's leading education, science and technology organizations working together towards achieving the goals of sustainable development.

6. OUTPUT 5: SCA PLAN OF ACTION ON S & T FOR SUSTAINABILITY

Further action by the SCA to promote science and technology for sustainability should consist of actions with the following objectives:

- Build capacity in Asia in the field of science and technology for sustainability;
- Strengthen Understanding of Unifying Core Concepts
- Strengthen the institutional base to research and disseminate knowledge on science and technology for sustainability in Asia;
- Support Ubuntu Group on Education for Sustainability

6.1 Activities to Build Capacity

Enhancing the capacity of institutions and individuals in Asia to meet the challenges of integration, adaptiveness, learning, evaluation, participation and overcoming institutional and resource constraints are the keys to enhancing the role of science and technology for sustainability in Asia. This is a need that should be addressed immediately.

A core group of scientists, policy and decision-makers, and leaders from the private sector and local communities have to be identified to form the nucleus to conduct these activities under the auspices of the SCA. Partners should be sought to enable the SCA to organize and support an annual series of awareness raising and capacity building workshops aimed at enhancing the awareness and capacity of the science, policy, business and local community leaders of the role that science and technology play in sustainability planning and implementation.

The aim of these workshops would be to broaden the sphere of influence of the interdisciplinary, place-based approach in research, training and education. Wherever possible it should participate in on-going global programmes of action on science and technology for sustainability.

6.2 Activities to Strengthen Understanding of Underlying Core Concepts

One of the recurrent themes emerging from the Mexico consultations on science and technology for sustainability was the need to strengthen understanding of core concepts and methods vital for enhancing the interface between science and technology and sustainability. ICSU has identified three topics that merit special attention *viz*.:

a) Understanding adaptiveness, vulnerability and resilience in complex social and ecological settings;

b) The issue of sustainability in complex production-consumption systems; and

c) Institutions for sustainable development.

In addition the Science Council of Japan (SCJ) has sought to develop understanding between energy and sustainability science (SCJ 2003). They recognise that an energy future compatible with a transition towards sustainability is possible but will not happen without actions to imrove the efficiency of energy markets, reform of the power sector, mobilization of the much needed capital investments, increased support for research and innovation in the energy sector and the promotion of international collaboration on the development of sustainable energy futures.

Strengthening understanding of the underlying core concepts of adaptiveness, vulnerability and resilience in complex social and ecological settings will require the long-term involvement of research and education institutions. Such institutions can establish research along the required lines while training post-graduates in the respective fields.

The Institute for Environment and Development (LESTARI) of Universiti Kebangsaan Malaysia, has in principle agreed to spearhead a regional initiative to develop and conduct prost-graduate diploma and degree courses in these subjects. These courses will be available to all students in Asia. This is crucial for furthering a common understanding of science and technology for sustainability in Asia. It

will involve modular teaching by scientists and educators from SCA countries. A draft course rationale and content is given in Appendix 4.

In a similar manner, institutions in Asia that already has initiated work on the issue of sustainability in complex production-consumption systems, and on institutions for sustainability should be identified and incorporated into the overall effort to enhance understanding the underlying core concepts in sustainability. More institutions will have to be identified that are willing to participate in these initiatives in Asia. A network of individuals and institutions that can act as resources for the successful conduct of the courses should also be started. This group will reach out and link-up with the larger science and technology community in the rest of the world

6.3 Activities to Strengthen the Institutional Base in Asia

Disseminating the concepts of a science for sustainability and providing a sufficient framework for anchoring long-term work on science and technology for sustainability in Asia will require strengthening of the current institutional base from which such work is undertaken. While the SCA can provide the regional coordinating infrastructure, institutions in Asia that has the mandate or is currently working to develop or enhance knowledge infrastructures for sustainability must collaborate to participate in joint regional activities. Such collaboration will provide the base from which long-term work can be undertaken.

A framework for the exchange and flow of information on science and technology for sustianability must be established. The development of the framework must be led by the SCA to serve the member countries of the SCA. The SCA must identify and recruit partners in

Asia willing to alocate resources and ideas that are grounded in the regional centres of excellence on education for sustainable development. The group will then determine the future directions and scope of work to strengthen the science that is needed for promoting sustainability in Asia.

6.4 Support the Ubuntu Group on Education for Sustainability

The Decade of Education on Sustainable Development, a programme of the United Nations will commence in 2005. Guidance for the promotion of education for sustainable development, especially as it relates to the roles and responsibilities of the science and technology community is given in the Ubuntu Declaration on Education and Science and Technology for Sustainable Development (Annex 3). This declaration made by education and scientific organizations of the world at the World Summit on Sustainable Development (WSSD), laid the basis for greater cooperation and mobilization of the education and science community for sustainable development. It called for the review of programmes and curricula of schools and universities to better address the challenges and opportunities of sustainable development.

At a meeting of the Ubntu Group in Tokyo in April 2003, a programme of action was developed that included:

- Urging UNESCO to include more linkage between S&T and Education for Sustainable Development (SD) initiatives;
- Carry out necessary institutional reform where appropriate;
- Strengthening inputs on SD education and science & technology through encouraging the integration of SD into

curricula at all levels of formal, informal and non-formal education;

- Seek assistance in developing regional centers of excellence that encompass tertiary level institutions; and

- Promote 'education without boundaries' emphasizing quality and global citizenship.

As part of the SCA Action Plan on science and technology for sustainability, it will participate actively in all activities involving the Ubuntu Group that is designed to enhance the incorporation of science and technology in sustainability initiatives. The identification of regional centers of excellence for education in sustainable development should be made. These centres can then become focal points for the actualisation of plans to embed sustainability concepts in school and university curricula.

These centres will be spread thorughout Asia and their progammes will be accessible to participants from all over the world. This will meet the Ubuntu Group's objective of achieving 'Education Without Boundaries' that simultaneously emphasize quality and global citizenship.

The scope of sustainable development is large and in order to facilitate the systematic development of expertise and capacity in Asia, at this initial stage it is proposed that member countries may take the lead in the four focal clusters given below. Membership of these groups must be as multinational as possible:

- Energy and sustainability;
- Sustainability in complex production-consumption systems;

- Adaptiveness, vulnerability and resilience in complex social and ecological settings in Asia
- Institutional frameworks for sustainability in Asia.

The groups will each develop an agenda of research to fill gaps in knowledge and understanding in these areas. Working groups would be given the task of documenting the body of knowledge relevant to sustainable development. Models for strategies to reduce the level of complexity and uncertainty in sustainable development planning and decision-making will be developed. Regular meetings of all groups will be held that would consist of annual workshops that preceed the Annual Conference of the SCA. Findings of workshops will be tabled at the Annual Conference and they will provide the reference points for further theoretical debates, and for the development of metrics to monitor progress towards sustainability in Asia as a whole.

7. CONCLUDING REMARKS

The commitment and allocation of resources to take this SCA Joint Project on Science and Technology for Sustainability to its next logical stage of development is vital for its success. The voluntary nature of the work undertaken thus far can only do so much. Without commitment and allocation of resources, the SCA initiative will not be able to progress further. Towards this end, international organizations such as ICSU, IAP, TWAS, WFEO, UNESCO and UNU to mention a few, must play a greater role in supporting the initiative started by the SCA.

The SCA has identified a major issue of importance to science and society and can mobilise the science and technology community in Asia to participate in this critical endeavour. What is needed in

future is the resources and personnel to drive the region-wide process systematically. By doing so, the SCA will not only meet the mandate of its establishment but will also make a significant contribution to the advancement of science and technology for sustainability.

REFERENCES

Clark W. C. and N. M. Dickson 2003. Sustainability science: The emerging research program. PNAS July 8, vol. 100 no. 14 8059–8061. www.pnas.org_cgi_doi_10.1073_pnas.1231333100

Corell, Robert. 2002. A progress report on a series of regional workshops around the world designed to broaden and deepen an agenda for science and technology for sustainability. Presentation at the Science and technology for a transition toward sustainability symposium, American Association for the Advancement of Science Annual Meeting. 17 February 2002. Boston, MA.

ICSU 2002. Science and Technology for Sustainable Development. Series on Science and Technology for Sustainable Development No. 9. Paris, ICSU.

ISTS (Initiative on Science and Technology for Sustainability) 2002. Science and Technology for Sustainable Development 27th August to 1st September, 2002 A contribution by ICSU-TWAS-WFEO to the Forum on Science, Technology and Innovation for Sustainable Development during the World Summit on Sustainable Development Ubuntu Village, Johannesburg, South Africa Posted to the Forum on Science and Technology for Sustainability, http://sustainabilityscience.org, 5 August 2002.

Kates R.W., W. C. Clark, R. Corell, J. M. H, C. C. Jaeger, I. Lowe, J. J. McCarthy, H J Schellnhuber, B Bolin, N. M. Dickson, S. Faucheux, G. C. Gallopin, A. Gruebler, B. Huntley, J. Jäger, N. S. Jodha, R. E. Kasperson, A. Mabogunje, P. Matson, H. Mooney, B. Moore III, T. O'Riordan, and U. Svedin. 2000. "Sustainability Science." Research and Assessment Systems for Sustainability Program Discussion Paper 2000-33. Cambridge, MA: Environment and Natural Resources Program, Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University.

Omar Abdul Rahman And Mohd Nordin Hasan 2003 Role Of Science Council Of Asia In Sustainable Development. 20th Pacific Science Congress, Bangkok March 2003.

Lebel, L. 2000. Chiang Mai Workshop on Sustainability Science: Synthesis Report and Background Documents. CD-ROM Electronic Publication. March 2002. Faculty of Social Science, Chiang Mai University, Thailand.

SCJ (Science Council of Japan) 2003. Conference Statement: Energy and Sustainability Scinece. Report of the International Conference on Science and Technology for Sustainability 2003. 16 – 19 December Mita Conference Hall, Tokyo.

TERI 2002. South Asia Regional Conference on Transitions towards Sustainable Development New Delhi, India *Organized by the Tata Energy Research Institute (TERI), Industrial Transformation Project of the International Human Dimensions Programme on Global Environmental Change (IHDP-IT), and START (global change SysTem for Analysis, Research, and Training)* http://www.teriin.org/events/docs/ihdp.htm

Annex 1 (Reprinted from the 2nd SCA Annual Conference Report)

The SCA Resolution on Sustainable Development in Asia

PREAMBLE

ASIA HAS THE ABILITY TO MAKE DEVELOPMENT SUSTAINABLE. TO MOVE FORWARD, WE MUST VIEW SUSTAINABLE DEVELOPMENT AS AN EFFORT TO REVIVE ECONOMIC DEVELOPMENT, IMPROVE QUALITY OF LIFE AND ACHIEVE A BALANCED GROWTH WITH SOCIAL EQUITY. TOWARDS THIS END, IT IS IMPERATIVE THAT WE, THE MEMBERS OF THE SCIENCE COUNCIL OF ASIA, DECLARE OUR RESPONSIBILITY TO ONE ANOTHER AND TO FUTURE GENERATIONS BY AGREEING:

1. To realise a common vision of sustainable development for Asia;

2. To enhance the contribution of Asia towards the achievement of economic growth and sustainable development at a regional and global level;

3. To achieve equitable distribution of peace, health and prosperity within and between generations throughout Asia;

4. To establish environmental conditions in Asia that will secure sustainability of its natural resources and ecosystem goods and services

WE NEED A SHARED VISION OF BASIC VALUES TO PROVIDE THE FOUNDATION FOR SUSTAINABLE DEVELOPMENT. THEREFORE, WE HAVE RESOLVED TO CONSOLIDATE OUR EFFORTS TO ACHIEVE "A PROSPEROUS, HARMONIOUS AND GREENER ASIA" THROUGH THE FOLLOWING PRINCIPLES AND ACTIVITIES.

PRINCIPLES

1. Sustained economic development, greater social equity and maintenance of ecological balance are the three pillars for sustainable development in Asia.

2. Stronger co-operation and networking within Asia is vital for the achievement of the goals and aims of sustainable development regionally as well as globally.

3. Each nation or state within a nation will formulate individual policies for making development sustainable as well as to develop monitoring systems to assess progress towards sustainable development.

4. Planning for sustainable development in Asia will take into account the primacy of the region's economic and environmental concerns as well as of local socio-cultural sensitivities.

5. Eradication of poverty is a primary concern in Asia and will be addressed together with concern for the environment. An improved quality of life is a basic precondition to sustainable development.

6. Economic, social and environmental objectives of development will be pursued in a balanced way that will involve new ways of thinking about and undertaking development as well as on production and consumption.

7. Incorporation of Asian values will be an integral part of the initiative towards sustainable development in Asia. Absence of extreme individualism; a belief in strong family ties; a reverence for education; frugality; hard work; a strong social contract between the people and the State; moral wholesomeness; and respect for the environment will be taken together with the more recent ideals expressed in the United Nations principles on sustainable development.

8. Sustainable development policies in Asia in this era of globalisation will promote balanced views on sustainable development and integrate traditional development concerns such as economic growth, political stability, and social equity with new themes such as transparency and good governance.

ACTIVITIES

TOWARDS THESE ENDS THE SCA SHALL DURING ITS FIRST FIVE YEARS OF ESTABLISHMENT UNDERTAKE THE FOLLOWING ACTIVITIES:

1. The SCA will spearhead work to develop adequate frameworks and mechanisms for co-operation and collaboration among Member countries to enable them to share knowledge and know-how for sustainable development in Asia. This will include *inter alia* frameworks of co-operation among countries within Asia as well as between Asia and the rest of the international community. Such co-operation should be based on mutual understanding and need to jointly develop and share resources in the development of environmentally friendly products, technologies and management practices.

2. The members of the SCA will hold regional workshops that will contribute towards the planning and design of sustainable development trajectories and processes for Asia that will ensure improvements in the quality of life of all Asians while preserving human dignity and Asian values.

3. The SCA will initiate work to develop adequate theoretical and practical understanding of the science of sustainable development as a process of social, economic and ecological change that require integration of knowledge from all three prime systems in the world (economic, social and ecological). Sustainability science will also contribute towards the development of tools for integration of economic, social and environmental considerations in development planning, analyses and monitoring will be developed and made available for wide usage throughout Asia.

4. The SCA will undertake to spearhead efforts to disseminate knowledge and understanding of the need to approach sustainable development in an integrated and holistic manner. The Academies of Science in Asian countries must provide the means, leadership and co-ordination in all work to develop the tools for integration and reconciliation of economic, social and ecological considerations in development.

5. A joint programme to develop, test and use sustainable development indicators (SDI) will be initiated so as to enable the monitoring of progress towards sustainable development in Asia. These indicators will reflect economic, social and ecological progress in an integrated manner and will make use of second-generation integrated SDI that takes into account the inter-play between them.

6. The SCA will also initiate work to develop indicators of co-operation between Asian economies as well as of the level of assistance from the global community towards the achievement of the goals of sustainable development.

AGREED BY THE MANAGEMENT BOARD AND ENDORSED BY THE GENERAL ASSEMBLY ON 14 MAY 2002.

Annex 2. Summary insights of knowledge needs and research agenda for sustainable development from the Asia workshop on science and technology for sustainable development, Chiang Mai, March 2000

1. There are multiple perspectives on what the key problems are, their causes and what would constitute solutions. Sustainability science will be continually challenged to justify its selection of problems to focus upon, and at the same time challenging society to re-examine what the problems really are. A good example is the series of controversies and re-interpretations of what the sustainability problem is of agriculture and forest use in upland watersheds.

2. For several decades, health, education and many other indicators of wellbeing have greatly improved in most Asian countries. Economies have grown at dizzying rates, agricultural productivity has soared, and supply of sanitation, electricity and other basic infrastructure has greatly improved for many. At the same time many natural resources have been over-exploited or degraded, air and water quality pollution became serious problems before efforts were made to tackle them, and what were once thought of as just local scale problems may now have transboundary, or international causes and consequences. The remarkable capacity for farmers to adapt to climatic variability or entrepreneurs to succeed in new green markets is sign that there are still many opportunities and substantial inherent capacity to respond to these challenges. The complex goal of sustainability or sustainable development provides a missionary-like call to action but in practise will need the support of good science to explore, identify and tackle the more complex and problematic of these challenges.

3. One size does not fit all. Sustainability transitions in different parts and sectors in the Asian region will not be the same. The starting points and contexts of change vary widely. Nevertheless, there are key transformations

underway in Asia that are crucial for the future. Re-directing these along more sustainable pathways is crucial for attaining sustainablity at many scales, in many sectors, and for many different livelihoods.

4. Sustainability transitions will require greater public participation in how science agendas are set and how findings are used. As a consequence sustainability science will be more accountable, credible and relevant to the public and policy making at various levels.

5. Achieving sustainability often depends on changing the behaviour of the rich and powerful. Much more research and attention is need on the impacts of consumption and analysis of exactly where environmental adjustment is needed.

6. Involvement of the corporate sector is crucial to any transitions to sustainability. In many ways improving environmental performance is good business. In many countries in Asia most of the investment in industry is still to come; guiding those investments into cleaner technologies is crucial and will require substantial institutional innovation.

7. Transitions to sustainability is not just a matter of getting the technology right and more hard science. It also requires a much better understanding of human behaviour, especially institutions, knowledge, markets and politics.

8. The knowledge and wisdom required for transitions to sustainability reside in people and in their landscapes and cultural artefacts. Knowledge comes from experiences, traditional practices and formal experimentation, comparison and analysis or science. Memory and innovations, in technology and institutions, drive choice on how to use environments and resources. Education is a key to the prospects of sustainability becoming an important principle or criteria for decisions. What is not required is *massaging*

consensus on any particular perspective of the sustainability debate, but an education that helps people think critically about evidence, arguments, goals and ways to reach them. Only through broad participation in exploring and debating ideas about economic development, ecosystems, and justice is there any chance that sustainability can become a norm with meaning in actions.

9. New tools and concepts are needed to understand transitions of complex adaptive systems. These highlight the importance of disturbances, diversity and novelty in deteriming the resilience and sustainability of ecosystems and their linked human enterprises.

10. Adaptation is often most effective at relatively local scales, but at the same time there are growing problems which are transboundary in scope. Research is needed on institutional arrangements for tackling cross-scale problems in ways that facilitate local adaptation and responses.

11. Developing agendas for sustainability science in Asia should be based on broad consultation to establish needs, guide priorities for funding, and make best use of existing experience and opportunities. An Asian perspective on sustainability has its own regional flavoursm but there is much diversity within. At most we can offer a framwork of guiding principles, processes and illustrations of research topics.

12. The pillars for developing effective science programmes that support transitions to sustainability in Asia are: participation, learning, communication and cooperation. Together these could help build a science that is relevant and credible.

13. There are many challenges and opportunities head and good foundations upon which to tackle them. In the short term there are a number of possible

actions that could be taken that would greatly help future work in this area. Two are suggested as priorities. First, to facilitate the establishment of a sets of regional case studies for focussed comparisons to test and evalute the core ideas of the evolving sustainability science framework, in short, to critically demonstrate whether sustainability science is worth pursuing. Second, to consolidate the network that the regional meetings have triggered by small follow-up workshops aimed at writing synthetic papers and proposals and by providing some basic information systems infrastructure to help remote collaboration.

Annex 3

UBUNTU DECLARATION

On Education and Science and Technology for Sustainable Development

In an effort to make integrated solutions work for sustainable development and to mobilize the education sector to contribute to sustainable development;

We, the education and scientific organizations of the world,

United Nations University
United Nations Educational, Scientific and Cultural Organization
African Academy of Science
International Council for Science
International Association of Universities
Copernicus-Campus
Global Higher Education for Sustainability Partnership
Science Council of Asia
Third World Academy of Sciences
University Leaders for a Sustainable Future, and
World Federation of Engineering Organizations,

call for an initiative to strengthen science and technology education for sustainable development.

Cognizant that integrated solutions for sustainable development depend on the continued and effective application of science and technology, and that education is critical in galvanizing the approach to the challenges of sustainable development.

Endorsing the Earth Charter as the inspiring, fundamental and balanced set of principles and guidelines for building a just, sustainable and peaceful global society in the 21st century, which should permeate all levels and sectors of education.

Noting that science is all science — natural, social and human.

Recognizing the necessity to bridge the knowledge gap between the nations of the world through a fundamental redress of the distribution of education for sustainability.

Acknowledging that the ultimate goal of education in all its forms is to impart knowledge, skills and values to empower people to bring about changes.

Concerned that education has not been utilized as a vehicle for attaining sustainable development.

Reaffirming the indispensable role of education in achieving sustainable development, and the important role education plays in the mobilization of science and technology for sustainability as contained in Chapter 36 of Agenda 21.

Recalling the Lüneburg Declaration on Higher Education for Sustainable Development of 10 October 2001, and its emphasis on the indispensable role of higher education informing and supporting all education in addressing the critical challenges of sustainable development.

And recognizing that the Scientific and Technological community, as represented by the International Council for Science, Third World Academy of Sciences, and World Federation of Engineering Organizations

in the WSSD process has called for a new social contract between science and technology and society for sustainable development.

Determined to work towards the goals contained in the Millennium Declaration, Monterrey Consensus and the Doha Development Declaration.

Call on Governments of the World Summit for Sustainable Development and the Post-Summit agenda to:

Designate educators as the tenth stakeholder group in the WSSD process.

Call on educators, Government and all relevant stakeholders to:

Review the programmes and curricula of schools and universities, in order to better address the challenges and opportunities of sustainable development, with a focus on:

- Plans at the local, regional and national country levels;

- Creating learning modules which bring skills, knowledge, reflections, ethics and values together in a balanced way;

- Problem-based education at primary and secondary levels in order to develop integrated and non-instrumental approaches to problem solving at an early stage in the education cycle;

- Problem-based scientific research in tertiary education, both as a pedagogical approach and as a research function;

Promote efforts to attract young people to the teacher profession both to meet the Millennium Development goals of universal access to primary education as well as to further strengthen primary, secondary and tertiary education. In developed countries the major challenge in the coming years will be to offset the high outflows of experienced teachers reaching retirement age or taking up other challenges.

Develop mechanisms to continuously inform teachers and update programmes on major progress in scientific and technological knowledge relevant for sustainable development.

Promote knowledge transfers in innovative ways in order to speed up the process of bridging gaps and inequalities in knowledge. This is the shared responsibility of teachers, schools, research and education institutions and governments.

To achieve these challenges and objectives, we are resolved to work towards a new global learning space on education and sustainability that promotes cooperation and exchange between institutions at all levels and in all sectors of education around the world. This space must be developed on the basis of international networks of institutions and the creation of regional centers of excellence, which bring together universities, polytechnics, and institutions of secondary education and primary schools. We invite all other responsible stakeholders to join us in this endeavour.

Appendix 4: PROPOSED POST-GRADUATE COURSE ON SUSTAINABILITY STUDIES AT THE INSTITUTE FOR ENVIRONMENT AND DEVELOPMENT (LESTARI), UNIVERSITI KEBANGSAAN MALAYSIA.

INTRODUCTION

UNCED and WSSD has suggested a number of changes regarding the way in which human beings view the environment and development. The Millennium Development Goals has clearly benchmarked the development targets that must be achieved by 2015 for sustainable development to be achieved at the global level. The role of education in achieving these goals are clearly embodied in the Ubuntu Declaration (Appendix 3) that seeks global educational alliance for sustainable development.

Education and training has a pivotal role in equipping future generations with as many choices for a sustainable future as the current generation enjoys. Ensuring that they have as many options in development as the current generation is a fundamental basis of sustainable development.

It has been realized that to achieve sustainability many currently held views of the use of the environment and natural resources, and their interrelations with development must change. Past paradigms that advocate preservation of natural environmental systems to the exclusion of economic and societal advancement, and those that advocate the exploitation of natural resources and the environment to the extent that there was total disregard about their ability to renew and sustain ecosystem goods and services in the longer term, have failed to bring about equitable development. Development strategies that advance societal, economic, and political institutions, while maintaining in posterity the same or better choices for natural resource use and management, are those that show promise for the future.

The complex interactions between and within environmental assets and human activities are now better understood. For example, actions taken with respect to the use of highland areas can impact soils, water quality, wildlife habitat, human health, and have a variety of other unforeseen consequences. The key to sustainability lies in the management of the interrelationships within and between these resources, especially as they relate to the response of the natural systems and the human activities that impinge on them. More and more, the information needed to develop successful resource utilization and management regimes will need to integrate information from a wide cross-section of sectors and human comunities.

On the positive side, there has been a tremendous growth in recent years of technologies that enable the monitoring and evaluation of the environmental and human condition. We can now:

- Remotely sense a wide range of variables at fine spatial resolutions;
- Acquire, store, analyze, and transmit large quantities of data;
- Perform statistical analyses that are spatially-explicit; and
- Make information and knowledge available to everyone via web-based technologies.

With the availability of these and other technologies, it is becoming not only possible to measure key environmental variables at a pixel-level of resolution, but to evaluate change in these variables with time. Today, we can cost-effectively and remotely identify the state of a particular unit of land and identify changes with time.

Nevertheless, it is not possible to effectively translate any of these data to processes and actions that would enhance sustainability without commensurate development of the intellectual capacity to integrate knowledge across

traditional boundaries. The proposed post-graduate courses aims to address this gap especially but not exclusively, for the Asian region.

Much of the environmentally-related science performed in the 20th century was marked by a lack of connection to any human values or interactions. This philosophic approach to science has drifted away from that of the 17th and 18th century enlightenment thinkers. The basic premise of these thinkers was that the greatest enterprise of the human mind has always been and always will be the attempted linkage of the sciences and humanities. It is believed that the fragmentation of science that has occurred in the 20th century has caused thinkers to focus more on the discipline in which they operate (i.e., the particular animal, plant, forest stand, or rangeland), rather than on the bigger question of what are the social and ethical impacts of their work. The course will seek to redress this fragmentation.

APPROACH

The design of the courses in this Programme has taken into account the need to unify the diversity understanding of concepts, principles and theories related to sustainable development. The framework suggested to approach such a complex endeavour is based on the assumption that all the components of the natural and man-made systems on earth can be unified using a systems approach. On this basis, the ecosystem approach has been used to organize knowledge on sustainability. Ecosystem sustainability is, after all, the basis for sustainable development.

Using the concept of ecosystem sustainability, courses are formulated that cuts across diverse spheres of environmental, economic and social concerns, consciously taking into account the influence of natural and anthropogenic processes on the decision-making process and procedures, applicable to a wide

variety of spatial scales and resolution levels. The mutual sustainability of ecosystem goods and services and human institutions is the foundation of sustainability in the long-term.

The approach recognizes the inherent connectivity of the issues and disciplines and attempts to highlight their interactions in the context of the overall theme of science for sustainable development.

OBJECTIVES OF PROGRAMME

After following the programme, participants would be able to:

- Competently determine the status, condition, and trends in development and ecosystem sustainability;
- Identify potential strategies, solutions, and opportunities applicable to solving sustainability challenges;
- Integrate and unify data, information, knowledge, and applications over multiple scales and institutions, of natural and man-made processes, with consideration of the social institutions, and human activities that influence sustainability
- Have a holistic view and understanding on sustainability issues and problems in a place-based context (i.e. of particular locations and spatial scales);
- Evaluate through case-studies potential or tested solutions to sustainability issues regarding particular natural or human

resource or the mitigation of the impacts of some process and procedures;

- Formulate appropriate and feasible individual, community and institutional responses to the sustainability challenges at multiple levels of spatial resolution using careful analyses and systhesis of quantitative and qualitative data;

- Place in context the major local and global issues impacting sustainability.

Participants will have a better understanding of the natural processes such as climate change, nutrient cycling, fire, insects/disease, hydrologic cycling, biodiversity, desertification, accretion, invasive species and anthropogenic processes such as urbanization, production and consumption, immigration, industrialization, economic development, transportation, education, governance, multi-national agreements, population growth, civil unrest, terrorism and war. The Programme will also provide opportunities for

- Enrichment of the intellectual capabilities of people from throughout Asia and other parts of the world;

- Exchange ideas, information and knowledge on sustainability;

- Networking and interact to promote sustainability in Asia and elsewhere

- Build awareness of current efforts being made by individuals and groups to promote sustainability and of the successes and the factors associated with failures in past sustainability efforts; and

- Develop a positive attitude and high-level of awareness of, and confidence in, the possibilities of human and environmental sustainability.

- The promotion of integration and exchange of information and knowledge about environmental and human sustainability at multiple scales and resolutions.

PROGRAMME CONTENT

The potential candidates for the Programme are resource managers, policy makers and analysts, industrialists, scientists, entrepreneurs, educators, students, and members of organizations that support research or management for sustainability. The generation and communication of information and knowledge that is accessible and useful to people and institutions will be one of the most important factors driving ecosystem and human sustainability in the new millennium. Having the ability to create, represent, and display (visualize) unified information and knowledge, and the mechanisms to convey them effectively to a wide variety of people interested in the environmental and socio-economic aspects of sustainability, will produce a fundamental transformation in the way we live, learn, work, make policy, govern, and interact with the natural environment. Hence the sustainability of a wide variety of ecosystem resources, natural processes, and human institutions defines the scope and context of the Programme. Participants will have the opportunity to explore a variety of monitoring and assessment frameworks and perspectives for generating and utilizing data, information, knowledge, and applications of a large number of natural resources and processes at a variety of scales (i.e., Global, Continental, National, Regional, Local) and resolutions, and ask questions that primarily interest.

The Programme will be offered according to the following logical sequence of focus areas:

1. State of knowledge for sustainability.

2. Knowledge required for monitoring and assessment.

    a. What are the most important information and knowledge that need to be communicated to people and institutions about the condition and trend of ecological resources and natural processes, and their significance to sustainable development?
    b. What are the issues and problems?
    c. What are the strategies, solutions, and opportunities to address the problems and issues in the most effective manner?
    d. What are or should be the institutional and individual responses to meet the challenge of making sustainability an operational concept across geopolitical domains, and spatial and temporal scales?

3. Hands-on research experience on a sustainability issue.

The proposed course content and its structure is given in the following table. A total of 36 credit units (one credit is equivalent to one 1-hour lecture or one 3-hour practical per week for 13 weeks) will e required to obtain the Masters. The course will be conducted in English and can be completed in a minimum of three study semesters (18 months).

COURSE OUTLINE - MASTERS OF SCIENCE IN SUSTAINABILITY STUDIES

COURSE NAME	Units	COURSE CONTENT
INTRODUCTION TO SCIENCE FOR SUSTAINABLE DEVELOPMENT	4	❑ Concepts ❑ Ethics for sustainability ❑ A new social contract for science
RESOURCE AND PROCESS SUSTAINABILITY	4	❑ Trends in natural resource use ❑ Consumption and production ❑ Economics and trade
EARTH SYSTEM ANALYSIS	4	❑ Status, condition, and trends in earth systems ❑ Sustainability of natural processes
INTEGRATION OF SCIENCE FOR SUSTAINABILITY	4	❑ Integrative Systems for science ❑ Approaches for integration ❑ Scenario Generation Tools ❑ Questions of scale ❑ Monitoring and assessments
NATURE AND SOCIETY	4	❑ Human dimensions of sustainability ❑ Values ❑ Change management ❑ Sustainability of anthropogenic processes ❑ Institutional response
METHODS AND APPLICATIONS	4	❑ Project design and research techniques ❑ Case study and applications ❑ Strategies, solutions, and opportunities applicable to solving sustainability challenges
RESEARCH PROJECT	12	Problem oriented, solutions driven research on sustainability issues at multiple scales and disciplinary scope.
Total	**36 units**	

Note: 1 unit is equivalent to one 1-hour lecture or one 3-hour practical per week for 13 weeks.

SCA Member Organizations

CHINA

China Association for Science and Technology (CAST)
3 Fuxing Road, Beijing 100863, China
Tel: +86-10-68578283 Fax: +86-10-68571897
URL: http://www.cast.org.cn
Prof. Zhou Guangzhao, President

INDIA

Indian Council of Social Science Research (ICSSR)
Aruna Asaf Ali Marg, New Delhi 110067, India
Tel: +91-11-26192059 Fax: +91-11-26182109
URL: http://www.icssr.org
Prof. André Béteille, Chairman

INDONESIA

Indonesian Institute of Sciences (LIPI)
Sasana Widya Sarwono, Jl. Jenderal Gatot Subroto No. 10, Jakarta 12710, Indonesia
Tel: +62-21-5225641 Fax: +62-21-5225709
URL: http://www.lipi.go.id
Prof. Dr. Umar Anggara Jenie, Chairman

Ministry of National Education
Jalan Jenderal Sudirman, Pintu 1, Senayan, Jakarta 10002, Indonesia
Tel: +62-21-573-1436 Fax: +62-21-573-1466 (Directorate General of Higher Education)
URL: http://www.pdk.go.id
His Excellency Prof. Dr. Bambang Soedibjo, Minister

JAPAN

Science Council of Japan (SCJ)
7-22-34 Roppongi, Minato-ku, Tokyo 106-8555, Japan
Tel: +81-3-3403-1949 Fax: +81-3-3403-1755
URL: http://www.scj.go.jp
Prof. Dr. Kiyoshi Kurokawa, President

REPUBLIC OF KOREA

National Academy of Sciences (NAS), Republic of Korea
San-94-4, Banpo 4-dong, Seocho-gu, Seoul 137-044, Republic of Korea
Tel: +82-2-534-0737 Fax: +82-2-535-8836
URL: http://www.nas.go.kr
Prof. Dr. Kim Tae-kil, President

Korean Academy of Science and Technology (KAST)
7-1, Gumi-dong, Bundang-gu, Seongnam, Gyeonggi-do 463-808, Republic of Korea
Tel: +82-31-710-4611 Fax: +82-2-566-3264
URL: http://www.kast.or.kr
Prof. KunMo Chung, President

MALAYSIA

Academy of Sciences Malaysia (ASM)
902-4 Jalan Tun Ismail, 50480 Kuala Lumpur, Malaysia
Tel: +603-2694-9898 Fax: +603-8925-0804
URL: http://www.akademisains.gov.my
Tan Sri Datuk Dr. Ahmad Zaharudin Idrus FASc, President

Ministry of Science, Technology and Innovation (MOSTI)
Aras 1-7, Block C5, Pusat Pentadbiran Kerajaan Persekutuan 62662 Putrajaya, Malaysia
Tel: +603-8885-8000 Fax: +603-8889-2996
URL: http://www.mosti.gov.my
YB Dato' Sri Dr. Jamaludin b Dato' Mohd, Jarjis, Minister

Institute for Environment and Development (LESTARI)
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, Darul Ehsan, Malaysia
Tel: +603-8921-4149/8926-1241 Fax: 603-8925-5104
URL: http://www.lestari.ukm.my
Prof. Dr. Ibrahim Komoo, Director

MONGOLIA

Mongolian Academy of Sciences (MAS)
Prime Minister A. Amar Street 1, Ulaanbaatar, 210620A, Mongolia
Tel: +976-11-321638 Fax: +976-11-261638
URL: http://www.mas.ac.mn/index_e.htm
Dr. B. Chadraa, President

THE PHILIPPINES

National Research Council of the Philippines (NRCP)
Patrocinio Valenzuela Hall, Gen. Santos Ave., Bicutan, Taguig, Metro Manila, Philippines
Tel: +632-837-6142 Fax: +632-837-6143
URL: http://mis.dost.gov.ph/nrcp
Prof. Fortunato T. de la Peña, President

Philippine Social Science Council (PSSC)
Philippine Social Science Center, Commonwealth Ave. Quezon City 1101, Philippines
Tel: +632-922-9621 Fax: +632-924-4178/929-2671
URL: http://www.pssc.org.ph
Dr. Ronald D. Holmes, Chairperson

Philippine Association of Marine Science (PAMS)
c/o Marine Science Institute, University of the Philippines, 1101 Diliman, Quezon City, Philippines
Tel: +63-2-9223958 Fax: +63-2-9247678
URL: http://www.geocities.com/pams7msun/
Dr. Wilfredo Licuanan, President

SINGAPORE

Agency for Science, Technology and Research (A*STAR)
20 Biopolis Way #07-01 Centros, Singapore 138668, Singapore
Tel: +65-6826-6111 Fax: +65-6777-1711
URL: http://www.a-star.edu.sg/
Mr. Philip Yeo, Chairman

THAILAND

Thai Academy of Science and Technology (TAST)
Gypsum Metropolitan Building, 18th Floor, 539/2 Sri Ayuthaya Road, Bangkok 10400, Thailand
Tel : +662-644-8002, 8083 Fax :+662-644-8022, 8100
URL: http://www.tast.or.th
Prof. Dr. Yongyuth Yuthavong, President

Science Society of Thailand under the Patronage of His Majesty the King (SST)
c/o Faculty of Science, Chulalongkorn University
254 Phayathai Road, Patumwan, Bangkok 10330, Thailand
Tel: +662-252-7987 Fax: +662-252-7987
URL: http://www.scisoc.or.th
Dr. Sumontha Promboon, President

VIETNAM

Ministry of Science and Technology (MOST)
39 Tran Hung Dao Str, Hanoi, Vietnam
Tel: +84-4-822-8751 Fax: +84-4-943-9987
URL: http://www.most.gov.vn
His Excellency Dr. Hoang Van Phong, Minister

Ministry of Health (MOH)
138A Giang Vo Str., Hanoi, Vietnam
Tel: +84-4-846-4918 Fax: +84-4-843-0015 (Science and Training Department)
URL: http://www.moh.gov.vn
His Excellency Prof. Dr.Tran Thi Trung Chien, Minister

(19 organizations from 11 member countries)