CBPF-CS-006/99

COMENTARIOS SOBRE LA WORLD CONFERENCE ON SCIENCE

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INTRODUCCION:

La World Conference of Science organizada por UNESCO e ICSU (International Council for Science) se desarrolló en Budapest entre el 25 de junio y el 1 de julio de 1999. Participaron delegados de alrededor de 150 países que acordaron un conjunto de principios y líneas de acción para implementar un ¨nuevo contrato social¨ entre la Ciencia y la sociedad.

Algunas de las sugerencias más importantes, que se desarrollarán con más detalle posteriormente, parten de insistir en que adecuados mecanismos de participación deben ser implementados a fin de facilitar un debate democrático sobre los diferentes aspectos de la política científica. En particular la ética y la responsabilidad social deberían formar parte integral de la formación de los científicos. La participación de la mujer en la Ciencia y la tecnología debe potenciarse por todos los medios. Deben realizarse esfuerzos para asegurar la participación de grupos desventajosos. En resumen, las naciones y los científicos deben percibir la urgencia de utilizar el conocimiento de todas las ramas de la Ciencia de manera responsable, a fin de resolver las necesidades humanas y sus aspiraciones sin hacer un uso indebido del conocimiento.

La Ciencia por otra parte es ciertamente jerárquica, con élites basadas en patrones de mérito ligados a los respectivos éxitos científicos. El único principio democrático en la Ciencia es la igualdad de oportunidades para realizar investigación de excelencia. El conocimiento científico no es el resultado de una votación.

Las conclusiones de la Conferencia están expresadas en los dos documentos llamados: Declaración sobre la Ciencia y el uso del conocimiento científico y Agenda científica, un marco de acción, respectivamente. Ambos documentos se incluyen en Anexo. El primero es una declaración de principios sobre la importancia de la Ciencia y la necesidad de un nuevo contrato por el cual la sociedad continúa a apoyar la Ciencia y los científicos se comprometen a aceptar y respetar las responsabilidades que surgen de ese apoyo. El segundo documento provee líneas de acción para implementar los principios establecidos por el primero, a ser adoptadas por los gobiernos nacionales, las organizaciones internacionales, las organizaciones profesionales y científicas, etc.

La primera recomendación es que cada país debería propender a poseer instituciones científicas de alta calidad capaces de proveer investigación y entrenamiento en áreas de interés específico. Los países a su vez, deberían tener el apoyo de la comunidad internacional si les fuese necesario. A ese respecto, la creación de una masa crítica para sostener investigaciones a través de la cooperación regional e internacional se define como de importancia central sobre todo para los países científicamente menos desarrollados. Es por ello que las redes regionales e internacionales y los centros de investigación especializados y cooperativos deberían ser fuertemente apoyados.

ORIGENES:

UNESCO comenzó con la sigla UNECO La S fue incluída entre la E y la C a partir de la propuesta de la Ministra de Educacion de Gran Bretaña, Ellen Wilkinson. hace 54 años:
" En estos días en que nos preocupamos, no sin temor, de lo que los científicos harán próximamente, es importante que ellos estén relacionados fuertemente con las humanidades y deberían sentir que tienen la responsabilidad frente a la humanidad de los resultados de sus trabajos" .
Este temor esta aún hoy con nosotros (Pal Pataki, representante de Hungria ante UNESCO)

UBICACION SOCIAL DE LAS CIENCIAS

Existe una creciente sensación pública de incomodidad con ciertos resultados de la Ciencia y por ello los científicos deben estar cada vez más preparados para justificar su trabajo y sus gastos. Esta situación nunca se habia percibido en el pasado. Es imprescindible establecer una comunicación de ida y vuelta entre la Ciencia y el público en el sentido más amplio. Debe surgir una especie de nuevo "contrato social" . Lamentablemente una de las partes de ese contrato (público en general e industria privada) estuvo practicamente ausente de la Conferencia. Es necesario abrir de inmediato el debate a un espectro lo más ancho posible de discursos públicos sobre la Ciencia

Los actores de la Ciencia deberían (N. Lane, Science Advisor of President Clinton) transformarse en "científicos ciudadanos globales". En esa nueva situación deberían salir de sus laboratorios e instituciones para comprometerse en un diálogo activo con todos los ciudadanos. Hacer de alguna manera más efectivo el uso del conocimiento científico por parte de la sociedad. Es imprescindible que el público tenga un mayor conocimiento de la Ciencia, pero también es igualmente importante que los científicos tengan un mejor conocimiento del público.

Por otra parte, ¿cómo reconciliar la protección de los derechos de propiedad intelectual con el libre acceso al conocimiento?

En la investigación científica la atracción de los mercados económicos es constantemente creciente. Consecuentemente, se incrementa la financiación de investigaciones por parte de empresas lucrativas con el fin de patentar los avances y no permitir su libre circulación.

CREDIBILIDAD DE LA CIENCIA
(Referimos a comentarios de B. Haerlin, D. Parr, Greenpeace)

En una encuesta realizada recientemente por la Comisión Europea se preguntaba: ¿En quién se confia cuando se habla, por ejemplo, sobre cultivos modificados genéticamente?
26% en organizaciones dedicadas a proteger el impacto ambiental y la ecología
6% (SOLO!!!) en las universidades
4% en las autoridades públicas nacionales
1% en la industria

Conclusión evidente: La comunidad científica está frente a un grave problema de credibilidad. Esta situación se presenta frente a muchos otros hechos como el agujero de ozono, las sustancias tóxicas, el calentamiento global y hasta la enfermedad de la Vaca Loca. Mas aún, el sector de negocios usa argumentos que tienen algun sabor científico en su favor, los que contribuyen finalmente también a disminuir la confiabilidad de la Ciencia

El papel de "sumos sacerdotes" de la verdad y la razón que las sociedades occidentales asignaron a los científicos durante los pasados 200 años necesita adaptarse a las nuevas realidades. Los científicos han comenzado a verse no como guardianes de la verdad objetiva sino como defensores de sus propios intereses en un medio manejado por las reglas de una economía de mercado.

La biología molecular es un ejemplo claro. Allí la división ciencia fundamental (básica) - ciencia aplicada es muy sutil. Es aquí donde la financiación (directa o indirecta) de las corporaciones económicas se ha transformado en la directriz de las actividades de investigación.

La integración de lo académico en el mercado, aunque parece productiva e innovatriz, hace pagar un precio altísimo al papel y la credibilidad general de los científicos. Es mandatoria una educada discusión entre los ciudadanos para poner de relieve la necesaria independencia de la ciencia basada en la honestidad y la transparencia.

Deben darse los pasos necesarios para obligar a las compañías e instituciones a comunicar toda nueva información científica que surja y que tenga algún impacto ambiental o sobre la salud. Obligando también a los científicos a comunicar cualquier hallazgo relevante.

Una propuesta de Sir J. Rotblat, Premio Nobel de la Paz 1995 de codificar públicamente esas obligaciones de manera analoga a un " juramento Hipocrático" y que reforzaría la posición y la responsabilidad de los científicos dentro del sistema institucional y de negocios, no fue finalmente aceptada.

La Ciencia necesita tanto del soporte material, como de la confianza pública.

PRIORIDAD POBREZA
(Referimos a conmentarios de M.S. Swaminathan en Green Revolution)

La erradicación de la pobreza para garantizar las necesidades humanas básicas debe ser primera prioridad.

El problema básico surge de la obvia implicancia: pobreza = imposibilidad de acceso al conocimiento. Da lugar a un verdadero apartheid tecnológico. Es claro que una causa adicional de este problema es el incremento de protección de derechos de propiedad intelectual.

La Ciencia debe jugar el papel central en la erradicación de la pobreza: 1) a traves de sus aplicaciones y 2) usada por los pobres mismos para ayudarse.
Ejemplo de 1): modificación genética de la agricultura. Ejemplo de 2): propio entendimiento de un racional uso del suelo

Propuestas: - Instalación de un centro internacional para el manejo del agua
(agua contaminada produce 10% de las muertes en los países en desarrollo (PED). En 1996, 1.800.000.000 de viviendas carecían de facilidades sanitarias.
30% menos de agua per capita hoy que hace 25 años)

- Instalación de un programa global para luchar contra la desnutrición materno-infantil
  (50% de los niños nacidos en PED poseen menor peso al normal debido a desnutrición materna)
- Instalación de un programa para eliminar causas escondidas del hambre producidas por ejemplo por ausencia de micronutrientes en la dieta

La política anti-pobreza debe enfatizar el acceso de la mujer a la Ciencia en los PED. Allí ellas sufren mucho más que los hombres. La enseñanza de la Ciencia está sesgada hacia el hombre: los textos científicos no tratan experiencias diarias de la mujer ni reconocen los aportes femeninos a la Ciencia. La mujer no sólo debe ser beneficiada por la tecnología, sino que debe participar en todo el proceso que va de la planificación a las aplicaciones.

JOVENES

Se formó el International Forum of Young Scientists (IFYS) (más de 150 jovenes de 54 países participaron) que recomendó:
. aumentar la responsabilidad de los científicos a fin de informar al público abiertamente sobre los alcances e implicaciones de la investigación.
. incrementar la educación científica a todos los niveles.
. presentar la Ciencia de manera interdisciplinaria.
. entender que los aspectos éticos deben ser parte de toda empresa científica y deben formar parte de los programas de estudio.
. comprometer a los científicos a adquirir mayores responsabilidades en la ayuda a los PED.

LA MUJER EN LA CIENCIA

Toca muy diversos problemas en áreas de educación, estructuras institucionales, sociedad y cultura.

Se percibió una cierta marginalización inicial de la mujer hasta en la misma Conferencia ya que hubo dificultades para que la mujer ganara acceso a la decisión política (por ejemplo, no hubo ninguna mujer en el podio inaugural) . Sin embargo, la actividad llevada a cabo durante la conferencia tuvo éxito en incluir modificaciones y agregados a las declaraciones directamente relacionados con los problemas de género en la Ciencia y sus soluciones.
Recomendaciones:
. transformar el sistema educativo para promover el acceso de la mujer, en todas las edades, a la educación científica en todos los niveles.
. lanzar una campaña a traves de la UNIFEM (UNESCO) para explicitar la contribución de la mujer a la Ciencia y la tecnología a fin de superar estereotipos de género entre los científicos, los políticos y la comunidad.
. asegurar la representación apropiada de la mujer en todos los foros nacionales, regionales e internacionales.
. hacer un seguimiento crítico del progreso y la expansión de la presencia de la mujer en ciencia y tecnología.

EDUCACION:

Se indicó que UNESCO debe cooperar, junto a otras organizaciones internacionales, a la formación de una red de centros especializados en educación en Ciencia y tecnología, alrededor del mundo.

Estados Unidos recomendó muy fuertemente la re-inclusión de un sector de educación en Ciencia dentro del sector educación de UNESCO. Lederman puntualizó la responsabilidad de los científicos en el desarrollo de los jóvenes en la Ciencia como parte de sus responsabilidades hacia la sociedad

Se debería proveer también educación básica en Ciencia a estudiantes de las áreas no científicas. Conjuntamente se debe promover el papel de los museos de ciencia como elemento importante en la educación en Ciencia del público en general.

CIENCIAS SOCIALES

A pesar de que su Director General explicó que la Conferencia fue concebida inicialmente dedicada a las ciencias naturales, Unesco produjo el primer World Social Science Report, sobre el estado y la evolución de las sociedades contemporáneas, incluyendo también una visión de las ciencias sociales modernas y sus conexiones. Provee una revisión analítica y cultural de los diferentes aspectos de estas ciencias.

La relación entre las ciencias naturales y las ciencias sociales nunca ha sido fácil. Las ciencias sociales, si bien no han producido resultados resonantes como las naturales (fundamentalmente a través de las tecnologías relacionadas), proveen una cierta comprensión de la dinámica del conjunto social que es imprescindible. Es importante entonces apoyar las disciplinas que proveen herramientas para tratar aspectos generales de la Ciencia como son la percepción por parte del público de los eventuales riesgos de los avances científico-tecnológicos y la relación entre la equidad social y el conocimiento. Estos aspectos requieren más que el uso del sentido común.

P. Sztompka de Polonia, autor de un capítulo del mencionado Report expresa claramente que algunos aspectos de la democracia fueron indispensables para la Ciencia, pero hay que ser cuidadoso en no exagerar la cercanía de ambas. La Ciencia requiere excelencia y consecuentemente es jerárquica por naturaleza, con élites basadas en patrones de mérito que surgen de los respectivos éxitos. Prácticamente el único principio democrático en la Ciencia es la igualdad de oportunidades para realizar investigación de excelencia. La representación oficial brasileña se hizo eco de estas consideraciones.

COMUNICACION DE LA CIENCIA

Una de las partes menos controvertidas de los documentos de la Conferencia tiene que ver con la necesidad de mejorar la comunicación sobre la ciencia. Nadie discute que dentro de una economía basada precisamente en el conocimiento, llegar al público con la ciencia es fundamental. Esto permite a la comunidad incrementar los beneficios del saber y sus aplicaciones y también reduce el “deficit democrático” que aparece inevitablemente cuando se dejan demasiadas decisiones en manos de expertos y consejeros técnicos.

Este proceso debe trascender la mera comunicación pública de la ciencia por parte del experto esperando que llegue intacto a un público expectante (aproximación en

algun sentido elitista). La comunicación será efectiva si es un proceso en ambas direcciones. Ambas partes deben proveer sus propios puntos de vista. Además del paso fundamental de desarrollar caminos más efectivos para comunicar ciencia al público, se debe estimular el crecimiento de un dialogo crítico y maduro intercultural. Un hecho clave es incrementar la transparencia en todas las esferas de decisión.

Existen planes para establecer un International Centre for Science Communication en el Museo de Ciencia de Londres.

ETICA

La Ciencia forma parte integral del proceso de cambio socio-económico en evidente aceleración. La pregunta es si la Ciencia, en términos generales, está preparada. Los desafíos reales e inmediatos que se presentan no han sido totalmente evaluados por la comunidada científica, cuya responsabilidad es insoslayable.

Tradicionalmente la Ciencia ha sido vista como benefactora de la humanidad. Si bien el entusiasmo popular por la Ciencia ha sido muy variado, en promedio su imagen ha sido buena. Por el contrario, en la actualidad la Ciencia sufre de un serio problema de imagen. El público ya no la concibe como benefactora y no la asocia automáticamente con el desarrollo de una civilización mejor. Ha declinado sensiblemente la confianza pública en la integridad ética y la responsabilidad de los científicos, apareciendo simultáneamente sospechas y miedos generalizados sobre eventuales abusos de diferente tipo. Esta situación causada, entre otras razones, por la insensibilidad de muchos científicos frente a problemas éticos que surgen de sus investigaciones.

La concepción tradicionalmente individualista de búsqueda de un conocimiento objetivo, está siendo sustituída hoy por una Ciencia que resulta de un trabajo de equipo orientada hacia un proyecto específico que necesita justificarse en términos de consecuencias humanas potenciales. Aparece entonces una dimensión ética explícita en la Ciencia que no puede ignorarse.

Como contraparte a la financiación de sus investigaciones, los científicos se ven obligados a abocarse a la búsqueda de soluciones a problemas específicos (lamentablemente muchas veces motivados por las guerras). De esa manera, las leyes del mercado se imponen sobre los valores y normas tradicionales. Para los críticos de la Ciencia, ésta se transformó en materia de decisión del poder. El público raramente ve a la Ciencia como algo propio y para la mayoría de los jóvenes la Ciencia no es un estímulo para su propio desarrollo futuro. La actitud de los medios de comunicación favorece este descrédito.

Ha surgido un interés creciente en la ética de la Ciencia. En 1984 se formuló el Uppsala Code of Ethics for Scientists (iniciado por las Conferencias Pugwash). Hoy el papel de la ética en la Ciencia ha adquirido muchas dimensiones y significados. UNESCO estableció la COMEST (World Commission on the Ethics of Scientific Knowledge and Technology). Un debate constructivo entre Ciencia y público está en marcha bajo la certeza de que la confianza va desapareciendo a medida que la ética se ve comprometida.

Algunos puntos específicos que levantan problemas éticos fundamentales y que están en discusión:

- La Ciencia cruza nuevas fronteras. Consecuentemente, conceptos tradicionales como verdad, realidad, espacio-tiempo, naturaleza humana, conciencia, moralidad, etc., son cuestionados. Se produce una tensión dramática entre usos ¨buenos¨ y ¨malos¨ de la Ciencia y sobre quién(es) determinan esas calidades. Surgen desafíos múltiples:

construir una posición ética coherente, balancear reacciones emocionales frente a argumentos racionales, entender los hechos científicos con propiedad, etc.
Algunos ejemplos críticos son los avances biotecnológicos (La UNESCO Declaration on the Human Genome es importante a este respecto), los desarrollos en las ciencias de la mente como la psiquiatría y la filosofía que replantean el concepto de personalidad, la revolución en la tecnología de la información con la vulnerabilidad que implica la dependencia en el ciberespacio.
- La Ciencia y el poder. Surge una situación crítica y peligrosa en la interfase entre Ciencia y poderes económicos y políticos. La Ciencia académica está dando su lugar a una Ciencia post-académica que produce un tipo diferente de conocimiento.
- Ciencia, bienestar y equidad. Además de bienes materiales, educación, información y desarrollo científico están distribuídos muy asimétricamente entre el Norte y el Sur.
- Incertezas científicas. Surgen en referencia a los sistemas altamente complejos. La noción de riesgo está relacionada y los estudios correspondientes ligados a concepciones alternativas.

Algunas medidas posibles:
- Incrementar la presencia de la ética en la educación científica. La existencia de una conciencia ética en los científicos individualmente es de importancia capital. Esta conciencia implica no solamente conocer lo moralmente adecuado sino también prever y analizar diferentes contextos para un uso eficiente de la ética. La propuesta del juramento ¨Rotblat¨ se conectaba con este punto.
- Establecer instituciones nacionales independientes para tratar con la ética en la Ciencia que operen sobre la base del consenso.
- Adoptar lineamientos internacionales para el desarrollo de la Ciencia (el Código Uppsala por ejemplo).
- Aplicar políticas científicas de duración prolongada. Se genera así una aproximación precautoria consistente con los problemas éticos.
- Mantener un diálogo abierto con el público en general. Los científicos son parte de la sociedad y pueden ofrecer puntos de vista importantes, pero deben reconocer y respetar otras autoridades y otros valores alternativos.

¿QUE FALTO?

- Acuerdo para formar un nuevo fondo global para la Ciencia. Este tipo de fondos se decidieron en Rio (1992) (2.000 M$) para el environment y en Montreal (1987) para la capa de ozono. Se proponía también un proceso de reducción de la deuda externa de los países cuando aplicados los fondos a Ciencia y tecnología, propuesta que no se concretó.
- Una fuerte alianza entre los PED para defender derechos y conseguir ayudas
- Reconocimiento formal por parte de los gobiernos particulares de que la responsabilidad de la implementación exitosa de las propuestas de la Conferencia, es de cada uno de ellos.
- Según Greenpeace, se perdió la oportunidad de establecer urgentes medidas para evitar las amenazas a la vida global como son las que provocan la desaparición de especies, la polución química y nuclear y la diseminación en nuestro entorno de organismos genéticamente construídos.

CONSECUENCIAS Y ANUNCIOS ESPECIFICOS MAS NOTABLES:

- La Ciencia debe ser vista en su sentido más amplio, cubriendo las Ciencias Naturales pero también las Ciencias Sociales.
- Todos los países y regiones deben involucrarse en el desarrollo de la Ciencia. Además de la ayuda de la comunidad internacional, cada país debe adquirir su propio compromiso.
- La Ciencia básica o fundamental (sin ninguna relación con las aplicaciones), es universal y única. Se puede estar en desacuerdo en muchas cosas pero no en el conocimiento científico. Por ello el conocimiento básico debe ser considerado un bien internacional.
- La participación activa de la mujer en Ciencia es uno de los grandes desafíos de la propia Ciencia.
- Se necesitan desarrollar nuevas formas para compatibilizar el acceso a la información con la eventual protección y las retribuciones por su explotación. La definición de nuevas relaciones entre Ciencia e industria y entre Ciencia y gobierno está en marcha sobre la base de reconocer que la Ciencia no es una mera mercancía ya que incluye aspectos sociales, éticos y trascendentes.
- Suecia incrementará de 60M$ a 100M$ el presupuesto de ayuda para países en desarrollo. El objetivo es construir capacidad para investigar en los PED, fundamentalmente en ¨knowledge producing research¨ como vacunas y agricultura
- El proyecto de un ¨International Centre for Science Communication¨ en Londres, avanza
- El ¨International Centre for Pure and Applied Mathematics¨(CIMPA) en Niza, recibirá un apoyo creciente de Francia (algunos millones de francos). Francia también está preparada para ser soporte de otros centros similares al Abdus Salam International Centre for Theoretical Physics de Trieste en áreas como la biología. También se interesa en redes internacionales de universidades
- Conferencia de los estados africanos (50) convocada para enero en El Cairo a fin de definir un protocolo de colaboración. UNESCO anunció la financiación de una Red de mujeres árabes en Ciencia y tecnología a ser lanzada en esa reunión de El Cairo.
- Propuesta de una Red de mujeres de la región indonesia y del Pacífico en Ciencia y Tecnología.
- Estados Unidos estaría considerando la posibilidad de volver a participar de UNESCO. Esto ocurriría sólo luego de la nueva elección presidencial. Sin embago el Senado aprobó ya el pago de la deuda de 1.000M$ a Naciones Unidas.
- El Banco Mundial intentó transmitir un mensaje de cambio respecto a sus políticas de los ochenta cuando forzaba a los PED a efectuar recortes en la financiación de la investigación y la educación. El Banco preconiza el concepto de desarrollo basado en el conocimiento. Este cambio surge en parte por la presión de América Latina para que aparezcan inversiones en centros de investigación de excelencia y el convencimiento entre los economistas del Banco de la importancia de la educación y la investigación en el crecimiento económico. No hay que olvidar, sin embargo, que en el Banco Mundial, la representatividad está pesada por el dinero que disponen los miembros.
- Se insiste en que los países lleguen al límite inferior de dedicar 1% del PNB a la Ciencia y la tecnología e intenten dedicar hasta el 3%.

FINALE
(Parafraseamos fundamentalmente al Rapporteur-general P. Tindemans)

Ya que la Ciencia y la tecnología son indispensables para el desarrollo social y económico, aún al nivel de ayuda, se requiere que los científicos, los gobiernos y las organizaciones que actúan a nivel tanto nacional como internacional:
- expresen su confianza en la Ciencia
- ejerzan total responsabilidad entre cada uno de ellos y con la Ciencia
- mantengan un diálogo abierto entre ellos y con el público en general
- desarrollen un esfuerzo educacional a fin de garantizar a las nuevas generaciones una vida acorde a la Ciencia y la tecnología presentes y futuras.

Debe sorprendernos y entusiasmarnos la gran cantidad de tópicos genuinamente sustanciosos que fueron debatidos durante la Conferencia, aunque sólo se hayan alcanzado algunas conclusiones específicas.

El desafío es conseguir que las líneas generales acordadas se transformen en políticas efectivas.

ANEXO

DECLARATION ON SCIENCE AND THE USE OF SCIENTIFIC KNOWLEDGE

Version adopted by the Conference

1 July 1999

Preamble

1. We all live on the same planet and are part of the biosphere. We have come to recognize that we are in a situation of increasing interdependence, and that our future is intrinsically linked to the preservation of the global life-support systems and to the survival of all forms of life. The nations and the scientists of the world are called upon to acknowledge the urgency of using knowledge from all fields of science in a responsible manner to address human needs and aspirations without misusing this knowledge. We seek active collaboration across all the fields of scientific endeavour, i.e. the natural sciences such as the physical, earth and biological sciences, the biomedical and engineering sciences, and the social and human sciences. While the Framework for Action emphasizes the promises, the dynamism but also the potential adverse effects that came with the natural sciences, and the need to understand their impact on and relations with society, the commitment to science, as well as the challenges and the responsibilities set out in this Declaration, pertain to all fields of the sciences. All cultures can contribute scientific knowledge of universal value. The sciences should be at the service of humanity as a whole, and should contribute to providing everyone with a deeper understanding of nature and society, a better quality of life and a sustainable and healthy environment for present and future generations.

2. Scientific knowledge has led to remarkable innovations that have been of great benefit to humankind. Life expectancy has increased strikingly, and cures have been discovered for many diseases. Agricultural output has risen significantly in many parts of the world to meet growing population needs. Technological developments and the use of new energy sources have created the opportunity for freeing humankind from arduous labour. They have also enabled the generation of an expanding and complex range of industrial products and processes. Technologies based on new methods of communication, information handling and computation have brought unprecedented opportunities and challenges for the scientific endeavour as well as for society at large. Steadily improving scientific knowledge on the origin, functions and evolution of the universe and of life provides humankind with conceptual and practical approaches that profoundly influence its conduct and prospects.

3. In addition to their demonstrable benefits, the applications of scientific advances and the development and expansion of human activity have also led to environmental degradation and technological disasters, and have contributed to social imbalance or exclusion. As one example, scientific progress has made it possible to manufacture sophisticated weapons, including conventional weapons and weapons of mass destruction. There is now an opportunity to call for a reduction in the resources allocated to the development and manufacture of new weapons and to encourage the conversion, at least partially, of military production and research facilities to civilian use. The United Nations has proclaimed the year 2000 as the International Year for the Culture of Peace and the year 2001 as the United Nations Year of Dialogue among Civilizations as steps towards a lasting peace; the scientific community, together with other sectors of society, can and should play an essential role in this process.

4. Today, whilst unprecedented advances in the sciences are foreseen, there is need for a vigorous and informed democratic debate on the production and use of scientific knowledge. The scientific community and decision-makers should seek the strengthening of public trust and support for science through such a debate. Greater interdisciplinary efforts, involving both natural and social sciences, are a prerequisite for dealing with ethical, social, cultural, environmental, gender, economic and health issues. Enhancing the

role of science for a more equitable, prosperous and sustainable world requires a long-term commitment of all stakeholders, public and private, through greater investment, review of investment priorities accordingly, and the sharing of scientific knowledge.

5. Most of the benefits of science are unevenly distributed, as a result of structural asymmetries among countries, regions and social groups, and between the sexes. As scientific knowledge has become a crucial factor in the production of wealth, so its distribution has become more inequitable. What distinguishes the poor (be it people or countries) from the rich is not only that they have fewer assets, but also that they are largely excluded from the creation and the benefits of scientific knowledge.

6. We, participants in the World Conference on "Science for the Twenty-first Century: a New Commitment", assembled in Budapest, Hungary, from 26 June to 1 July 1999 under the aegis of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Council for Science (ICSU):

Considering:

7. where the natural sciences stand today and where they are heading, what their social impact has been and what society expects from them,

8. that in the twenty-first century science must become a shared asset benefiting all peoples on a basis of solidarity, that science is a powerful resource for understanding natural and social phenomena, and that its role promises to be even greater in the future as the growing complexity of the relationship between society and the environment is better understood,

9. the ever-increasing need for scientific knowledge in public and private decision-making, including notably the influential role to be played by science in the formulation of policy and regulatory decisions,

10. that access to scientific knowledge for peaceful purposes from a very early age is part of the right to education belonging to all men and women, and that science education is essential for human development, for creating endogenous scientific capacity and for having active and informed citizens,

11. that scientific research and its applications may yield significant returns towards economic growth, sustainable human development, including poverty alleviation, and that the future of humankind will become more dependent on the equitable production, distribution and use of knowledge than ever before,

12. that scientific research is a major driving force in the field of health and social care and that making further use of scientific knowledge has great potential for improving the quality of health for humankind,

13. the current process of globalization and the strategic role of scientific and technological knowledge within it,

14. the urgent need to reduce the gap between the developing and developed countries by improving the scientific capacity and infrastructure in developing countries,

15. that the information and communication revolution offers new and more effective means of exchanging scientific knowledge and advancing education and research,

16. the importance for scientific research and education of full and open access to information and data belonging to the public domain,

17. the role played by the social sciences in the analysis of social transformations related to scientific and technological developments and the search for solutions to the problems generated in the process,

18. the recommendations of major conferences convened by the organizations of the United Nations system and others, and of the meetings associated with the World Conference on Science,

19. that scientific research and the use of scientific knowledge should respect human rights and the dignity of human beings, in accordance with the Universal Declaration of Human Rights and in the light of the Universal Declaration on the Human Genome and Human Rights,

20. that some applications of science can be detrimental to individuals and society, the environment and human health, possibly even threatening the continuing existence of the human species, and that the contribution of science is indispensable to the cause of peace and development, global safety and security,

21. that scientists with other major actors have a special responsibility for seeking to avert applications of science which are ethically wrong or have adverse impact,

22. the need to practice and apply the sciences in line with appropriate ethical requirements developed on the basis of an enhanced public debate,

23. that the pursuit of science and use of scientific knowledge should respect and maintain life in all its diversity, as well as the life-support systems of our planet,

24. that there is a historical imbalance in the participation of men and women in all science-related activities,

25. that there are barriers which have precluded the full participation of other groups, of both sexes, including disabled people, indigenous peoples and ethnic minorities hereafter referred to as disadvantaged groups,

26. that traditional and local knowledge systems as dynamic expressions of perceiving and understanding the world, can make and historically have made, a valuable contribution to science and technology, and that there is a need to preserve, protect, research and promote this cultural heritage and empirical knowledge,

27. that a new relationship between science and society is necessary to cope with such pressing global problems as poverty, environmental degradation, inadequate public health, and food and water security, in particular associated with population growth,

28. the need for a strong commitment to science on the part of governments, civil society and the productive sector, as well as an equally strong commitment of scientists to the well-being of society,

Proclaim the following:

1. Science for knowledge; knowledge for progress

29. The inherent function of the scientific endeavour is to carry out a comprehensive and thorough enquiry into nature and society leading to new knowledge. This new knowledge provides educational, cultural and intellectual enrichment and leads to technological advances and economic benefits. Promoting fundamental and problem-oriented research is essential for achieving endogenous development and progress.

30. Governments, through national science policies and in acting as catalysts to facilitate interaction and communication between stakeholders, should give recognition to the key role of scientific research in the acquisition of knowledge, in the training of scientists and in the education of the public. Scientific research funded by the private sector has become a crucial factor for socio-economic development, but this cannot exclude the need for publicly funded research. Both sectors should work in close collaboration and in a complementary manner in the financing of scientific research for long-term goals.

2. Science for peace

31. The essence of scientific thinking is the ability to examine problems from different perspectives and seek explanations of natural and social phenomena, constantly submitted to critical analysis. Science thus relies on critical and free thinking, which is essential in a democratic world. The scientific community, sharing a long-standing tradition that transcends nations, religions or ethnicity, should promote, as stated in the Constitution of UNESCO, the "intellectual and moral solidarity of mankind", which is the basis of a culture of peace. Worldwide cooperation among scientists is a valuable and constructive contribution to global security and to the development of peaceful interactions between different nations, societies and cultures, and could give encouragement to further steps in disarmament, including nuclear disarmament.

32. Governments and society at large should be aware of the need to use natural and social sciences and technology as tools to address the root causes and impacts of conflict. Investment in scientific research which addresses them should be increased.

3. Science for development

33. Today, more than ever, science and its applications are indispensable for development. Governments at all levels and the private sector should provide enhanced support for building up an adequate and well-shared scientific and technological capacity through appropriate education and research programmes as an indispensable foundation for economic, social, cultural and environmentally sound development. This is particularly urgent for developing countries. Technological development requires a solid scientific basis and needs to be resolutely directed towards safe and clean production, greater efficiency in resource use and more environmentally friendly products. Science and technology should also be resolutely directed towards prospects for better employment, improving competitiveness and social justice. Investment in science and technology aimed both at these objectives and at a better understanding and safeguarding of the planet's natural resources base, biodiversity and life-support systems must be increased. The objective should be a move towards sustainable development strategies through the integration of economic, social, cultural and environmental dimensions.

34. Science education, in the broad sense, without discrimination and encompassing all levels and modalities is a fundamental prerequisite for democracy and for ensuring sustainable development. In recent years, worldwide measures have been undertaken to promote basic education for all. It is essential that the fundamental role played by women in the application of scientific development to food production and health care be fully recognized, and efforts made to strengthen their understanding of scientific advances in these areas. It is on this platform that science education, communication and popularization need to be built. Special attention is still required for marginalized groups. It is more than ever necessary to develop and expand science literacy in all cultures and sectors of society as well as reasoning ability and skills and an appreciation of ethical values, so as to improve public participation in decision-making related to the application of new knowledge. Progress in science makes the role of universities particularly important in the promotion and modernization of science teaching and its coordination at all levels of education. In all countries, and in particular the developing countries, there is a need to strengthen scientific research in higher education and postgraduate programmes, taking into account national priorities.

35. The building of scientific capacity should be supported by regional and international cooperation, to ensure both equitable development and the spread and utilization of human creativity without discrimination of any kind against countries, groups or individuals. Cooperation between developed and developing countries should be carried out in conformity with the principles of full and open access to information, equity and mutual benefit. In all efforts of cooperation, diversity of traditions and cultures should be given due consideration. There is a responsibility of the developed world to enhance partnership activities in science with developing countries and countries in transition. Helping to create a critical mass of national research in the sciences through regional and international cooperation is especially important for small states and least developed countries. The presence of scientific structures, such as universities, is an
essential element for the training of personnel in their own country with a view to a subsequent career in that country. Through these and other efforts favourable conditions should be created that will tend to reduce or reverse the brain drain. However, any measures should not restrict the free circulation of scientists.

36. Progress in science requires various types of cooperation at and between the intergovernmental, governmental and non-governmental levels, such as: multilateral projects; research networks, including South-South networking; partnerships involving scientific communities of developed and developing countries to meet the needs of all countries and facilitate their progress; fellowships and grants and promotion of joint research; programmes to facilitate the exchange of knowledge; the development of internationally recognized scientific research centres, particularly in developing countries; international agreements for the joint promotion, evaluation and funding of megaprojects and broad access to them; international panels for the scientific assessment of complex issues; and international arrangements for the promotion of postgraduate training. New initiatives are required for interdisciplinary collaboration. The international character of fundamental research should be strengthened by significantly increasing

support for long-term research projects and for international collaborative projects, especially those of global interest. In this respect particular attention should be given to the need for continuity of support for research. Access to these facilities for scientists from developing countries should be actively supported and open to all on the basis of scientific merit. The use of information and communication technology, particularly through networking, is to be expanded as a means to promote the free flow of knowledge. At the same time, care must be taken to ensure that the use of these technologies does not lead to a denial or restriction of the richness of the various cultures and means of expression.

37. For all countries to respond to the objectives set out in this Declaration, in parallel with international approaches, in the first place national strategies and institutional arrangements and financing systems should be set up or revised to enhance the role of sciences in sustainable development within the new context. In particular they should include: a long-term national policy on science to be developed together with the major public and private actors; support to science education and scientific research; the development of cooperation between R&D institutions, universities and industry as part of national innovation systems; the creation and maintenance of national institutions for risk assessment and management, vulnerability reduction, safety and health; and incentives for investment, research and innovation. Parliaments and governments should be invited to provide a legal, institutional and economic basis for enhancing scientific and technological capacity in the public and private sectors and facilitate their interaction. Science decision-making and priority-setting should be made an integral part of the overall development planning and formulation of sustainable development strategies. In this context, the recent initiative by the major G8 creditor countries to embark on the process of reducing the debt of certain developing countries will be conducive to a joint effort by the developing and developed countries towards establishing appropriate mechanisms for the funding of science in order to strengthen national and regional scientific and technological research systems.

38. Intellectual property rights need to be appropriately protected on a global basis, and access to data and information is essential for undertaking scientific work and for translating the results of scientific research into tangible benefits for society. Measures should be taken to enhance those relationships between the protection of intellectual property rights and the dissemination of scientific knowledge that are mutually supportive. There is a need to consider the scope, extent and application of intellectual property rights in relation to the equitable production, distribution and use of knowledge. There is also a need to further develop appropriate national legal frameworks to accommodate the specific requirements of developing countries and traditional knowledge, sources and products, to ensure their recognition and adequate protection on the basis of the informed consent of the customary or traditional owners of this knowledge.

4. Science in society and science for society

39. The practice of scientific research and the use of knowledge from that research should always aim at the welfare of humankind, including the reduction of poverty, be respectful of the dignity and rights of human beings, and of the global environment, and take fully into account our responsibility towards present and future generations. There should be a new commitment to these important principles by all parties concerned.

40. A free flow of information on all possible uses and consequences of new discoveries and newly developed technologies should be secured so that ethical issues can be debated in an appropriate way. Each country should establish suitable measures to address the ethics of the practice of science and of the use of scientific knowledge and its applications. These should include due process procedures for dealing with dissent and dissenters in a fair and responsive manner. The World Commission on the Ethics of Scientific Knowledge and Technology of UNESCO can provide a means of interaction in this respect.

41. All scientists should commit themselves to high ethical standards, and a code of ethics based on relevant norms enshrined in international human rights instruments should be established for scientific professions. The social responsibility of scientists requires that they maintain high standards of scientific integrity and quality control, share their knowledge, communicate with the public and educate the younger generation. Political authorities should respect such action by scientists. Science curricula should include science ethics, as well as training in history, philosophy and the cultural impact of science.

42. Equality in access to science is not only a social and ethical requirement for human development, but also a necessity for realizing the full potential of scientific communities worldwide and for orienting scientific progress towards meeting the needs of humankind. The difficulties encountered by women,

constituting over half of the population in the world, in entering, pursuing and advancing in a career in the sciences and in participating in decision-making in science and technology should be addressed urgently. There is an equally urgent need to address the difficulties faced by disadvantaged groups which preclude their full and effective participation.

43. Governments and scientists of the world should address the complex problems of poor health and the increasing inequalities in health across different countries and between communities within the same country with the objective of achieving an enhanced, equitable standard of health and an improved provision of quality health care for all. This should be undertaken through education, by using scientific and technological advances, by developing robust long-term partnerships between all stakeholders and by harnessing programmes to the task.

44. We, participants in the World Conference on "Science for the Twenty-first Century: a New Commitment", commit ourselves to making every effort to realize the possibility of promoting dialogue between the scientific community and society to remove all discrimination with respect to education for and the benefits of science, to act ethically and cooperatively within our own spheres of responsibility, to strengthen scientific culture and its peaceful application throughout the world, and to promote the use of scientific knowledge for the well-being of populations and for sustainable peace and development, taking into account the social and ethical principles illustrated above.

45. We consider that the Conference document Science Agenda - Framework for Action gives practical expression to a new commitment to science, and can serve as a strategic guide for partnership within the United Nations system and between all stakeholders in the scientific endeavour in the years to come.

46. We adopt therefore this Declaration on Science and the Use of Scientific Knowledge and agree upon the Science Agenda - Framework for Action as a means of achieving the goals set forth in the Declaration, and call upon UNESCO and ICSU to submit both documents to the General Conference and the General Assembly respectively. These documents will be also seized by the United Nations General Assembly. The purpose is to enable both organizations to identify and implement follow-up action in their respective programmes, and to mobilize the support of all partners, particularly those in the United Nations system, in order to reinforce international coordination and cooperation in science.

SCIENCE AGENDA - FRAMEWORK FOR ACTION

Version adopted by the Conference

1 July 1999

PREAMBLE

1. We, participants in the World Conference on Science for the Twenty-First Century: A New Commitment, assembled in Budapest, Hungary, from 26 June to 1 July 1999 under the aegis of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Council for Science (ICSU), state the following:

2. Advancing the objectives of international peace and the common welfare of humankind is one of the highest and most noble goals of our societies. The creation of UNESCO and of ICSU, more than half a century ago, was a symbol of the international determination to advance these objectives through scientific, educational and cultural relations among the peoples of the world.

3. The above objectives are as valid now as they were fifty years ago. However, while the means of achieving them have been greatly improved over this half-century through scientific and technological progress, so have the means of threatening and compromising them. In the meantime, the political, economic, social, cultural and environmental context has also changed profoundly, and the role of the sciences (natural sciences such as physical, earth and biological sciences, biomedical and engineering sciences, social and human sciences) in this changed context needs to be collectively defined and pursued: hence the grounds for a new commitment. Having adopted the Declaration on Science and the Use of Scientific Knowledge, and having taken inspiration from the Introductory Note to the Science Agenda - Framework for Action,

4. We agree, by common consent, to the present Science Agenda - Framework for Action, as guidelines and instruments for action to achieve the goals proclaimed in the Declaration.

5. We consider that the guidelines for action formulated hereafter provide a framework for dealing with the problems, challenges and opportunities confronting scientific research and for the furthering of existing and new partnerships, both national and international, between all actors in the scientific endeavour. Such research efforts and partnerships must be consistent with the needs, aspirations and values of humankind and respect for nature and future generations, in the pursuit of lasting peace, equity and sustainable development.

1. SCIENCE FOR KNOWLEDGE; KNOWLEDGE FOR PROGRESS

6. We commit ourselves to the advancement of knowledge. We want this knowledge to be at the service of humanity as a whole, and to produce a better quality of life for present and future generations.

1.1 Role of fundamental research

7. Each country should aim at having high-quality scientific institutions capable of providing research and training facilities in areas of specific interest. In those cases where countries are unable to create such institutions, the necessary support should be granted by the international community, through partnership and co-operation.

8. The conduct of scientific research should be supported by an appropriate legal framework at the national and international level. Freedom of opinion and protection of intellectual rights are particularly important in this respect.

9. Research groups and institutions and relevant non-governmental organizations should strengthen their regional and international cooperation activities, with a view to: facilitating scientific training; sharing expensive facilities; promoting the dissemination of scientific information; exchanging scientific knowledge and data, notably between developed and developing countries; and jointly addressing problems of global concern.

10. Universities should ensure that their programmes in all fields of science focus on both education and research and the synergies between them and introduce research as part of science education. Communication skills and exposure to social sciences should also be a part of the education of scientists.

11. In the new context of increased globalization and international networking the universities are faced not only with new opportunities but also with challenges For example, universities play an increasingly important role in the innovation system. Universities are responsible for educating the highly skilled work force for the future and equipping their students with the capabilities needed to deal with global issues. They should also be flexible and regularly update their knowledge. Universities in developed and developing countries should intensify their co-operation, for example through twinning arrangements. UNESCO could act as a clearing house and facilitator.

12. Donor countries and agencies of the United Nations system are urged to foster cooperation in order to increase the quality and efficiency of their support to research in developing countries. Their joint effort should be focused on strengthening national research systems, taking into account national priorities and science policies.

13. Professional organizations of scientists, such as national and international academies, scientific unions and learned societies, have an important role to play in the promotion of research, for which they should be given wide recognition and corresponding public support. Such organizations should be encouraged to further international collaboration on questions of universal concern. They should also be encouraged to be the advocates of the freedom of scientists to express their opinions.

1.2 The public and private sectors

14. Through participatory mechanisms involving all relevant sectors and stakeholders, Governments should identify the needs of the nation and give priority to support of the public research needed to achieve progress in the various fields, ensuring stable funding for the purpose. Parliaments should adopt corresponding measures and levels of budget appropriation.

15. Governments and the private sector should achieve an adequate balance between the various mechanisms for funding of scientific research, and new funding possibilities should be explored or promoted through appropriate regulation and incentive schemes, with public-private partnerships based on flexible schemes, and governments warranting the accessibility of generated knowledge.

16. A close dialogue should exist between donors and recipients of S&T funding. Universities, research institutes and industry should develop closer cooperation; financing of S&T projects should be promoted as a means of advancing knowledge and strengthening science-based industry.

1.3 Sharing scientific information and knowledge

17. Scientists, research institutions and learned scientific societies and other relevant non-governmental organizations should commit themselves to increased international collaboration including exchange of knowledge and expertise. Initiatives to facilitate access to scientific information sources by scientists and institutions in the developing countries should be especially encouraged and supported. Initiatives to fully incorporate women scientists and other disadvantaged groups from the South and North into scientific networks should be implemented. In this context efforts should be made to ensure that results of publicly funded research will be made accessible.

18. Countries that have the necessary expertise should promote the sharing and transfer of knowledge, in particular through support to specific programmes set up for the training of scientists worldwide.

19. The publication and wider dissemination of the results of scientific research carried out in the developing countries should be facilitated, with the support of developed countries, through training, exchange of information and the development of bibliographic services and information systems better serving the needs of scientific communities around the world.

20. Research and education institutions should take account of the new information and communication technologies, assess their impact and promote their use, for example through the development of electronic publishing and the establishment of virtual research and teaching environments or digital libraries. Science curricula should be adapted to take into account the impact of these new technologies on scientific work. The establishment of an international programme on Internet-enabled science and vocational education and teaching, together with the conventional system, should be considered to redress the limitations of educational infrastructure and to bring high-quality science education to remote locations.

21. The research community should be involved in regular discussion with the publishing, library and information technology communities to ensure that the authenticity and integrity of scientific literature are not lost in the evolution of the electronic information system. The dissemination and sharing of scientific knowledge are an essential part of the research process, and governments and funding agencies should therefore ensure that relevant infrastructure and other costs are adequately covered in research budgets. Appropriate legal frameworks are necessary as well.

2. SCIENCE FOR PEACE AND DEVELOPMENT

22. Today, more than ever, the natural and social sciences and their applications are indispensable to development. Worldwide cooperation among scientists is a valuable and constructive contribution to global security and to the development of peaceful interactions among different nations, societies and cultures.

2.1 Science for basic human needs

23. Research specifically aimed at addressing the basic needs of the population should be a permanent chapter in every country's development agenda. In defining research priorities, the developing countries and countries in transition should consider not only their needs and weaknesses in terms of scientific capacity and information, but also their own strengths in terms of local knowledge, know-how and human and natural resources.

24. For a country to have the capacity to provide for the basic needs of its population, science and technology education is a strategic necessity. As part of this education, students should learn to solve specific problems and to address the needs of society by utilizing scientific and technological knowledge and skills.

25. Industrialized countries should cooperate with developing countries through jointly defined S&T projects that respond to the basic problems of the population in the latter. Careful impact studies should be conducted to ensure better planning and implementation of development projects. Personnel engaged in such projects should receive training of relevance to their activity.

26. All countries should share scientific knowledge and cooperate to reduce avoidable ill-health throughout the world. Each country should assess and so identify the health improvement priorities that are best suited to their own circumstances. National and regional research programmes aimed at reducing variations in health among communities, such as collecting good epidemiological and other statistical data and communicating corresponding best practice to those who can use it, should be introduced.

27. Innovative and cost-effective mechanisms for funding science and pooling S&T resources and efforts of different nations should be examined for implementation by relevant institutions at the regional and international levels. Networks for human resources interchange, both North-South and South-South, should be set up. These networks should be so designed as to encourage scientists to contribute their expertise to their own countries.

28. Donor countries, non-governmental and intergovernmental organizations and United Nations agencies should strengthen their programmes involving science to address pressing developmental problems as elaborated in the Science Agenda while maintaining high quality standards.

2.2 Science, environment and sustainable development

29 National, regional and global environmental research programmes should be strengthened or developed, as appropriate, by governments, concerned United Nations agencies, the scientific community and private and public research funding institutions. These research programmes should include programmes for capacity-building. Areas requiring special attention include the freshwater issue and the hydrological cycle, climate variations and change, oceans, coastal areas, polar regions, biodiversity, desertification, deforestation, biogeochemical cycles and natural hazards. The goals of the existing international global environmental research programmes should be vigorously pursued within the framework of Agenda 21 and the action plans of the global conferences. Co-operation between neighbouring countries or among countries having similar ecological conditions must be supported in the solution of common environmental problems.

30. All components of the earth system must be monitored systematically on a long-term basis; this requires enhanced support by governments and the private sector for the further development of the global environmental observing systems. The effectiveness of monitoring programmes depends crucially on the wide availability of monitoring data.

31. Interdisciplinary research between natural and social sciences must be vigorously enhanced by all major actors concerned, including the private sector, to address the human dimension of global environmental change including health impacts, and to improve understanding of sustainability as conditioned by natural systems. Insights into the concept of sustainable consumption also demand interaction of natural sciences with social and political scientists, economists and demographers.

32. Modern scientific knowledge and traditional knowledge should be brought closer together in interdisciplinary projects dealing with the links between culture, environment and development in such areas as the conservation of biological diversity, management of natural resources, understanding of natural hazards and mitigation of their impact. Local communities and other relevant players should be involved in these projects. Individual scientists and the scientific community have the responsibility to communicate in popular language the scientific explanations of these issues and the ways in which science can play a key role in addressing them.

33. Governments, in co-operation with universities and higher education institutions, and with the help of relevant United Nations organizations, should extend and improve education, training and facilities for human resources development in environment-related sciences, utilizing also traditional and local knowledge. Special efforts in this respect are required in developing countries with the co-operation of the international community.

34. All countries should emphasize capacity-building in vulnerability and risk assessment, early warning of both short-lived natural disasters and long-term hazards of environmental change, improved preparedness, adaptation, mitigation of their effects and integration of disaster management into national development planning. It is important, however, to bear in mind that we live in a complex world with an inherent uncertainty about long-term trends. Decision-makers must take this into account and therefore encourage the development of new forecasting and monitoring strategies. The precautionary principle is an important guiding principle in handling inevitable scientific uncertainty, especially in situations of potentially irreversible or catastrophic impacts.

35. S&T research on clean and sustainable technologies, recycling, renewable energy resources and efficient use of energy should be strongly supported by the public and private sectors at national and international levels. Competent international organizations, including UNESCO and UNIDO, should promote the establishment of a freely accessible virtual library on sustainable technologies.

2.3 Science and technology

36. National authorities and the private sector should support university-industry partnerships involving also research institutes and medium, small and micro-enterprises, for promoting innovation, accelerating returns from science and generating benefits for all the participants.

37. Curricula relating to science and technology should encourage a scientific approach to problem-solving. University-industry cooperation should be promoted to assist engineering education and continuing vocational education and to enhance responsiveness to the needs of industry and support from industry to the education sector.

38. Countries should adopt best practices for advancing innovation, in a manner best suited to their needs and resources. Innovation is no longer a linear process arising from a single advance in science; it requires a systems approach involving partnerships, linkages between many areas of knowledge and constant feedback between many players. Possible initiatives include co-operative research centres and research networks, technology "incubators" and research parks, and transfer and advisory bodies for small and medium enterprises. Specific policy instruments, including initiatives to encourage national innovation systems to address science-technology links, should be developed taking into account global economic and technological changes. Science policy should promote the incorporation of knowledge into social and productive activities. It is imperative to tackle the issue of endogenous generation of technologies starting from problems that pertain to developing countries. This implies that these countries should have resources available to become generators of technologies.

39. Acceleration of technology transfer to promote industrial, economic and social development should be supported through the mobility of professionals between universities and industry and between countries as well as through research networks and inter-firm partnerships.

40. Greater emphasis should be placed by governments and institutions of higher learning on engineering, technological and vocational education, also in the form of lifelong learning and through the means of international cooperation. New curriculum profiles which are consistent with the requirements of employers and attractive to youth should be defined. In order to mitigate the adverse impact of asymmetric migration of trained personnel from the developing to the developed countries and also to sustain high-quality education and research in developing countries, UNESCO may catalyse more symmetric and closer interaction of S&T personnel across the world and the establishment of world-class education and research infrastructure in the developing countries.

2.4 Science education

41. Governments should accord highest priority to improving science education at all levels, with particular attention to the elimination of the effects of gender bias and bias against disadvantaged groups, raising public awareness of science and fostering its popularization. Steps need to be taken to promote the professional development of teachers and educators in the face of change and special efforts should be made to address the lack of appropriately prepared science teachers and educators, in particular in developing countries.

42. Science teachers at all levels and personnel involved in informal science education should have access to continuous updating of their knowledge for the best possible performance of their educational tasks.

43. New curricula, teaching methodologies and resources, taking into account gender and cultural diversity, should be developed by national education systems in response to changing educational needs of societies. Research in science and technology education needs to be furthered nationally and internationally through the establishment and networking of specialized centres around the world, with the cooperation of UNESCO and other relevant international organizations.

44. Educational institutions should encourage the contribution of students to decision-making concerning education and research.

45. Governments should provide increased support to regional and international programmes of higher education and to networking of graduate and postgraduate institutions, with special emphasis on North-South and South-South cooperation, since they are important means of helping all countries, especially the small or least developed among them, to strengthen their scientific and technological resource base.

46. Non-governmental organizations should play an important role in the sharing of experience in science teaching and education.

47. Educational institutions should provide basic science education to students in areas other than science. They also should provide opportunities for lifelong learning in the sciences.

48. Governments, international organizations and relevant professional institutions should enhance or develop programmes for the training of scientific journalists, communicators and all those involved in increasing public awareness of science. An international programme on promotion of scientific literacy and culture accessible to all should be considered in order to provide appropriate technology and scientific inputs in an easily understandable form that are conducive to the development of local communities.

49. National authorities and funding institutions should promote the role of science museums and centres as important elements in public education in science. Recognizing the resource constraints of developing countries, distance education should be used extensively to complement existing formal and non-formal education.

2.5 Science for peace and conflict resolution

50. The basic principles of peace and coexistence should be part of education at all levels. Science students should also be made aware of their specific responsibility not to apply scientific knowledge and skills to activities which threaten peace and security.

51. Governmental and private funding bodies should strengthen or develop research institutions that carry out interdisciplinary research in the areas of peace and the peaceful applications of S&T. Each country should ensure its involvement in this work, either at the national level or through participation in international activities. Public and private support for research on the causes and consequences of wars, conflict prevention and resolution should be increased.

52. Governments and the private sector should invest in sectors of science and technology directly addressing issues that are at the root of potential conflicts, such as energy use, competition for resources and pollution of air, soil and water.

53. Military and civil sectors, including scientists and engineers, should collaborate in seeking solutions to problems caused by accumulated weapon stocks and landmines.

54. A dialogue should be promoted between representatives of governments, civil society and scientists in order to reduce military spending and the orientation of science towards military applications.

2.6 Science and policy

55. National policies should be adopted that imply consistent and long-term support to S&T, in order to ensure the strengthening of the human resource base, establishment of scientific institutions, improvement and upgrading of science education, integration of science into the national culture, development of infrastructures and promotion of technology and innovation capacities.

56. S&T policies should be implemented that explicitly consider social relevance, peace, cultural diversity and gender differences. Adequate participatory mechanisms should be instituted to facilitate democratic debate on scientific policy choices. Women should actively participate in the design of these policies.

57. All countries should systematically undertake analyses and studies on science and technology policy, taking into account the opinions of all relevant sectors of society, including those of young people, to define short-term and long-term strategies leading to sound and equitable socio-economic development. A World Technology Report as a companion volume to the present UNESCO World Science Report should be considered in order to provide a balanced world opinion on the impact of technology on social systems and culture.

58. Governments should support graduate programmes on S&T policy and social aspects of science. Training in legal and ethical issues and regulations guiding international R&D in strategic areas such as information and communication technologies, biodiversity and biotechnology should be developed for scientists and professionals concerned. Science managers and decision-makers should have regular access to training and updating to cope with the changing needs of modern society in the areas of S&T.

59. Governments should promote the further development or setting up of national statistical services capable of providing sound data, disaggregated by gender and disadvantaged groups, on science education and R&D activities that are necessary for effective S&T policy-making. Developing countries should be assisted in this respect by the international community, using the technical expertise of UNESCO and other international organizations.

60. Governments of developing countries and countries in transition should enhance the status of scientific, educational and technical careers, and make determined efforts to improve working conditions, increase their capacity to retain trained scientists and promote new vocations in S&T areas. Programmes should also be set up or promoted to establish collaboration with scientists, engineers and technologists who have migrated from these countries to developed countries.

61. Governments should make an effort to use scientific expertise more systematically in policy-making addressing the process of economic and technological transformation. The contribution of scientists should be an integral part of programmes supporting either innovation or measures aimed at industrial development or restructuring.

62. Scientific advice is an increasingly necessary factor for informed policy-making in a complex world. Therefore, scientists and scientific bodies should consider it an important responsibility to provide independent advice to the best of their knowledge.

63. Governments at all levels should establish and regularly review mechanisms which ensure timely access to the best available advice from the scientific community drawing on a sufficiently wide range of the best expert sources. These mechanisms are to be open, objective and transparent. Governments should publish the scientific advice in media accessible to the public at large.

64. Governments, in cooperation with the agencies of the United Nations system and international scientific organizations, should strengthen international scientific advisory processes as a necessary contribution to intergovernmental policy consensus-building at regional and global levels and to the implementation of regional and international conventions.

65. All countries should protect intellectual property rights and recognize that access to data and information is essential for scientific progress. In developing an appropriate international legal framework, WIPO, in cooperation with relevant international organizations, should constantly address the question of knowledge monopolies, and WTO, during new negotiations of the TRIPS Agreement, should incorporate into this Agreement tools aimed at financing the advancement of science in the South with the full involvement of the scientific community. In this regard, the international programmes of ICSU and the five intergovernmental scientific programmes of UNESCO should play a catalytic role by, inter alia, improving the compatibility of data collection and processing, and facilitating access to scientific knowledge.

3. SCIENCE IN SOCIETY AND SCIENCE FOR SOCIETY

66. The practice of scientific research and the use of scientific knowledge should always aim at the welfare of humankind, be respectful of the dignity of human beings and of their fundamental rights, and take fully into account our shared responsibility towards future generations.

3.1 Social requirements and human dignity

67. Governments, international organizations and research institutions should foster interdisciplinary research aimed specifically at identifying, understanding and solving pressing human or social problems, according to each country's priorities.

68. All countries should encourage and support social science research to better understand and manage the tensions characterizing the relations between science and technology on the one hand, and the different societies and their institutions on the other hand. Transfer of technology should be accompanied by analysis of its possible impact on populations and society.

69. The structure of educational institutions and the design of their curricula should be made open and flexible so as to adjust to the emerging needs of societies. Young scientists should be provided with a knowledge and an understanding of social issues, and a capacity to move outside their specific field of specialization.

70. University curricula for science students should include field work that relates their studies to social needs and realities.

3.2 Ethical issues

71. Ethics and responsibility of science should be an integral part of the education and training of all scientists. It is important to instil in students a positive attitude towards reflection, alertness and awareness of the ethical dilemmas they may encounter in their professional life. Young scientists should be appropriately encouraged to respect and adhere to the basic ethical principles and responsibilities of science. UNESCO's World Commission on the Ethics of Scientific Knowledge and Technology (COMEST), in cooperation with ICSU's Standing Committee on Responsibility and Ethics of Sciences (SCRES), have a special responsibility to follow up on this issue.

72. Research institutions should foster the study of ethical aspects of scientific work. Special interdisciplinary research programmes are needed to analyse and monitor the ethical implications and means of regulation of scientific work.

73. The international scientific community, in cooperation with other actors, should foster a debate, including public debate, promoting environmental ethics and environmental codes of conduct.

74. Scientific institutions are urged to comply with ethical norms, and to respect the freedom of scientists to express themselves on ethical issues and to denounce misuse or abuse of scientific or technological advances.

75. Governments and non-governmental organizations, in particular scientific and scholarly organizations, should organize debates, including public debates, on the ethical implications of scientific work. Scientists and scientific and scholarly organizations should be adequately represented in the relevant regulating and decision-making bodies. These activities should be institutionally fostered and recognized as part of the scientists' work and responsibility. Scientific associations should define a code of ethics for their members.

76. Governments should encourage the setting up of adequate mechanisms to address ethical issues concerning the use of scientific knowledge and its applications, and such mechanisms should be established where they do not yet exist. Non-governmental organizations and scientific institutions should promote the establishment of ethics committees in their field of competence.

77. Member States of UNESCO are urged to strengthen the activities of the International Bioethics Committee and of the World Commission on the Ethics of Scientific Knowledge and Technology and ensure appropriate representation.

3.3 Widening participation in science

78. Government agencies, international organizations and universities and research institutions should ensure the full participation of women in the planning, orientation, conduct and assessment of research activities. It is necessary that women participate actively in shaping the agenda for the future direction of scientific research.

79. The full participation of disadvantaged groups in all aspects of research activities, including the development of policy, also needs to be ensured.

80. All countries should contribute to the collection of reliable data, in an internationally standardized manner, for the generation of gender-disaggregated statistics on S&T, in cooperation with UNESCO and other relevant international organizations.

81. Governments and educational institutions should identify and eliminate, from the early learning stages on, educational practices that have a discriminatory effect, so as to increase the successful participation in science of individuals from all sectors of society, including disadvantaged groups.

82. Every effort should be made to eliminate open or covert discriminatory practices in research activities. More flexible and permeable structures should be set up to facilitate the access of young scientists to careers in science. Measures aimed at attaining social equity in all scientific and technological activities, including working conditions, should be designed, implemented and monitored.

3.4 Modern science and other systems of knowledge

83. Governments are called upon to formulate national policies that allow a wider use of the applications of traditional forms of learning and knowledge, while at the same time ensuring that its commercialization is properly rewarded.

84. Enhanced support for activities at the national and international levels on traditional and local knowledge systems should be considered.

85. Countries should promote better understanding and use of traditional knowledge systems, instead of focusing only on extracting elements for their perceived utility to the S&T system. Knowledge should flow simultaneously to and from rural communities

86. Governmental and non-governmental organizations should sustain traditional knowledge systems through active support to the societies that are keepers and developers of this knowledge, their ways of life, their languages, their social organization and the environments in which they live, and fully recognize the contribution of women as repositories of a large part of traditional knowledge.

87. Governments should support cooperation between holders of traditional knowledge and scientists to explore the relationships between different knowledge systems and to foster inter-linkages of mutual benefit.

FOLLOW-UP

88. We, participants in the World Conference on Science, are prepared to act with determination to attain the goals proclaimed in the Declaration on Science and the Use of Scientific Knowledge, and uphold the recommendations for follow-up described hereafter.

89. All participants in the Conference consider the Agenda as a framework for action, and encourage other partners to adhere to it. In so doing, governments, the United Nations system and all other stakeholders should use the Agenda, or relevant parts of it, when planning and implementing concrete measures and activities which embrace science or its applications. In this way, a truly multilateral and multifaceted programme of action will be developed and carried out. We are also convinced that young scientists should play an important role in the follow-up of this Framework for Action.

90. Taking into account the outcome of the six regional forums on women and science sponsored by UNESCO, the Conference stresses that special efforts should be made by governments, educational institutions, scientific communities, non-governmental organizations and civil society, with support from bilateral and international agencies, to ensure the full participation of women and girls in all aspects of science and technology, and to this effect to:
.promote within the education system the access of girls and women to scientific education at all levels;
.improve conditions for recruitment, retention and advancement in all fields of research; .launch, in collaboration with UNESCO and UNIFEM, national, regional and global campaigns to raise awareness of the contribution of women to science and technology, in order to overcome existing gender stereotypes among scientists, policy-makers and the community at large;
.undertake research, supported by collection and analysis of gender-disaggregated data, documenting constraints and progress in expanding the role of women in science and technology;

.monitor the implementation and document best practices and lessons learned through impact assessment and evaluations;
.ensure an appropriate representation of women in national, regional and international policy and decision-making bodies and forums;
.establish an international network of women scientists;
.continue to document the contributions of women in science and technology.
To sustain these initiatives governments should create appropriate mechanisms, where these do not yet exist, to propose and monitor introduction of the necessary policy changes in support of the attainment of these goals.

91. Special efforts also need to be made to ensure the full participation of disadvantaged groups in science and technology, such efforts to include:
.removing barriers in the education system;
.removing barriers in the research system;
.raising awareness of the contribution of these groups to science and technology in order to overcome existing stereotypes;
.undertaking research, supported by the collection of data, documenting constraints; .monitoring implementation and documenting best practices;
.ensuring representation in policy-making bodies and forums.

92. Although the follow-up to the Conference will be executed by many partners who will retain the responsibility for their own action, UNESCO, in co-operation with ICSU - its partner in convening the Conference - should act as a clearing house. For this purpose, all the partners should send UNESCO information about their follow-up initiatives and action. In this context, UNESCO and ICSU should develop concrete initiatives for international scientific cooperation together with relevant United Nations organizations and bilateral donors, in particular on a regional basis.

93. UNESCO and ICSU should submit the Declaration on Science and the Use of Scientific Knowledge and Science Agenda - Framework for Action to their General Conference and General Assembly respectively, with a view to enabling both organizations to identify and envisage follow-up action in their respective programmes and provide to them enhanced support. The other partner organizations should do likewise vis-à-vis their governing bodies; the United Nations General Assembly should also be seized of the outcome of the World Conference on Science.

94. The international community should support the efforts of developing countries in implementing this Science Agenda.

95. The Director-General of UNESCO and the President of ICSU should ensure that the outcome of the Conference be disseminated as widely as possible, which includes transmitting the Declaration and the Science Agenda - Framework for Action to all countries, to relevant international and regional organizations and to multilateral institutions. All participants are encouraged to contribute to such dissemination.

96. We appeal for increased partnership between all the stakeholders in science and recommend that UNESCO, in cooperation with other partners, prepare and conduct a regular review of the follow-up to the World Conference on Science. In particular, no later than 2001, UNESCO and ICSU shall prepare jointly an analytical report to governments and international partners on the returns of the Conference, the execution of follow-up and further action to be taken.