



Consultations of the Director-General with Member States

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Science and Technologies for Knowledge Societies

What role for UNESCO in 2014-2021?

NEW PERSPECTIVES ON KNOWLEDGE SOCIETIES

In 2014-2021, UNESCO will assist its Member States in their aspirations to building knowledge societies based on peace and sustainable development.

Knowledge is fundamental to human development, and plays a key role in economic growth, social development, cultural enrichment and political empowerment. The concept of knowledge societies, advanced by UNESCO as distinct from the 'information society', includes notions of inclusiveness, pluralism, equity, openness and participation. It reflects UNESCO's conviction that knowledge societies should be shaped and driven not only by scientific and technological forces but also by societal choices.

Every society has its own knowledge assets. It is therefore necessary to work towards connecting the forms of knowledge that societies already possess and the new forms of development, acquisition and sharing of knowledge. Indeed, sciences and technologies have created enormous new potential for information and knowledge exchange, for the emergence of new patterns of communication and exchange of ideas as well as

for production and design. At the same time, they have facilitated the prowess of *human capacity to abridge scales* (from local, regional to global); promoted convergence of different types of technologies (ICT, nanotechnology, space-based technology, cloud computing, etc.); and enabled us to better understand the nexus between science and society¹. Thus science and technology are increasingly recognized as fundamental to creating sustainable knowledge societies. Not least to note "A successful modern economy is founded on a strong scientific base that has the ability to convert scientific research and knowledge into products and services, which bring social and economic benefits²."

Of particular significance in creating tomorrow's knowledge societies, given the multiple challenges they will face, is the sound use of scientific knowledge in the development of public policies. UNESCO participates in a number of international scientific assessments and as an intergovernmental Organization is particularly well placed to act as a catalyst in bridging the gap between science and policy and in bringing knowledge to inform decision-making and drive sustainable development, as well as serving as a clearing house and centre for sharing knowledge and best practices.

UNESCO's ability to promote peace and sustainable development will depend on continued support for the creation of knowledge in multifaceted dimensions and dynamic transformation over time. Knowledge creation will be induced by science, technology and innovation and developments in the fields of culture, society and education. The world's societies and economies are increasingly knowledge societies, increasingly committed to global sustainability which requires the mobilization of knowledge and skills at all levels. Such mobilization needs to occur within a broader framework that recognizes and values the social, environmental and economic aspects of sustainable development.

Today's societies are challenged to equip themselves with new ways of thinking, creating, promoting quality education, and with the science, technology and innovation systems that can offer new knowledge and new pathways to knowledge, allowing contemporary societies to handle uncertainty and complexity. This is particularly relevant for addressing the basic challenges of access to water, food and energy in the context of the impact of climate change and the related objectives of human security, environmental sustainability, equality and peace.

1. Dominique Pestre, Science, Society and Politics Knowledge Societies from an Historical Perspective, http://ec.europa.eu/research/science-society/document_library/pdf_06/historical-perspectives_en.pdf, 2007.

2. Creating a knowledge-based society; an interview with Noel Treacey, Minister for Science, Technology and Commerce of the Republic of Ireland, EMBO Rep. 2000 December 15; 1(6): 460-462.

AXIS 1 – SCIENCE, TECHNOLOGY AND INNOVATION: CREATING A POLICY ENVIRONMENT TO ENABLE KNOWLEDGE GENERATION AND APPLICATION

Establishing an enabling policy environment at local, national and international levels to create the conditions for the development of new scientific knowledge and the mobilization of existing knowledge systems will be a central parameter for UNESCO's future work.

Investment in science, technology and innovation (STI) to create new knowledge is an important driver of economic growth and social development. Specifically, UNESCO works to provide sound **policy advice** assisting countries to invest in STI, to develop national science policies, to reform their science systems and to build capacity to monitor and evaluate performance through STI indicators. Every five years, the *UNESCO Science Report* assesses the status of investment in STI around the world. Bridging the gap between science, technologies and policy is pivotal to UNESCO's mandate. Concrete examples include the sustained use by governments of evidence-based policy advice relying on UNESCO-led and UNESCO-sponsored global assessments and reports including *the World Water Assessment Report*, *the EFA Global Monitoring Report*, and *the World Social Science Report*.

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efforts to instil **interdisciplinarity** through intersectoral projects will be given continuity and enhanced in order to further take science out of disciplinary silos, to provide an holistic evidence-base for integrated policy development and to reduce the disconnect between science, policy and society.

UNESCO will promote **sustainability science** which will be a major defining factor of the post-2015 development agenda, drawing on scientific, traditional and indigenous knowledge in an interdisciplinary way to address particular development, societal, economic and environmental challenges.

The strengthening of the **science-policy-society interface** will therefore constitute a major axis of UNESCO's action in 2014-2021.

The social and human sciences have a distinctive contribution to make in connecting global processes to the specific values of the societies and communities they affect and in equipping them with the capacity to develop their own understanding and responses. The **Management of Social Transformations Programme (MOST)** promotes the development and use of social science knowledge to better understand and manage

social transformations, consistent with the universal values of justice, freedom, human dignity and sustainable development. The objective is to reduce the gap between social science and policy, giving scientific meaning to policy concerns and providing political meaning to the knowledge produced by social science.

► The UN Secretary-General has requested that UNESCO take a leading role in establishing his Scientific Advisory Board specifically focused on strengthening the linkage between science and policy and ensuring that up-to-date rigorous science is appropriately reflected in high-level policy discussion.

► UNESCO is a partner in the Future Earth Initiative, a new ten-year international interdisciplinary research initiative which will develop the knowledge to respond to global change and support the transformation towards global sustainability.

► UNESCO is a co-sponsor of the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) which aims to link biodiversity scientific knowledge to policy to inform decision-making to conserve biodiversity.

Multiple pressures on science, technology and innovation create the risk that knowledge production

might be oriented in inappropriate ways and inadequately shared with those who need it – and have an established human right to share in its benefits. It is crucial to elaborate and promote ethical norms and principles and to embed ethical practices in the institutions of science and technology at all levels. It is further necessary to connect such ethical norms, principles and practices to the institutional design of science, technology and innovation systems, with particular concern for the priority needs of developing countries. The **social and ethical dimensions of science and technology** are central to UNESCO's mandate, as it strives to reach out to the most vulnerable segments of society and to contribute to sustainable development and peace through a human rights-based approach and social change focus in all its fields of competence. In addition, UNESCO promotes ethical norms, principles and practices in certain specific areas of major contemporary concern. **Bioethics** identifies and addresses the ethical dilemmas that scientific advances and their applications may pose to the integrity of human beings and to their rights. The character of contemporary leading-edge science research and technological advancement, the globalized effects of their application, and the increasing volume of research from a variety of countries call for a global human rights-based approach. Bioethics also ensures the participation of all relevant voices in decision-making processes on very

sensitive issues that affect society as a whole.

► In 2011, UNESCO launched the Science, Technology and Innovation Global Assessment Programme (STIGAP) to widen the scope of standard STI assessment, to take into account county-specific contexts, including the social dimension, as well as emerging knowledge on the relationship between technological progress and sustainable development.

► The Science Policy Information Platform (SPIN), a web-based information and knowledge system presents up-to-date and comprehensive information on STI policies and best practices was developed by UNESCO in the Latin America and the Caribbean region. UNESCO plans to develop GO-SPIN into a global platform and an observatory to support STIGAP.

► Country-specific STI policy advice was provided to Albania, Benin, Bosnia and Herzegovina, Botswana, Burundi, Cape Verde, Central African Republic, Gabon, Gambia, Madagascar, Malawi, Namibia, Nigeria, Republic of the Congo, Senegal, Serbia, Sudan, Tanzania, Togo, Zambia and Zimbabwe. Our collaboration with these countries continues and we have already established contact with at least 5 more countries with which UNESCO will begin to advise in the next months.

► Providing technical assistance in the process of establishment of National Bioethics Committees (NBCs), as well as the subsequent capacity-building for ensuring their viability and sustainability, are essential elements of UNESCO's capacity-building action in the field of bioethics.

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UNESCO continues to be a pioneer and leader in international scientific cooperation. Today, the vast majority of scientific knowledge created is done through international collaborations with most scientific research papers authored by multiple multi-national scientists. In promoting international collaboration in science, UNESCO has also a demonstrated advantage through its extensive scientific networks.

Since its foundation, UNESCO has been the catalyst for, and the promoter of, major international scientific programmes in the field of the marine, freshwater, ecological, earth and the basic sciences to create and share knowledge to bridge knowledge divides.

Through these programmes, a significant body of scientific knowledge has been created and disseminated, from knowledge of the role of the ocean in climate regulation through the Global Ocean Observation System (GOOS) coordinated by UNESCO's **Intergovernmental Oceanographic Commission (IOC)**, transboundary aquifers of the world through the **International Hydrological Programme (IHP)**, the relationship between man and nature through the **Man and the Biosphere**

AXIS 2 – MOBILIZING INTERNATIONAL COLLABORATION TO ADVANCE KNOWLEDGE GENERATION AND CAPACITY DEVELOPMENT

Programme (MAB) to the knowledge gained on the earth's geological history helping us to understand present climate change through the **International Geosciences Programme (IGCP)**. The new *UN Global Compact on Oceans*, with which UNESCO is closely affiliated, will focus also on ocean knowledge generation and sharing as well as related capacity-building.

UNESCO is promoting and building capacity and knowledge in the basic sciences and cutting-edge fundamental research through the **International Basic Sciences Programme (IBSP)**, the **International Centre of Theoretical Physics (ICTP)** and collaboration with such projects as the Human Genome.

All of these major international scientific collaborative programmes have helped build scientific capacity in UNESCO Member States, and serve as the core scientific knowledge base for, among others, the management of the environment. UNESCO continues to be a pioneer and leader in international scientific cooperation. Today, the vast majority of scientific knowledge created is done through international collaborations with most scientific research papers authored by multiple multi-national scientists. In promoting international collaboration in science, UNESCO has also a demonstrated advantage through its extensive scientific networks.

Science education, disaster-risk reduction, engineering, and biodiversity, are cross-cutting themes in UNESCO and have spawned

new international collaboration and partnerships for knowledge generation and capacity-building. **Science education** is critical to creating knowledge societies, not only to educate aspiring scientists – men and women alike – but also to develop the knowledge and critical thinking skills to equip young people to make informed personal and competent professional choices. UNESCO has a unique niche in the UN system to promote science education. Engineering uses science and technology to create knowledge to provide solutions to sustainable development challenges. No knowledge society can be without an adequate numbers of engineers. **UNESCO's Engineering Initiative** is working with the major professional partners to attract more young people, in particular young women, to careers in engineering.

Reducing natural disasters demands not only scientific knowledge but also knowledge of social and cultural norms. UNESCO works in a truly interdisciplinary way to live up to this challenge as it does to address biodiversity loss. Scientifically sound knowledge and information, capacity of early warning, and monitoring of natural hazards are critical in building resilient societies against natural disasters. UNESCO has pioneered the establishment of **early warning systems** including for tsunamis and floods that are critical information and knowledge infrastructures for many Member States. The Organization is making similar scientific efforts to address other major natural

hazards, such as droughts, cyclones, landslides and large scale cross-boundary environmental pollution as its contribution to the UN concerted agenda for disaster risk reduction. Building knowledge and capacity in all areas of UNESCO's actions in knowledge generation go hand in hand.

The unique stakeholder composition of UNESCO gives it a privileged position to help bridge existing knowledge divides between countries. Similarly, it also allows for a broad-based participation of stakeholders and policy-makers, e.g. parliamentarians, government officials, the corporate sector, scientists, as well as women, students, youth, indigenous people and the public at large. This uniqueness has already been demonstrated through **South-South** and **North-South** collaborative projects or through the development of science-industry partnerships.

UNESCO's science programmes focus particularly on **Africa**. Examples include providing assistance to African countries in the formulation of STI policies, with support to African scientific networks such as the African Network of Scientific and Technological Institutions (ANSTI) and the African Inter-parliamentary Forum on Science, Technology and Innovation. The Man and the Biosphere programme supports environmental conservation and sustainable development through the African biosphere reserves network (AfriMab). UNESCO's water networks are particularly active in Africa in the field of groundwater and water resource management in disaster situations while UNESCO's earth sciences programmes aim to build capacity in African countries to manage their natural resources. UNESCO's IOC provides assistance to African countries in data exchange on marine issues.

► **Learning sites for sustainable development:** UNESCO-designed Biosphere reserves, World Heritage Sites, geoparks, Ramsar sites, constitute approx. 15% of the total conservation areas of the world, and are vast international networks of conservation, research and sustainable management, as well as areas of learning, knowledge generation and sharing in sustainable practices

► Since 1972 the International Geosciences Programme has contributed in some 150 countries to building knowledge on geological resources and processes and to creating networks of geoscientists.

► **Geological and Transboundary Aquifer Mapping:** UNESCO in partnership with the China Geological Survey and Chinese Academy of Geological Sciences worked with sub-regional groups in updating the Asian Regional Hydrogeological, Groundwater Resources, Groundwater Environment and Geothermal Distribution Maps for Asia. For the first time, an inventory was carried out of trans-boundary aquifer maps for Asia.

► In the period 2010-2011, **UNESCO-IHE** in Delft (the Netherlands) awarded some 400 MSc degrees in various fields of water sciences; during the same period, **UNESCO-ICTP** in Trieste (Italy) trained over 10,000 scientists from developing countries in various fields of physics and applied sciences.

► **Remote sensing and space technology** are highly useful techniques to monitor environmental change. UNESCO through its **Open Initiative** works through a unique network of space agencies, research institutions and the private sector to help preserve natural and cultural World Heritage Sites and biosphere reserves.

► In 2012, several partnerships with major international professional engineering organizations were developed, including the Institute of Electrical and Electronic Engineers (IEEE), to create synergies in the

promotion of engineering careers, especially among youth and women.

► A UNESCO category 2 center in Yazd on qanats (underground water transportation and storage) and historical hydraulic structures has played critical role in promoting traditional water management knowledge and technologies, which evolved for centuries in many dry land countries. The sharing of the traditional knowledge and skills through UNESCO training and advisory services has led to the restoration of traditional water transportation systems in a number of countries in West Asia, and helped in one large rural community water supply system in Iraq, as part of the UN post-conflict effort in the country.

► Through over 40 UNESCO-sponsored and UNESCO-affiliated scientific institutes the Organization has access to the best science in several disciplines ranging from the water sciences to biotechnology. Around 200 Chairs in the fields of basic and engineering sciences, ecological and earth sciences, water and the ocean sciences are part of the UNESCO Chairs and university twinning programme. All of these programmes support activities which facilitate access to knowledge and information within their networks and are unique in their systematic outreach to the developing world.

► In its efforts, UNESCO benefits from collaborations with regional entities and mechanisms, such as the South Asian Association for Regional Cooperation (SAARC), the West African Economic and Monetary Union (UEMOA), the Association of Southeast Asian Nations (ASEAN), or the African Ministerial Council on Science and Technology (AMCOST). Moreover, UNESCO is engaged with national apex level organizations such as National Science Foundations and/or Departments of Science and Technology.

AXIS 3 – EXPANDING ACCESS TO AND EQUITABLE SHARING OF KNOWLEDGE IN ALL DOMAINS

In 2014-2021, UNESCO will step up its action for the mobilization of new technologies to expand the access to and the equitable sharing of knowledge in its multiple dimensions related to science, technology, culture and education.

The sphere of formal **STI education** has changed considerably over time. A giant step in the development of STI learning was made when knowledge acquisition and sharing became technology – mediated and, in parallel, the dependence of global development processes from the ability to efficiently produce, disseminate and use information and knowledge dramatically increased. In a relatively short time, STI education has moved from a rigid, fixed system to a highly mobile structure. Not least to note, one of the main consequences of technology today arguably is mobility. Internet, whether fixed or mobile, and mobile telephony, together with traditional media such as radio and TV broadcasting, enable large parts of the world's population to have quasi-permanent access to information and knowledge from almost everywhere on the planet and at any time.

Thus, advances in science and technologies have created enormous new potential for information and knowledge exchanges and for the emergence of new patterns of communication and exchange of ideas. The right to access these new technologies and to all aspects of knowledge available through these technologies is of fundamental concern to the mandate of UNESCO. Access to culture and related knowledge systems is a cause UNESCO strongly promotes.

Culture represents an invaluable, limitless and renewable knowledge capital. From traditional and indigenous knowledge, to contemporary forms of cultural expression and creativity, cultural assets are fundamental to building knowledge-based societies. With this in mind, UNESCO will capitalize on the results of the ECOSOC Annual Ministerial Review taking place in July 2013 on the theme "Science, technology and innovation, and the potential of culture, for promoting sustainable development and achieving the Millennium Development Goals" to foster access to knowledge as a mainspring of innovation. This will entail, in particular, tapping the protection and safeguarding of cultural heritage in its manifold forms, and the promotion of the diversity of cultural expressions, using normative instruments as a dissemination platform, and the potential of ICTs.

New technologies have already provided new ways for **monitoring world heritage sites**. By generating evidence-based data on human-made threats to their conservation, they play a key role in alerting the international community and in raising awareness on the need to enhance their protection.

New technologies are of key importance for recording, registering and sharing knowledge about **intangible cultural heritage** within and among countries and offer an immense potential in this regard. They play a crucial role in the identification and inventorying of intangible cultural heritage which is in turn an essential component of its safeguarding under the Convention

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for the Safeguarding of Intangible Cultural Heritage. The International Information and Networking Centre for Intangible Cultural Heritage in the Asia-Pacific Region (ICHCAP), a Category 2 Centre under the auspices of UNESCO, is working with many countries in Asia and the Pacific to restore and digitalize intangible cultural heritage-related data, disseminate it and use it for education and promotion purposes.

Museums are unique education platforms and repositories of invaluable knowledge that they are created to share. The digitalization of their collections is revolutionizing access to this knowledge as well as the promotion of the values attached to it, facilitating intercultural understanding and respect for cultural diversity, by making it available to the widest audience, and in particular youth.

ICTs also offer increased possibilities for disseminating the knowledge developed within the framework of the UNESCO General and Regional Histories, especially with regard to youth, and offer new perspectives for its teaching.

Finally, ICTs are essential to **reinforce and enhance knowledge-sharing and management among networks and within communities of practices**. For example, ICTs may be used for creating online exhibitions and platforms for exchange among heritage managers.

UNESCO promotes and supports **Open Access (OA)—the online availability of scholarly information to everyone, free of most licensing and copyright barriers**—for the benefit of global knowledge flow, innovation and socio-economic development. UNESCO places particular emphasis on scientific information (journal articles, conference papers and datasets of various kinds) emanating from publicly funded research. Working with partners, UNESCO works to improve awareness about the benefits of OA among policy makers, researchers and knowledge managers. Through its global network of Field Offices, Institutes and Centers, UNESCO facilitates the development and adoption of OA-enabling policies. In addition, UNESCO engages in global OA debates and cooperates with local,

regional and global initiatives in support of OA. UNESCO's OA programme pays particular attention to African and other developing countries. **Open Access benefits researchers, innovators, teachers, students, media professionals and the general public**. It promotes global knowledge flows for the benefit of scientific discovery, innovation and socio-economic development.

UNESCO holds that **universal access to high quality education** is key to the building of peace, sustainable social and economic development, and intercultural dialogue. Open Educational Resources (OER) provide a strategic opportunity to improve the quality of education as well as facilitate policy dialogue, knowledge sharing and capacity building. Open Educational Resources are teaching, learning or research materials that are in the public domain or released with an intellectual property license that allows for free use, adaptation, and distribution. Access to Open Educational Resources relies heavily on communication and communication technology, a powerful example of technology underpinning the creation of knowledge societies.

► **The Virtual Museum** seeks to use resources provided by the digitalization of cultural artefacts so as to strengthen intercultural dialogue between online visitors. As an interactive platform, this Virtual Museum exhibits innovative narratives around the theme of intercultural interactions and exchange of collections of up to 60 artefacts from the National Museum of Damascus (Syria) and the Nubia Museum in Aswan (Egypt). The Virtual Museum is being used as an interactive platform of exchange for museums and cultural institutions.

► **The UNESCO Network of Creative Cities**, working together to promote

creativity as a lever for sustainable urban development, strongly relies on its constellation of intertwined websites providing multimedia content to stimulate exchange and cooperation among cities worldwide.

Science for sustainable development must benefit from the talents and perspectives of both women and men. However, reaching **gender equality** in science remains a challenge. In fact, although the number of female scientists today has increased, women are still under-represented in science due to a complex set of factors including the loss of opportunity during women's child-bearing years, and thus the world is depriving itself of the full potential of half of humanity to bring the power of science to address sustainable development challenges. UNESCO has been a pioneer in this field. Notably, the UNESCO-I'OREAL Partnership "For Women in Science", the UNITWIN/UNESCO Chairs Programme and activities in the basic and engineering sciences place special emphasis on supporting women scientists, in particular young women scientists. Since 1998, the L'Oréal-UNESCO Prize has recognized 64 laureates from 30 countries, exceptional women who have made great advances in scientific research. Two of them have gone on to receive the Nobel Prize. To date, Fellowships have been granted to more than 1,200 women in 103 countries, permitting them to pursue their research in institutions at home or abroad.

► UNESCO has partnered with UNDP, UNEP, UNIDO, the Chinese Ministry of Science and Technology and a UNESCO Chair to develop a compilation of applicable technical manuals for South-South cooperation on S&T to address climate change. The material has assembled the most up-to-date models

of application technologies in the fields of renewable energies, agriculture, forest, waste utilization and recycling, water resource management, natural resource and environmental management, energy saving buildings, emission reduction in industry production and in civil and commercial uses, disaster prevention and mitigation and public health.

► UNESCO has developed a policy guideline for **Open Access for Scientific Information** and has developed a **Global Open Access Portal for Scientific and Scholarly communication** which contains information for 148 countries.

► Over the last 10 years, UNESCO has helped spur an international movement in support of OERs. UNESCO also hosts the Open Training Platform, a comprehensive database of more than 10,000 OERs designed to facilitate

teaching, learning, and research. The Open Training Platform is searchable by subject and provides a central access point for capacity building in a wide variety of disciplines.

► In 2012, UNESCO, the Nature Publishing Group, and the private company Roche created a partnership to establish a cutting-edge **educational platform for science education**.

► The E-Learning Tools on the Role of Women in African History and the Atlas of interactions of African Diaspora being developed under the Slave Route project show the possibilities for ICTs to modernize knowledge dissemination.

► UNESCO has been assisting Sudan (2011-2012) to incorporate practical experimentation in the science curriculum of secondary schools.

In cooperation with the Ministry of Education, UNESCO's microscience teaching and learning materials have been adapted to the Sudanese curriculum and 33 pilot schools have been chosen to implement the project. A total of 50 teachers and trainers have received training so far.

► As a response to the Horn of Africa 2011 drought crisis, UNESCO launched in 2012 the initiative **Strengthening Capacity to Combat Drought and Famine in the Horn of Africa (Kenya, Somalia, Ethiopia): Tapping Groundwater Resources for Emergency Water Supply**. The project aims to map drought-resilient groundwater resources in an affected area and strengthen regional capacities in managing groundwater for drought-preparedness by giving access to scientific information and knowledge.

