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Third World Academy of Sciences

1. Introduction

The Third World Academy of Sciences (TWAS, www.twas.org) is a knowledge-based institution promoting scientific excellence in developing countries. The Academy, at its core, consists of an extensive network of scientists throughout the South who are key actors for the implementation of sustainable development policies both in developing countries and as participants in international research initiatives. Together with the Third World Network of Scientific Organizations (TWNSO), the Third World Organization for Women in Science (TWOWS) and the InterAcademy Panel on International Issues (IAP), TWAS helps countries in the South build scientific and technological capacities that contribute directly to sustainable economic development.

TWAS is an autonomous international organization, founded in Trieste, Italy, in 1983, by a distinguished group of scientists from the South under the leadership of the late Nobel laureate Abdus Salam of Pakistan. It is located on the campus of the Abdus Salam International Center for Theoretical Physics (ICTP, www.ictp.trieste.it), which was also founded by Abdus Salam. TWAS membership currently totals 666 Fellows and Associate Fellows from 79 countries.

TWAS programmatic activities include support for research grants, fellowships, lectures and exchange visits. The Academy also oversees a prestigious awards scheme and an extensive publications programme. In 1991, the United Nations Educational, Scientific and Cultural Organization (UNESCO) assumed responsibility for administering TWAS staff and funds. The Academy's operational funds come largely from the Italian government. Donor countries, cooperation agencies and foundations provide funding for programmatic activities. In addition to its strong links with UNESCO and the ICTP, the Academy has close relationships with other international bodies with which it shares common objectives: for example, the International Council for Science (ICSU), the International Foundation for Science (IFS) and the International Science Programme (ISP).

TWNSO is a non-governmental organization, founded in 1988 at the initiative of TWAS, by ministers of science and technology and heads of science academies and research councils in developing countries, to promote science-based sustainable economic development in the South. In 1990, TWNSO acquired consultative status with UNESCO.

TWAS also played a key role in the establishment of TWOWS, which was officially launched in Cairo in 1993. TWOWS currently has more than 2000 members from over 80 countries in the South. Its main objective is to promote women's leadership in science and technology in the South with a view to strengthening their effective participation in science-based development and decision-making processes. The TWOWS secretariat is currently hosted and assisted by TWAS.

Since May 2000, TWAS has served as the secretariat for IAP, a global network of 88 science academies world-wide established in 1993. IAP's primary goal is to help member academies work together to inform citizens and advise decision makers on the scientific aspects of critical global issues.

2. The Scientific Divide.

Scientific research and technology drive today's economies and serve as twin pillars of progress for advances in knowledge for all humankind. Globalization, in turn, helps drive material well-being but large segments of the global community remain excluded from its benefits and, in fact, have often become unwitting victims of its success. The persistence of poverty, hunger, malnutrition, and pandemic diseases are the most flagrant signs of the global 'economic segregation' that has become such a central characteristic of globalization itself. These economic ills – and the social and environmental ills that accompany them – coexist with the extraordinary scientific achievements and the luxurious lifestyles of the minority of humankind.

Science and technology are essential tools for achieving sustainable development, but pervasive poverty in developing countries remains an imposing obstacle to that transition. Due to poverty, indebtedness and lack of financial resources, it has become difficult, and sometimes impossible, for developing countries, particularly least developed countries (LDCs), to marshal the resources that are necessary for building effective scientific research institutions and scientific capacities.

Asymmetry is a central feature of globalization and at the center of this global divide is the enormous gap in scientific research, innovation and diffusion of technology. According to UNESCO's *World Science Report*, global expenditure on research and development currently totals US$500 billion per year, or about 1.5% of the gross national product (GNP) on a global scale. About 85% of this expenditure takes place in the developed countries and only 15% in the developing world. India, China, and the newly industrialized countries of East Asia, moreover, account for two thirds of the developing world's contribution to research and development (R&D), which means that the rest of the developing world provides just a 4% to 5% share of annual global expenditures in this vital area of investment.

In the developed world, current gross domestic expenditure on research and development exceeds on average 2% of GNP. The comparable figure in the developing world is about 0.5%. On a per capita basis, R&D expenditure amounts to US$80 per year. North America spends about US$500 per person per year on R&D and the developing world about US$20. R&D expenditures in the developing world would have to increase 20- to 30-fold to reach the same per-capita ratio found in the developed world .

Africa has only 70 researchers per million inhabitants; the Middle East and India have about 130; the rest of Asia 340; and Latin America about 550. By contrast, Europe has about 1900

researchers per million inhabitants; North America 3640; and Japan, Australia and New Zealand about 4380[1], representing the highest ratio.

All indicators of technological innovation demonstrate the startling gap between rich and poor. The top 10 innovating countries accounted for around 94% of all of the patents issued in the USA in 2000; yet, these countries represent only 14% of the world's population. The bottom 128 countries (with populations of at least 1 million) on the patents list all toll received less than 150 patents. Several dozen countries did not have a single patent[2].

3. ICT Divide = Scientific Divide

It should be no surprise to learn that the digital divide shares many of the same characteristics as the scientific divide. Communication and computer technologies are the result of decades of public and private research resources and initiatives in basic sciences and engineering that have taken place in OECD (Organization for Economic Cooperation and Development) countries. This investment gives OECD a commanding lead in the development of information and communication technologies (ITCs) that will likely remain in place for a long time, especially when one considers that nations with the strongest infrastructure and greatest expertise in ICTs are likely to benefit most from any additional technological advances.

As enabling technologies, ICTs are central to scientific research. ICTs help scientists perform basic and applied research, build partnerships and scientific international consortia, collect data, conduct experiments, manage laboratories, and communicate their findings to their peers and the public. The digital world in which we live is not only a product of science but a fundamental force for shaping the scientific research agenda and determining how the future of scientific knowledge will unfold and be utilized. As a result, success in bridging the digital divide will also help bridge the scientific divide.

4. Availability and dissemination of scientific journals and publications.

An interrelated series of effects created by the digital divide has proven particularly worrisome for scientists in developing countries. These effects include the devastating disparity in the production of scientific literature between the North and the South; a lack of access to timely information faced by many scientists in the developing work; and the poor means of dissemination of research results found in many nations in the South.

The limited access that scientists in developing countries have to electronic journals is due to a variety of factors: most notably, the cost of such services and inadequate connections. Some observers have concluded that such factors have made the information gap in the electronic era even greater than it was in the print age.

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[1] Waardenburg, G., "1999: EU-LDC research partnership in critical perspectives", NmoFA, quoted by Hurni, Hans, Lys Jon-Andri and Maselli, Daniel, in the "The Role of Research for Development", in the volume "Enhancing Research Capacity in Developing and Transition Countries", Swiss Commission for Research Partnerships with Developing Countries, 2001.

[2] Sachs, Jeffrey, "The Global Innovation Divide", in "Innovation Policy and the Economy, Vol.3", Conference held on 16 April 2002, National Bureau of Economic Research.

Many international organizations and initiatives have developed dialogues, partnerships and programmes with copyright and professional associations to address the complex issues related to the North-South information divide. WSIS Prepcom should consider analyzing the wide range of programmes that have been launched to facilitate access to scientific journals by researchers in the developing countries. More specifically, WSIS Prepcom should encourage governments and the private sector to make facilitated or subsidized access to scientific journals and databases and provisions for broadband internet access to scientific research data in developing countries a priority in their overall strategies for sustainable growth.

WSIS Prepcom should also explore, in cooperation with international organizations like the International Telecommunications Union (ITU) and the World Intellectual Property Organization (WIPO) and in partnerships with the private sector, ways to design programmes that cover both copyright and licensing arrangements that take account of the interests of all stakeholders and, more specifically, address the special needs of scientists and researchers in developing countries. Ongoing efforts and contacts with international aid agencies, private foundations, editors and publishing organizations should be initiated and expanded.

In October 2002, a multidisciplinary group of international experts gathered in Trieste, Italy, to discuss the complex issues related to developing country access to online scientific publishing. The meeting was organized by the ICTP and co-sponsored by TWAS, ICSU, the International Union of Pure and Applied Physics (IUPAP), UNESCO and the World Innovation Foundation. Experts analyzed concrete alternatives for supporting scientists working in remote areas that could not take full advantage of ICTs because of low-bandwidth and the high costs of access to on-line database services and the internet. Main topics of discussion included web to e-mail access, limitations in connectivity experienced by research and educational institutions in the least developed countries, local solutions to improving networks and internet infrastructures, licensing issues, challenges faced by content providers and the importance of increasing awareness of existing resources and technologies. Workshop participants made the following recommendations:

- To encourage web to e-mail access (for instance, via the open source software www4mail).
- To create a new special (low-cost) license in which publishers offer off-line web to e-mail access to current scholarly literature.
- To invite additional scientific publishers to participate in the Trieste-based ejds programme (www.ejds.org or www.ictp.trieste.it/ejournals).
- To build a critical mass of skilled people in ICTs in the developing world by providing additional training and greater opportunities to exchange experiences through networking.
- To provide resources to monitor in real-time the connectivity of research and educational institutions in developing countries and to encourage the investment of resources to develop connectivity.
- To provide low-cost or free access to scholarly literature to developing countries where reasonable internet bandwidth is available and publishers' revenue would not be significantly impacted.
- To emphasize the obligation of well-off institutions to help those less fortunate, both in developing and developed countries, to achieve access to scholarly literature.

- To continue to build capacities and share methodologies to ensure that content from developing countries has a presence on the Web.

- To publicize all access alternatives to better inform the public, scientists and policy makers of the existence of these alternatives.

- To encourage and enable the uploading, downloading and sharing of publications from developing countries.

Those in attendance agreed that a failure to confront these issues will have major implications for scientific research carried out in developing countries.

On behalf of the scientists in developing countries, we call upon the members of ITU and the private sector to consider putting these recommendations into practice. Internet and communication technologies provide unprecedented technological and cultural opportunities to create and expand, interactively, scientific knowledge and to advance science-based sustainable development on a global scale. Governments, bilateral and multi-lateral agencies, nongovernmental organizations, the business sector, and civil societies should do everything within their power to ensure that we take full advantage of this opportunity so that all people, and not just a select few, benefit from the historic opportunities that the development and advances in ICTs provide.