بسم الله الرحمن الرحيم

ISLAMIC WORLD ACADEMY OF SCIENCES
OUTREACH SEMINAR

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PREFACE

Science and scientific activities are, in many OIC-Member countries are not looked upon as priority areas. Neither are they considered a platform for sustained socio-economic development. Science is viewed as an expensive pursuit indulged in by either a few academics or individuals who are fond of spending long hours in their laboratories or staring at the monitors of their PCs. In general, science has been only really prized by some political and community leaders. It has some way to go before becoming part of the public's priority list. People, it seems, are indifferent to the fact that had it not been for science and technology, our lives would not be as they are today. Indeed science still is not considered to be a major component of the knowledge base of any country or community as with history, literature, the arts or music.

Among the international scientific elite and those involved in North-South and South-South scientific and technological collaboration, science and science-based terminologies have become part of their thinking and science for sustainable development has become a *buzzword.* To the pillars of the science and technology suprastructure of any country; scientific organizations, universities, academics of sciences, ministries of science and technology, the true value of scientific advancement has time and again more than manifested itself.

Of such pillars, academies of sciences stand out as organizations with multifaceted and multi-layered roles. Not only as propagandists for science and technology among the political decision-making circles, but also as decision support/analysis units, especially on matters related to science and technology, education, health and the environment. Perhaps if we were to unglamorously or

straightforwardly express the mission of an academy of sciences in terms of bridging the divide between the fans of science and its inimitable foes, we will be hitting the right note.

Some academies of sciences, such as the IAS, often organise what are called outreach activities to which politicians, diplomats, academics and civil servants working at scientific institutions are invited. Such activities aim to expose the attendees to the latest scientific and development concepts as well as contemporary ideas on the attainment of socio-economic development. Such S&T fora often reiterate and show the value of science as a means of knowledge creation.

This publication contains the presentations that were made at an outreach seminar organised by the Islamic World Academy of Sciences at the Royal Scientific Society in Amman, Jordan, on 8 December 2004, under the patronage of His Royal Highness Prince El-Hassan Ibn Talal, Founding Patron of the Islamic World Academy of Sciences.

Moneef R. Zou'bi
Director General, IAS
Amman, Jordan
May 2005

Address of
His Royal Highness Prince Al-Hassan Ibn Talal of Jordan,
Founding Patron of the Islamic World Academy of Sciences

بسم الله الرحمن الرحيم

والصلاة والسلام على سيدنا محمد وعلى آله وصحبه أجمعين

1. The ***Limits of Growth***[1] – the world model was built specifically to investigate five major trends of global concern – accelerating industrialisation, rapid population growth, widespread malnutrition, depletion of non-renewable resources and a deteriorating environment.

   The conclusions were:

   (i) If the present growth trends in world population, industrialisation, pollution, food production and resource depletion continue unchanged, then the limits to growth on this planet will be reached some time within the next one hundred years. The most probable result will be a rather sudden and uncontrollable decline in both population and industrial capacity;

[1] *Limits to Growth, a report to the Club of Rome (1972), by Donella H. Meadows, Dennis I. Meadows, Jorgen Rander and William W. Behrens III.*

(ii) It is possible to alter these growth trends and to establish a condition of ecological and economic stability that is sustainable far into the future. A state of global equilibrium could be designed so that the basic material needs of each person on earth are satisfied and each person has an equal opportunity to realise his individual human potential.

At the time, the writers said that if the world's people decide to strive for the second outcome rather than the first, the sooner they begin working to attain it, the greater will be their chances of success.

2. **30-year update of Limits to Growth**[2] – "an enormous shift has occurred in our understanding of the global environment over the past three decades! In the 1970's, before the promotion of *Limits to Growth*, there was little recognition that society could destroy important global systems. Today there is little hope that we can avoid causing profound and permanent damage to natural processes, such as climate regulation and regeneration of marine fisheries.

3. The Club of Rome held its annual conference in Helsinki in October 2004. The theme of the meeting was: '*Limits of Ignorance: The Challenge of Informed Humanity.*' At that meeting, Professor Antoni Kuklinski presented a paper entitled: *Sustainable development as the major challenge for the XXI century*. In this paper, Professor Kuklinski looked at three perceptions: the **global perspective**; the **secular perspective** and the **holistic perspective**.

The **global perspective** means that the development processes in the long-term horizon must incorporate the totality of global space naturally with considerable differentiation of the scale and

[2] *Limits to Growth: The 30 Year Update, published by Chelsea Green* www.chelseagreen.com

velocity of development which is unavoidable in the conditions of the capitalist economy. It is very difficult to imagine a situation in which the sustainable (durable) development will tolerate the exclusion from the developmental processes vast fragments of global space.

The **secular perspective** means that sustainable development must incorporate the *problematique* of a few generations. The decisions of the present generation should not destroy the development chances of the next generation. In this context, the secular perspective means literally a perspective of a century incorporating the present, the past and the future generations.

The **holistic perspective** means a broad and comprehensive approach to sustainable development.

4. After the Helsinki meeting, a Workshop of the German and Polish Associations for the Club of Rome was held entitled: ***The Future of Europe - the Global Future – The Club of Rome.***

   At the Workshop, they tried to overcome **three barriers**:

   Primo- the barrier of conventional wisdom;
   Secundo- the barrier of political correctness; and
   Tertio- the barrier of intellectual self-satisfaction.

   The human being has an ego endowed with rationality, imagination and can accept **two attitudes in relation to the future**:

   Primo - the **future is an unavoidable fate** that cannot be changed by the will and action of the individual and the society;

   Secundo - the **future can be created** at least in some domains - in the global, European, national and regional scale;

   Three trajectories were presented:

The general trajectory – education; talent; innovation; values and institutions; trust; happiness and well being.

The social trajectory – education; learning society; knowledge society; competitive society; dynamic society; happiness and well being.

The economic trajectory – education; learning economy; knowledge economy; competitive economy; dynamic economy; happiness and well being.

"*Thus, the first aim of prospective thought is to illuminate the choices of the present by the light of possible futures.*"

Michel Godet[3]

"*Projecting current events forward is always wrong. Such projections miss the turning points in human events.*"

Lester C. Thurow[4]

5. In their well-known work ***Learning***: ***The Treasure Within,*** Jacques Delors and others eloquently referred to the concept of 'learning to live together' as one of the **four pillars of education**, together with the concepts of 'learning to know,' 'learning to do,' and 'learning to be.' These four pillars can be rephrased as follows:

   Learning to live together – democratically;
   Learning to know – for the future;
   Learning to do – usefully;
   Learning to be – peacefully;

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3 M. Godet, *From Anticipation to action* – a handbook of strategic perspective, UNESCO – Paris, 1993.

4 L.C. Thurow, *The Future of Capitalism*, N. Y., 1995, p.3.

6. **Environmental Awareness in Europe with Focus on Central and Eastern Europe (Triple E)**.

   Following plans developed:

   - Raising environmental awareness in the countries of the EU in a coordinated "**train the trainer,**" "**teachers teach teachers,**" "**children teach children" and "children teach parents;**"
   - **Existing know-how** to be **adapted and translated** with existing and active organizations;
   - **E**xisting "**partnerships of cities**" **and other institutional partnerships** to be either revived, expanded or installed to comprise also the topic "environment;"
   - Installation of a "**standing working group**" of experts who represent different levels of information and education.

7. With foreseen and unforeseen challenges, the advances that are taking place in **biotechnology, nanotechnology and ICT** are 'electrifying' societies – cutting across cultural, social and economic barriers. As in the statement of the Club of Rome to the World Summit on the Information Society, Geneva 2003, the emerging knowledge society itself adds new challenges: ensuring rights of access to and creation of knowledge; re-defining and protecting the 'commons,' especially related to knowledge and Intellectual Property Rights; assuring privacy; addressing the coherence and simultaneity of the infrastructure developments and the educational processes, and finally caring for stability and security in the transition towards a sustainable world society. The risks are tremendous and the dangers invariably lurk in the horizon; but the opportunities are also there. Both developed and developing countries should work together hand in hand to

achieve what our faiths demand: peace, forgiveness, moderation, and above all *humanitarianism*, for all mankind.

Advanced technologies, especially ICT, have contributed to the creation of the infamous **digital divide**. The info-rich are getting richer and the info-poor are getting poorer. At the same time, and in an unfortunate vicious cycle, it is those that can afford access to technology that tend to benefit, thereby increasing their wealth – not the communities with little or no access to electricity, water or the minimum essentials of life. Around 900 million illiterate people live in developing countries. So long as 2 billion people continue to live on less than 1 USD a day, we cannot claim that our proposed digital earth will indeed be meaningful and useful to everyone. The poor, by definition, have very few resources. First-rate education and health care are vital investments in the assets they do control: their own labour, enterprise and ingenuity.

8. **Millennium Declaration Goals** (From Part V: *Sustaining our Future*). I would like to talk about sustainable rationality. People speak about coping with climate change. The threat of global warming requires reduction in emission as well as for other "greenhouse gases" by 60%. We have to promote energy efficiency and rely on renewable energy sources. In short, the 1997 Kyoto Protocol should be implemented.

9. This is a water-impoverished part of the world. A "**Blue Revolution**" would increase agricultural productivity per unit of water, while improving management of watersheds and flood plains. If we cannot adopt the encyclopedic approach of the Kyoto Protocol, can we not at least discuss a thematic approach? *Limits to Growth* speaks of 40 billion tons of topsoil being blown away each year. When Mrs. Bruntland presented the report on the trees of Amazonia, she omitted sadly, to mention the 40 million indigenous people living under the trees. I personally am

not very keen on one-note summits. I think the time has come to develop a rationale for a new ethic of stewardship.

10. What we are looking at is more like what **Jean Francois Rischard** of the World Bank referred to in the three categories of pressing global challenges he enunciated. They cover a wide range of problems: in Category I, he enumerates problems involving the *global commons* such as global warming; biodiversity; deforestation and water deficits, etc. Category II includes problems requiring a *global commitment* such as the fight against poverty; conflict prevention; combating terrorism; education for all; and global infectious diseases. I would like to suggest that he might have added to Category II, a *global commitment to regional commons*.

11. This is a non region, an orphan region. I am the first Asian President of the Club of Rome. West Asia and South Asia, if I may, are not included as an extension to the borders of the Caucasus. I think South Asia represents less than 1% of world trade. FDI in our part of the world is slumping despite the gas finds in Qatar. In terms of *regional commons*, very little in terms of substance is thought of, in terms of preventive diplomacy or crisis avoidance, with our Euro-Atlantic friends. I say preventive diplomacy, not fighting wars!

12. We all know how wars start, but as I have said many times, we don't know how they end. After the Middle East North Africa Summit, Shimon Peres and I asked the EU in 1994 for 35 million dollars for a decade of infrastructure improvement for 24 countries from Morocco to Turkey inclusive, to encourage the will to stay of those migrants who are giving Europe so much trouble at the present time, and giving us so much grief. 35 million dollars was the same figure assigned in one day by the President of the US on the Homeland Security Bill to create *fortress America*. I believe Europe is now assigning billions of

dollars for the creation of an extension to Shengen – *fortress Europe*. I wonder how we bring those *global commons* together with the *regional commons*, if we do not devise what has been referred to as a 'global humanitarian Versailles.' In social and economic terms, whether it was what was called the Copenhagen Plan of 1993 (referred to as the Copenhagen shopping list), after peace was made between my country and Israel in 1994, the sadness was that the two countries in the context of the Euro-Atlantic world looked to projects - a list of projects to invest in our part of the world - rather than a concept of improving intra-regional cooperation. In the absence of a vision, the inequities of climate change will continue (Vital Signs of the World Watch Institute) to create greater poverty.

Let me cite as one who has in-laws in India, Bangladesh and Pakistan - we know something about the disasters of that part of the world - the rain; the floods in India, Nepal and Bangladesh; the suffering and the droughts - a warming world means rising sea levels. Biologists are recording spring events such as the first flowering of plants and the arrival of migrant birds. I worked with the World Intellectual Property Organisation and I recognise the outflight of over 60 billion dollars annually worth of plants into the pharmaceutical industry.

I believe in a "bottom-up" approach, but bottom-up where the poor are recognised, where the poor are empowered and where the poor get the kickbacks. $1.3 trillion dollars are owned by 300,000 Middle Easterners in the US according to Merrill Lynch. Yet, we complain about poverty and about terrorism. We talk about 'drying the swamps of terror' by dropping bombs. The time has come to talk about drying the swamps of terror by empowering citizens; by building a multilayered civil society. In terms of Gross World Production (GWP), the aggregate estimate of the global output of goods and services increased 2.5% in 2002

to 48 trillion (in 2001 USD). This indicator is not accurate enough to represent economic activity. In the Club of Rome, we believe that growth is not to be equated with equity. The Genuine Progress Indicator (GTI) takes into account traffic, pollution and crime and adds unaccounted benefits such as unpaid childcare and volunteer work. In the US, GWP grew 77% in 1975-2000, compared with a growth of 2% in the same period. The wealth of several countries has declined, even when the GNP has increased once depletion of natural capital has been factored in.

Ecological footprint expresses the carrying capacity per capita of available 'global hectare' for renewable use. The carrying capacity today already exceeds the earth's availability by about 20%. Mankind today, uses 1.2 'earths' to satisfy its 'wants and needs.'

13. **Human health** is increasingly determined by environmental conditions. Poor environmental quality is directly responsible for some 25% of all preventable ill-health, with diarrhoeal diseases and acute respiratory infections. Air pollution is the major contributor to a number of diseases and globally, 7% of all deaths and diseases are due to inadequate or unsafe water, sanitation and hygiene. Approximately 5% are attributable to air pollution.

14. **The Global Marshal Plan Initiative** (GMPI) launched in Vienna in October this year, seeks an international order based on partnership and cooperation. This should lead to an optimal use of human and natural resources to the benefit of all. GMPI offers a viable comprehensive concept for stimulating a worldwide socio-economic development aiming at overcoming poverty. At the same time finite natural resources or our planet force us to follow a path of sustainability by introducing resource-efficient technologies and lifestyles.

15. **Vandana Shiva** established Navdanya in India, a movement for biodiversity conservation and farmers' rights. She talks about the basis of phenomena that we call biopiracy, where seeds such as the Basmati seed, the aromatic rice from India and the Neem tree are treated as inventions by food and chemical companies.

16. **Trans-Mediterranean Renewable Energy Collaboration (TREC)**

    The aims of TREC are climate, energy and water security for the regions of EU-MENA, and accelerated development in MENA region. The TREC team now includes 17 members from Europe (Austria, Belgium, Germany, Spain) and 18 members from MENA (Morocco, Algeria, Libya, Egypt, Jordan, Lebanon, Yemen, Oman and Bahrain). The main goal of the TREC team is to unlock the potentials of solar and wind energy in the MENA region for the growing demand of water and electricity, for development in this region, and for global climate security through export of clean energy to Europe. It is the hope of TREC that the cooperation for renewable energies may become a seed for a community for climate, energy and water security around the Mediterranean Sea.

17. **The Jordan Badia Research and Development Programme** joins both environments (the physical and human) in studies most useful to our region, with a view towards sustainable development. It is no secret that our region has the highest per capita share of arid lands and deserts signifying its water poverty. It is an equally known fact that the region is wealthy in energy sources and has the highest fossil fuel reserves. I feel that a community of water and energy for the region may have similar benefits that the community of steel and coal presented to post-war Europe.

    The Badia Project is an example of what was described in the preamble of the IAS Tunis declaration on Information

Technology for Development in the Islamic World (2000), which stated:

"The teachings of Islam emphasise the importance of the well being of man, and underline the fact that Man's relationship to the universe and to his fellow man must be one of stewardship and complementarity, respectively, and never one of mastery."

18. The **Islamic World Academy of Sciences** is a body that has been working to provide an institutional umbrella for the utilization of Science and Technology for the development of Islamic countries and humanity at large. The IAS programme has been addressing many contemporary issues with a view of not only benefiting the Islamic world but all mankind by means of a well-informed, cooperative, pragmatic and humanitarian approach in scientific and technological development.

Thank you.

Address of Dr Abdel Salam Majali FIAS
President, Islamic World Academy of Sciences (IAS)
Amman, Jordan

بسم الله الرحمن الرحيم

Your Royal Highness Prince Al-Hassan Ibn Talal, Founding Patron of the IAS, and Chairman of the Higher Council of Science and Technology
Excellencies
Distinguished Guests
Ladies and Gentlemen

السلام عليكم ورحمة الله وبركاته

It is a distinct honour for me to be able to pay tribute to His Royal Highness Prince El-Hassan Bin Talal for his patronage of this activity, here, at the Royal Scientific Society, the home of 'upbeat' yet 'downstream' science and technology in Jordan, and the brainchild of HRH, back in 1970. Let me also extend my greetings to you all in this assembly of diplomats, academics, and scientists as we try together to define a scientific outlook concerning important scientific themes that affect our lives… To shed a light on how we can move forward in the realm of science and technology for the benefit of member countries of the Organisation of the Islamic Conference (OIC) and humanity at large.

Our meeting comes at a time of profound global transition, with the world witnessing the unfolding of one dramatic event after

another. It is a rare opportunity for us to evaluate our development efforts and draw a roadmap for the future.

The distinguished participants gathered here represent the local science and academic community as well the OIC diplomatic corps in Jordan. Maybe at some point, we should aim to further engage the representatives of countries with large Muslim communities in our neighborhood such as India and China and Central Asia. That, we are actually doing. We are also carefully nurturing a collaborative effort with the US National Academy of Sciences, and indeed the French Academy of Sciences, both organizations of which have a proven track record of helping out, of caring about Third World problems, and for lending a hand, especially in the area of science education.

I cite this to "break any potential ice," or dispel any uncertainty that might arise in the minds of people about the Islamic world, or Islamic countries, or indeed Muslims. When we say "Islamic world," it is fair to assume that we are referring to that *geographical* area that spans from Indonesia to Morocco, and from Kazakhstan to Uganda. That includes all the races, creeds and religions that live within it and without excluding peoples of other faiths that live, and have lived in that area since the dawn of time, and are part of its social fabric. A closer look at the problems and ills, scientific and otherwise, in Islamic countries reveals that they are trans-religious, and cut across the barriers of religion, language, colour, gender or creed….

The IAS has always urged the political and scientific leaders of the OIC to *integrate not segregate*, …to reach out to their neighbours in friendship and not barricade themselves behind the ugly mask of seclusion.

Your Royal Highness
Excellencies

The IAS is eighteen years old this year. This might still be a little short of full maturity; but it is the exciting beginning of adulthood. It is the

age when attempts are tirelessly made to reach out to new realms of creativity and constructive change.

As its mission statement declares, the purpose of the Islamic World Academy of Sciences is "to provide an institutional set up for the utilisation of Science and Technology for the development of Islamic countries and humanity at large." I would emphasize the word *utilisation*. Since its launch, the IAS has addressed many issues facing the Islamic world, with a view of not only benefiting the Islamic nation, but also of benefiting all humankind by means of a well-informed, co-operative, pragmatic and *humane* approach.

Decision and policy makers have benefited over the years from the Academy's publications of conference proceedings and journals. The IAS has so far discussed – among other topics – energy, nanotechnology, biotechnology, information technology, science education, water in the Islamic world, health and nutrition, the environment, S&T manpower, technology transfer, and S & T policy. In each case, the Academy has been concerned above all with the question of *development* – that is, with the practical measures that can be taken by individuals and organisations within the scientific community to maintain values alongside innovative change, and to establish a culture of scientific education and creativity.

In this context, I would mention our concern of getting the public in all our countries interested in science and scientific activities. This in what we have called our Culture of Science Initiative.

Promoting good scientific communication via the mass media should be a primary objective of all science academies. In communicating their ideas, scientists should explain the basis for their scientific conclusions or opinions, and be party to a dialogue between scientists, the public, and policy-makers. This may take many forms: public policy consultations and review committees, science fairs, and public information services provided by universities and research institutes.

Another standing activity in this context that the IAS is engaged in, lies in promoting the use of Information and Telecommunications Technologies (ICTs), and their primary manifestation; the Internet, to publicize science and scientific activities in the OIC context. This is again an important area that all our academies of science should get into and utilize, to bridge that divide between scientists in the various countries, and indeed between scientists and the public.

Your Royal Highness
Excellencies
Dear Colleagues

Science for sustainable development has become the *buzz word* for scientific organizations, academics, ministries of science and technology, and science academies. The knowledge that science can generate is a prerequisite for a sustainable and bright future. For this, we need research – research that takes a holistic perspective and brings together different disciplines and research communities. The IAS will continue to promote sustainable development policies throughout its catchement area, namely the member countries of the OIC. It will continue to be part of all important research and capacity-building programmes in the Third world. It will continue to work with other academies of sciences on various aspects of sustainable development through cooperative activities.

It is our intention to be a champion for stimulating and engaging the basic sciences in support of sustainable development, especially through capacity-building, knowledge-sharing and promotion of international and regional cooperation. As one of a number of academies promoting interest in basic sciences on a regular basis, the IAS has a unique role to play in this area, not only by identifying and disseminating best practices but also by fostering synergies between modern science and local knowledge systems.

Let me acknowledge, at this juncture, the extensive support and involvement that the IAS has enjoyed in this endeavour from the scientific community represented by many academies of sciences. The Pakistan Academy of Sciences, the Malaysian, Iranian, Kazak, Egyptian, and Moroccan academies have all helped in the implementation of collaborative science programmes of capacity-building nature. These entities have all shared a vision at some point with the IAS, and joined hands with us to implement joint activities.

Indeed, the IAS's aim to increase interaction among scientists from member states of the OIC, and to function as the *Islamic Brain Trust* would not have been addressed without the help and support of these organisations.

Your Royal Highness
Excellencies
Ladies and Gentlemen

A major trend shaping science today is globalisation. There is a growing technology demand from emerging economies. There is increasing world recognition of the interconnectedness of the planet's biophysical systems and improved communications, especially via the Internet. All these forces are boosting cross-border scientific cooperation and information exchange between individual researchers, institutions and governments. Much of the expansion is however occurring outside the boundaries of the countries of the South and the OIC.

We remember how the twentieth century witnessed global war, population explosion, space exploration, unimaginative strides in Information Technology and Biotechnology. We need to ask ourselves, as the representatives of science community in Developing countries, as to whether our contribution to some of these events was of a magnitude that reflects our historical and cultural size or even our wealth of natural God-given resources.

Our countries are still mostly exporters of raw materials, inexpensive agricultural products and low-technology manufactured goods. Sizeable ones amongst us still suffer from adult illiteracy, indebtedness, food insecurity as well as environmental degradation. Our contribution to global wealth is significantly small when compared to industrialized countries.

Your Royal Highness
Excellencies
Distinguished Scientists

The Islamic World Academy of Sciences believes that it is time that we extracted a sound development policy from the mass of information accumulated to our planners, decision-makers and scientists. An S&T template that our decision-makers can study, appreciate, and implement. This development policy should be realistic and implementable. One that could be jump-started in months rather than years. A policy that we can adopt using our own human resources, and one which gives priority to inter-Islamic collaboration without closing the door in the face of help and assistance by industrialized countries.

In this context, it is heartening to observe that a number of OIC countries such as Pakistan, Jordan, Egypt, Tunisia, the Emirates,… are reacting promptly to the ICT revolution, and making up for lost development opportunities of the past, however much more on the collective level needs to be done.

Academies of sciences realize that they have a serious role to play in raising the awareness of the decision-maker and the public, and in helping people understand the importance of development and scientific advancement, and indeed helping in achieving socio-economic progress.

The IAS prides itself on being ever conscious of the problems of the Islamic world, on attempting to provide remedies to our countries

problems in science and technology, and would through this distinguished forum propose the following broad development goals for the consideration of the S&T community especially in developing countries:

- Development and the release of dormant human potential;
- Attainment of Food and Water Security at the national and regional levels;
- Development of selected medium to high technology export-oriented industries;
- Halting environmental degradation;
- Health and Nutrition for all;
- Eradication of adult alphabetical and numeral illiteracy;
- Bridging national and international digital divides.

A further broad objective that our science community needs to be involved in, one that really falls beyond being a straightforward development goal is the need of our scientists and technologists, to work hard at projecting the true image of our Islamic faith, to counter balance the gross distortions that have become part of Western mentality towards Islam, especially after the events of 9/11.

Your Royal Highness
Excellencies

Academies of sciences have an important role to play to help speed up development in their catchement areas. Their role can be a multifaceted and a multi-layered one; from capacity building to acting as decision analysis incubators,…. Their role must not be underestimated.

For academies of sciences to flourish, they need full independence and long-term financial security, and the status that they deserve. Only through making available such conditions would academies of

sciences fully realise their potential as think tanks or brain reservoirs of their respective communities.

To our friends from the diplomatic corps present here, I request you to convey to your governments the willingness of the IAS to help out, to fully act as their science advisor in whatever S&T obstacles they face, to bring in specialists where necessary, and steer through focussed S&T programmes.

Through them I also appeal for help, both moral and material. Support for the IAS will enable it to implement more activities and will ultimately positively affect the science community in all our countries. We all really need to do a lot to speed up socio-economic development through the sure means of science and technology.

Dare I say that in Jordan, the Islamic World Academy of Sciences has enjoyed unprecedented support and total freedom to operate and implement activities that fall within its mandate. Jordan has truly been an ideal base from which we have reached out, often at times of political uncertainty, to our counterparts all over the world, without undue hindrance. For that, we are ever so grateful to our host country, the Hashemite Kingdom of Jordan.

Thank you.

Address of Dr Khaled Shuraydeh, Secretary General, Jordan Higher Council of Science and Technology, President of INWRDAM

بسم الله الرحمن الرحيم

والصلاة والسلام على سيدنا محمد وعلى صحبه أجمعين

Your Royal Highness Prince Al-Hassan Ibn Talal
Excellencies, Ambassadors of OIC Member Countries
Ladies and Gentlemen

It is a great pleasure and an honor for me to welcome you all to this seminar in which programs and activities of the Inter-Islamic Network on Water Resources Development and Management, and of the Islamic World Academy of Sciences will be presented.

I would like to seize this opportunity to brief you about the Inter-Islamic Network on Water Resources Development and Management (INWRDAM), since Dr Murad Bino, the executive director of this Network, will present to you in more detail its programs and activities.

INWRDAM is one of the six Inter-Islamic Networks established by the OIC Standing Committee on Science and Technology Cooperation (COMSTECH) based on the resolution of the Fifth Islamic Summit, which was held in Kuwait in December 1986. His Royal Highness Prince Al-Hassan Bin Talal subsequently hosted the founding meeting of INWRDAM that was attended by representatives from eight OIC member countries namely; Turkey, Egypt, Tunisia, Mali, Niger, Pakistan, Bangladesh, and Jordan. The outcome of that meeting was the recommendation to COMSTECH to establish

INWRDAM in order to employ science and technology for water resources development and management, and to serve the *Ummah* on the basis of collective self-reliance, and as such the request made by the Government of Jordan to COMSTECH for hosting INWRDAM headquarters in Amman was honored. Since 1992 the Higher Council for Science and Technology has been the host organization of this Network in Jordan. The Network has grown from eight founding members in 1987 to fifteen OIC member countries in 1994 when Lebanon, Iraq, Malaysia, Oman, Syria, Sudan, and Yemen joined to share their experiences on water resources management with other OIC member countries.

INWRDAM is governed by a body composed of high level officials from all its member countries and representatives from COMSTECH and OIC Secretariat.

Your Royal Highness
Excellencies

The mission of INWRDAM is to foster closer cooperation among the countries of the *Ummah* in the field of development and management of water resources. In pursuit of this mission, it seeks to generate ideas and policy directions through intensive dialogue, studies and research on a continuous basis.

The primary objective of INWRDAM is to assist member countries in building up their national capabilities in the field of integrated water resources development and management, exchange knowledge and information, share experiences and maintain continuous dialogue relating to water resources development and management in the *Ummah* countries, initiate demand-driven and need-based joint Research and Development (R&D) projects, help its member countries in the training of quality manpower, and render consultancy and advisory services for water resources development and management.

The benefits to the Network member countries include:

- Participation of their scientists and officials in workshops and seminars organized and financed by the Network;
- Use of the Network expertise in studying local problems related to water resources;
- Sharing of information on efficient use of water;
- Expert advice on wastewater and grey-water treatment and reuse, and water management techniques; and
- Scholarships (on competitive basis) to young scientists for carrying out research.

Your Royal Highness
Excellencies

The aspirations of INWRDAM are:

- To expand the Network to include all OIC member countries;
- To be the representative organization of the *Ummah* in the global arena, and make meaningful contributions in all important regional and global deliberations on water resources development and management;
- To establish and maintain an effective network of communication among the *Ummah* countries for dissemination and sharing of knowledge on water management between individuals, institutions, agencies and societies at all levels;
- To help further advance the process of collaboration among the *Ummah* countries in order to put agreed upon water management principles, based on the guidelines established by the *Qur'an* and *Sunnah*, into action with partnerships and synergies among the government, citizens and other stakeholders; and
- To work closely with multilateral institutions, particularly the UN system, to strengthen water-related policies and programs

that enhance water security, and to assist member countries, to the extent possible, to address the major challenges in the water sector.

Your Royal Highness

On behalf of the Governing Body of INWRDAM, I wish to extend to Your Royal Highness our utmost appreciation and respect for your continuous guidance and support of this Network, and look forward today to hearing your invaluable foresight and directives for INWRDAM, and the crucial role it should continue to play for the *Ummah*.

In concluding, I would like to thank our distinguished guests for joining us in this seminar.

والسلام عليكم ورحمة الله وبركاته.

Address of Dr Murad Bino, Executive Director, Inter-Islamic Network on Water Resources Development and Management (INWRDAM)

بسم الله الرحمن الرحيم

والصلاة والسلام على سيدنا محمد وعلى صحبه اجمعين

Your Royal Highness Prince El-Hassan Ibn Talal
Excellencies, Ambassadors of OIC Member Countries
Distinguished Guests
Colleagues
Ladies and Gentlemen

It is great pleasure and honour for me to welcome you all to this seminar and to seize this opportunity to brief you about Inter-Islamic Network on Water Resources Development and Management (INWRDAM).

The Inter-Islamic Network on Water Resources Development and Management (INWRDAM) was established by the Organization of the Islamic Conference Standing Committee on Scientific and Technological Cooperation (COMSTECH) in 1987 and since then it has grown from eight founding member countries to fifteen OIC member countries. INWRDAM member states at present are the following 15 OIC countries: Bangladesh, Egypt, Iraq, Jordan, Lebanon, Malaysia, Mali, Niger, Oman, Pakistan, Sudan, Syria, Tunisia, Turkey and Yemen. The host organization of INWRDAM in Jordan since 1992 has been the Higher Council for Science and Technology. Our headquarters is located on the Royal Scientific Society campus.

INWRDAM has a Governing Body (Board) which is composed of high officials from all its member countries and the representatives of COMSTECH and OIC Secretariats. More Muslim countries are interested in joining this Network and sharing their experiences on water resources management.

Your Royal Highness
Excellencies

The mission of INWRDAM is to foster closer cooperation among the countries of the *Ummah* in the field of development and management of water resources. In pursuit of this mission, it seeks to generate ideas and policy directions through intensive dialogue, studies and research on a continuous basis.

The primary objectives of INWRDAM are to collaborate and cooperate with a view to help each other in building up the national capability of its member states in the field of integrated water resources development and management (IWRM) for overall economic development; to exchange knowledge and information, share experiences and maintain continuing dialogue related to water resources development and management in the *Ummah* countries; and to initiate demand driven and need based joint projects of research and development (R&D) and help its member states in the training of quality manpower and render consultancy and advisory services for water resources development and management.

Your Royal Highness
Excellencies

The vision of INWRDAM is:

a) To have all the OIC countries as members in the Network;
b) To make its mark in the global arena as the representative organization of the *Ummah* and make meaningful

contributions in all important regional and global deliberations on water resources development and management;

c) To establish and maintain an effective network of communication amongst the *Ummah* countries for dissemination and sharing of knowledge on water management between individuals, institutions, agencies and societies at all appropriate levels;

d) To help further advance the process of collaboration among the *Ummah* countries in order to translate agreed water management principles into action, based on the guidelines established by the *Qur'an* and *Sunnah* with partnerships and synergies among the government, citizens and other stakeholders; and

e) To work closely with the multilateral institutions, particularly the UN system to strengthen water-related policies and programs that enhance water security and to assist member countries, to the extent possible, to address the major challenges in the water sector.

When an OIC country becomes a Network member it gains many benefits some of which are:

- Participation of its scientists and officials in workshops and seminars organized and financed by INWRDAM;
- Use of INWRDAM expertise in the study of local problems related to water resources;
- Sharing of information on efficient use of water;
- Expert advice on wastewater and greywater treatment and reuse and water management techniques.
- Scholarships (competitive basis) to young scientists for carrying out research.

Your Royal Highness
Excellencies

INWRDAM has realized the need for developing new technologies, in particular for water scarce OIC countries that could help the urban poor in terms of sustainable access to water. In 2000, INWRDAM was able to obtain funding from the International Development Research Centre (IDRC), Ottawa, Canada, to develop low cost treatment methods for greywater reuse in home gardens of peri-urban poor. A project was implemented in the town of Ein Al Baida, Tafila Governorate in southern Jordan. Three years of concerted efforts resulted in development and testing of on-site greywater treatment modules that proved to be efficient, reliable and cost effective.

Greywater results from use of domestic water for washing, shower, laundry, but does not include toilet waste (black water). It was found that a representative family in rural areas of Jordan consists of 6 persons and consumes about 85 litres per person per day. More than sixty percent of all wastewater can be recovered as greywater and this means that about 300 liters per day of treated greywater can be recovered and used for irrigating trees and forage and other plants grown in the home garden. INWRDAM optimised designs of two modules for greywater treatment, one module composed of four plastic barrels suitable for average small households of 6 members and another module composed of plastic barrels and confined trench for households of ten members. The average cost of the four barrel unit and the confined trench including drip irrigation for 2000m2 is US$350 and US$500, respectively. Post project evaluation by a Canadian independent evaluator showed that use of greywater treated by these units could generate additional income in the range of US$15 to US$45 per month. This income is due to saving cost of fresh water, regular emptying of septic cesspits and higher productivity of the home garden. Many indirect benefits of

reuse of greywater lie in saving the environment, reduction of poverty and saving precious fresh water.

This has resulted in dissemination of low cost greywater treatment technology developed by INWRDAM in Jordan and in some neighbouring countries. The Ministry of Planning of Jordan requested INWRDAM during 2003 to install greywater units for 700 homes in 91 villages across Jordan. In conducting this project INWRDAM trained trainers in many communities and trained local technicians thus creating a basis for dissemination of this low cost technology across Jordan. Many international organizations operating in Jordan adopted these modules and now more than 1000 households in Jordan are using these greywater treatment units.

On the regional scale many activities are going on where INWRDAM provides technical know how and expertise on wastewater treatment and reuse and community development. A project with financial support form IDRC was started in May 2002 in the West Bekaa area of Lebanon, to serve a cluster of towns including Rashaya, Kawkaba, Majdal Balhis, Daher Alahmar, Libayya and Kfar Mecchki. INWRDAM provides technical assistance and designs of greywater treatment modules for this project. Technical cooperation is also going on between INWRDAM and the Palestinian Agriculture Relief Committee (PARC) on the same subject. Syria is also interested in greywater reuse and a project could be started in near future.

At present INWRDAM is implementing a second phase of IDRC supported greywater project to serve 300 households in towns of Al-Amer in Karak Governorate in Jordan. This project will serve single households in large communities with greywater units and will train households, in particular women, on best practices for water conservation and for sustainable agriculture at the households' level. The Ministry of Water and Irrigation and the Ministry of Social Development in Jordan are the main key stakeholders in this project.

INWRDAM is working on a program to support a joint research to develop greywater treatment units that suit high-income users in cities and towns in the Middle East. This project will be implemented jointly by INWRDAM and the RSS. It is hoped that during 2005-2006 a model unit will be deigned, tested and commercialised.

INWRDAM is a regional partner of the Euro-Mediterranean Participatory Water Resources Scenarios (EMPOWERS) project (2003-2007), which is a regional partnership that aims at improving long-term access to water by vulnerable populations through integrated water resources development and management at the local level, with special emphasis on stakeholder involvement and empowerment. INWRDAM is responsible for the regional aspect of this project that deals with information and regional outreach components of EMPOWERS. The more long-tem and institutional sustainability perspective is that EMPOWERS will contribute to the establishment in INWRDAM of a "Documentation and Reference Centre for Publications on Public Participation in Local Water Resource Management."

In 2004 INWRDAM in cooperation with the International Foundation for Sciences (IFS) an international NGO in Stockholm, Sweden, and COMSETCH, established a special ten years funding program starting at US$100,000 per year and increasing by 10% every year to support young researchers in OIC countries to conduct research at home institutions on different aspects of water resources. During November 2004 the program granted six researchers with financial assistance. This program will also conduct a workshop in Amman during April 2005 to inform researchers at selected universities in Jordan, Egypt, Turkey, Syria, Lebanon and Tunisia on how to help MS and PhD student apply for grants from this program. Similar workshops will be conducted to inform universities in other OIC countries about this program.

INWRDAM is active member in many international organizations dealing with water issues. The World Water Council, the Global Water Partnership and World Water Forum are some of the organizations that we work with. Many MOUs are signed between INWRDAM and many local and international institutions. In Jordan, MOUs were signed with RSS, NCARTT, Al Al-Bayit University, ICARDA, ACSAD, Diplomatic Institute, CARDNE and CARE International. Joining hands with others is a tool for INWRDAM to achieve its goals.

The Islamic Development Bank, Jeddah, Saudi Arabia, provides financial support for INWRDAM capacity building programs on yearly basis. This cooperation is continuing and expanding since 1995. Many international organizations such as ESCWA, WHO, International Water and Sanitation Centre (IRC) and CARE International provide experts to our capacity building activities.

INWRDAM publishes many proceedings and books related to water issues and in particular water management in Islam. The book on "Water Management in Islam" published in three official OIC languages, Arabic, English and French was published in New York, Beirut and Paris is just an example. Also our home page on the Internet (www.inwrdam.org) is hosted by IRC server and gives more details about our work.

Your Royal Highness

The Governing Body of INWRDAM conveys to Your Royal Highness its regards and appreciates and highly values the guidance and support that you give to INWRDAM.

والسلام عليكم ورحمة الله وبركاته.

Lobbying for S&T in Decision-making Circles: The Islamic World Academy of Sciences as an example

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1 ABSTRACT

This overview paper addresses policy and decision-makers/ politicians rather than scientists. As such, it highlights some of the major challenges that will be witnessed by humanity in the Twenty-First Century. It projects science as a tool for advancement, and promotes the Millennium Development Goals (MDG) and Vision 1441 as potential development 'yardsticks' that politicians can readily relate to when formulating/evaluating development policies.

The possible role that is/ could be played by academies of sciences, and the Islamic World Academy of Sciences in particular, in realizing socioeconomic advancement through scientific and technological means, in their respective catchment areas, is also outlined.

2 NORTH-SOUTH DIVIDE

2.1 A Timeline

Divides between countries, regions, and civilisations have existed since the dawn of time. Socio-economic or development divides have too always existed between countries and regions for just as long.

2000 years ago, the world was divided up into empires; the Persian and Roman empires, to the east there was China.

Islam was founded in Mecca around 610 AD. Within 150 years, the new Islamic state stretched from the Himalayas in the East to the Pyrenees in Europe. The Islamic civilisation bloomed between 750 and 1258 AD, in terms of science and technology output among other feats, with a South-North divide in terms of scientific advancement appearing between the Islamic state and the rest of the then world, especially Europe. The flow of knowledge and science through Muslim Spain to Europe (i.e. South-North) contributed to the renaissance in Europe that started around 1500.

That turning point marked the start of the slow decline of scientific enterprise in the South.

200 years ago, the industrial revolution was underway in Europe, and yet another phase in the progress of science and technology in the world. The twentieth century was marked by three world wars: the First World War (1914-1918); the Second World War (1939- 1945); and the Third World War … the Cold War (1945? -1990). The first two wars saw the defeat of a Western power, namely Germany, at the hands of a diverse alliance of powers, whilst the third saw the defeat of the Eastern Block at the hands of America and Europe (Figure 1).

Figure 1. A Proposed S&T 'Divide' Timeline.

2.2 The contemporary divide

The First World is made up mostly of the English-speaking world and Europe. Apart from Australia, most of the countries that belong to the economic or industrialised North actually lie north of the equator **[1]**.

The South is made up of the countries of South America, Africa, Middle East, South and South East Asia including China and India (Figure 2). Needless to say that most of the 57 Organisation of the Islamic Conference (OIC) Countries lie in the South.

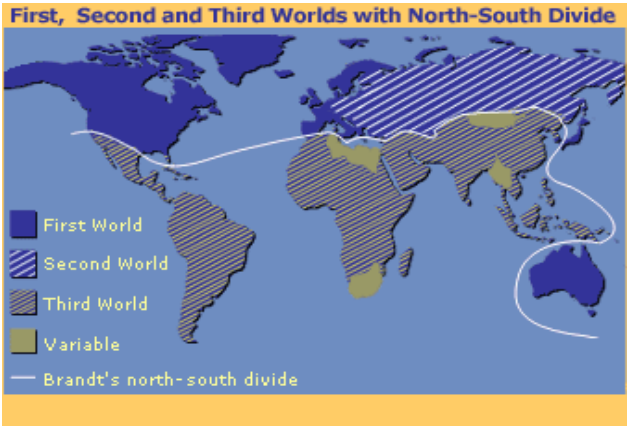

Figure 2. Brandt's North-South Divide [1].

3 THE INTERNATIONAL S&T SYSTEM

3.1 Some of the landmarks/players

After the end of World War II, policy-makers in Europe and the US realised that science and technology (S&T) programmes had had a profound impact on the outcome of the War, and wanted to put such benefits to civilian/societal benefit, as well as to stay ahead in the 20th Century's Third World War; The Cold War.The end of World War II

also witnessed the birth of a number of international organisations that were founded to help humanity get back on its feet again after the global war which left Europe almost completely destroyed, many countries bankrupt, and most of the countries of the South eager to gain political independence.

Apart from the United Nations and its various off-shoot organisation, a number of regional political groupings were founded, and for a variety of reasons. The Organisation of the Islamic Conference (OIC), grouping 57 countries of the South at present was, for example, launched in 1969 **[2]** after the infamous arson attack at the *Aqsa* Mosque in Jerusalem.

Some of the players that were/are part of the international S&T system are:

1964: International Centre for Theoretical Nuclear Physics (ICTP), Trieste, Italy;
1981: Organisation of the Islamic Conference Committee on Scientific and Technological Co-operation (COMSTECH), Pakistan;
1983: Third World Academy of Sciences (TWAS);
1986: Islamic World Academy of Sciences (IAS), Amman, Jordan;

3.2 Other international stakeholders

The United Nations, which was created in 1945, developed into an elaborate set-up over the years, with science and technology forming part of the mandate of almost every UN body. Whether UNESCO, UNDP, FAO, WHO, collaborative programmes in science and technology by such UN agencies formed a sizeable portion of international activities in S&T.

3.3 Academies of sciences

Academies of sciences play a vital role as science advisors of the political leaderships of their 'catchment areas,' in both developed and developing countries.

Worldwide, there exists around 90 national, regional and international academies of sciences according to the InterAcademy Panel (IAP) **[3]**.

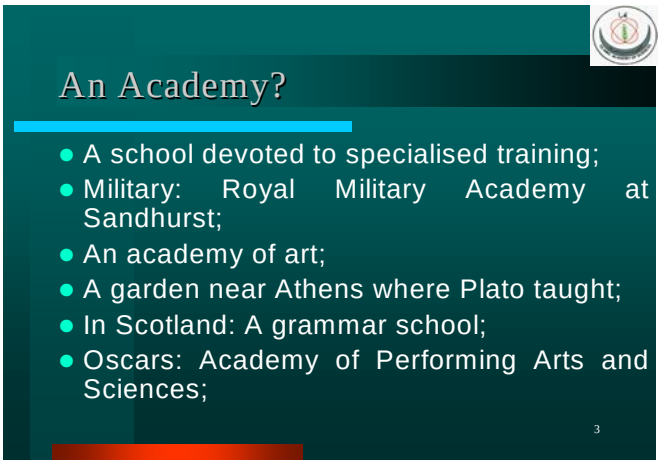

Figure 3. What is an Academy?

However, despite the existence of many academies of sciences in the Islamic world, the understanding of the term 'academy of sciences' is still lacking. People's reaction is often nonchalant when the explanation is given that an academy of sciences is a Science *Policy Research Centre* or *Think Tank* where science and scientific issues are debated and studied. Put simply, an academy of sciences is the science advisor of the leadership in the catchment area in which it operates. See Figure 3 above.

Academies of sciences are mostly national non-governmental agencies the aim of which is to provide advise to governments on science and technology matters.

The Islamic World Academy of Sciences (IAS) came into being in 1986. The Summit Conference of the Organisation of the Islamic Conference (OIC), which was held in Casablanca in 1984 approved the founding of the Academy, and mandated it as the *Think Tank* of OIC-member countries.

3.4 Why sciences?

Science remains as the most successful means of knowledge creation **[4]**. The value of science and science capacity as a means to achieve socio-economic development and attain economic might has been proven beyond doubt, especially since the end of World War II. The rise of the economic power of the United States, Germany, Japan, and other OECD countries can be inextricably linked to S&T advancement.

Moreover, the rise of the Pacific Rim Tigers can also be attributed to scientific and technological advancement. Having said that, it is probably worthwhile to highlight some pointers as to how advancement in S&T in such instances has been achieved. In other words, the success of such countries may be credited to there:

- Will to advance;
- Education, education and education* **[5]**;
- Building up their capacity including S&T capacity;
- Implementation of sound S&T policies;
- Increased funding;
- Increased regional, North-South, South-South co-operation…

Needless to say that science and scientific activities are probably the only sure means through which humanity can overcome its twenty first century challenges.

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* As stated by British Prime Minister Tony Blair in an British national elections campaign speech (1997).

4 MAIN GLOBAL CHALLENGES AT THE TURN OF THE MILLENNIUM

4.1 What are the challenges?

The world, shaped as it is today by the progress in science and technology, is marked by the emergence of new, increasingly complex societal forms: a networked, self-managing society. This growing complexity is also a feature of the developing regions, where a series of problems have become increasingly acute: poverty, lack of access to drinking water, to health care and to education, pollution, deforestation, desertification, exploitation of children, migration, armed conflict, illiteracy, isolation, marginalization and North-South disequilibria in the use of science and technological know-how; are all factors of instability that threaten the world.

The Twenty First Century will see problems of a magnitude not experienced by humankind in the past. Population growth is the main driver. Population growth invariably leads to food and water insecurity, uncertain energy outlook, the spread of HIV/AIDS, as well as environmental degradation. Outlined below are some of the major challenges that will face our world in the twenty-first century, including off-course OIC-member countries.

4.2 World population

According to the Population Reference Bureau **[6]**, world population stands at over 6.134 billion at present (May 2004) **[7]**, with Asia's share mounting to 57% (Figure 4).

Population factors have an impact on many facets of life. The need for health care preoccupies the political leaders of the North whose populations are "aging," while the need for classrooms, employment opportunities, and housing, preoccupies the leaders of the countries of the South. The high-fertility countries in the Middle East and

Africa with large proportions of young adults and children are examples. Populations of the North are relatively old.

A population's age structure affects how that population lives. Developing countries (of the South) have relatively young populations while most developed countries have old or "aging" populations. In many developing countries, 40 percent or more of the population is under age 15, while 4 percent is 65 or older. In all but a few developed countries, on the other hand, less than 25 percent of the population is under the age of 15 and more than 10 percent is 65 or older.

Countries of the South can implement joint programmes to gradually limit the high rate of population increase in their countries. As many developing nations share the same religious and cultural heritage with their neighbours, they may be able to learn from each other's experiences in limiting population increase, as that is normally a factor adversely affecting economic growth.

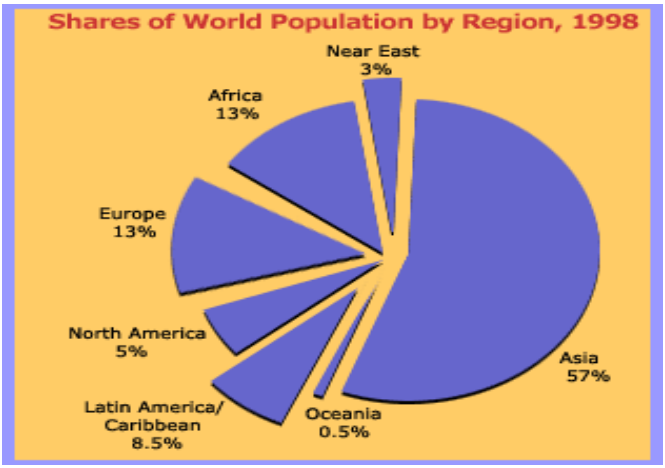

Figure 4. World Population, 1998.

The population of OIC-member countries is over 1300 million. Populous OIC-member countries in Asia include: Indonesia,

Bangladesh, Pakistan, Iran and Turkey. In Africa OIC countries include Nigeria, Egypt, Morocco, Sudan and Algeria…

4.3 Food insecurity

Worldwide, the UN Food and Agriculture Organization (FAO) estimates that 842 million people were undernourished in 1999-2001. This includes 10 million in industrialized countries, 34 million in countries in transition and 798 million in developing countries.

According to the FAO's annual report *The State of Food Insecurity in the World 2003 (SOFI 2003)* **[8]**, hunger is on the rise again after falling steadily during the first half of the 1990s. FAO's latest estimates signal a setback in the war against hunger.

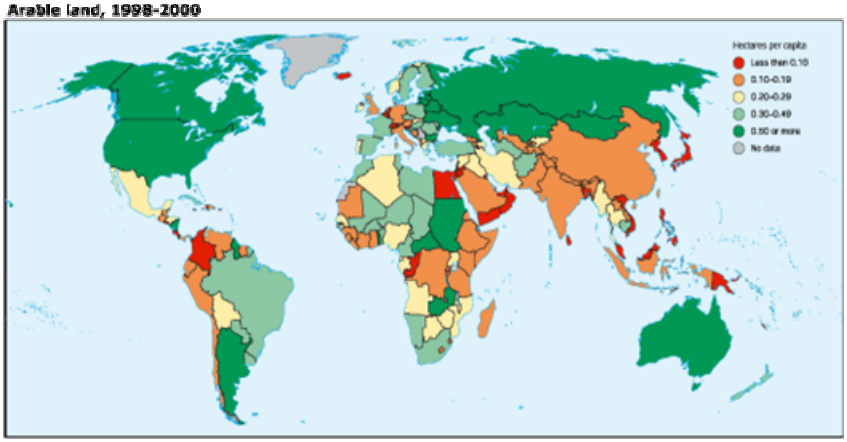

Figure 5. Arable Land, 1998-2000.

Figure 5 shows Arable Land ratios worldwide. It can be noted that in a number of OIC countries including Egypt, Jordan, PNA, Yemen, Oman and Malaysia…… the situation is critical

Given the rate at which hunger has declined since 1990 on average, the World Food Summit goal of reducing the number of undernourished people by half by 2015 cannot be reached. The goal

can, according to the FAO, only be reached if the recent trend of increasing numbers is reversed.

Only 19 countries, including China, succeeded in reducing the number of undernourished throughout the 1990s, says the report. Twenty-two countries, including Bangladesh and Mozambique, succeeded in turning the tide against hunger. In 17 other countries; among them India, Indonesia, Nigeria, Pakistan and Sudan however; the number of undernourished people, which had been falling, began to rise.

4.4 Water scarcity

Many parts of the world suffer from water scarcity. This is not only due to the low rates of precipitation they receive, but also due to the increase in demand on water resources for domestic, agricultural and industrial uses. Central and northern China, northwest and southern India, parts of Pakistan, North Africa, the Middle East and the Arabian Peninsula as well as the Gulf states, are areas with serious water deficits.

Oil rich countries in the Middle East have adopted water desalination as the main means of supplementing their fresh water budgets, while other Middle Eastern countries such as Jordan, with no oil resources, are struggling to make ends meet. Jordan is one of the world's ten most poor in water resources.

Population growth, pollution and climate change, all accelerating, are likely to combine to produce a drastic decline in water supply in the coming decades, according to the World Water Development Report published in late 2003 **[9]**.

Faced with "inertia at the leadership level and a world population not fully aware of the scale of the problem," the global water crisis will reach unprecedented heights in the years ahead, the report says, with growing per capita scarcity in many parts of the developing world. And that means hunger, disease and death.

A big difficulty with water is that, at least in the rich North, it is largely taken for granted. After all, it is the most widely occurring substance, whilst in the arid and semi-arid countries of the South, it is a matter of critical importance.

Regional co-operation in water matters is imperative if countries were to try to achieve some level of water security **[10]**.

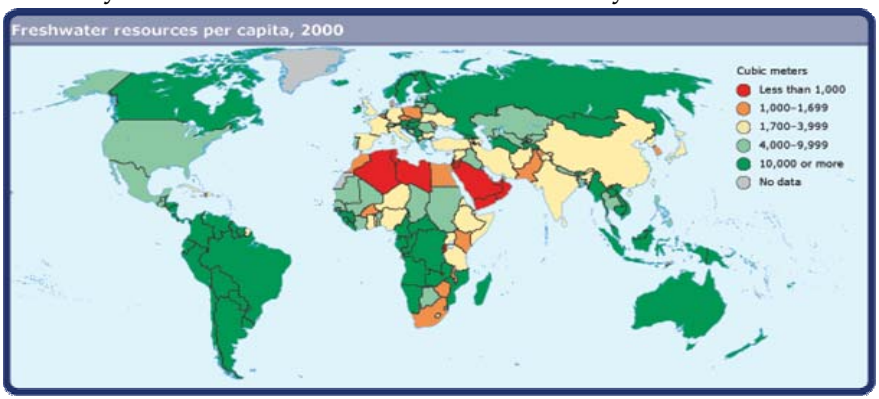

Figure 6. Freshwater resources per capita, 2000.

Figure 6 shows the freshwater resources map of the world in 2000. It shows how critical the water resources problem is in most Arab and many OIC countries… Only Indonesia and Malaysia (OIC countries) are *in the green* in terms of water resources

4.5 Energy

According to the *IEO2004* **[11]** mid-term outlook, energy demand in the emerging economies of Asia (South), which include China and India, is projected to more than double over the next twenty-five years. In the developing world as a whole, primary energy consumption is projected to grow at an average annual rate of 2.7 percent between 2001 and 2025.

Oil is expected to remain the dominant energy fuel throughout the forecast period, with its share of total world energy consumption

remaining unchanged at around 40 percent through 2025. The *IEO2004* projects declining oil use for electricity generation, with other fuels (especially natural gas) expected to provide more favourable alternatives to oil-fired generation.

In the countries of the South, oil consumption is projected to increase for all end uses. In some countries where non-marketed fuels have been widely used in the past, diesel generators are now being used to dissuade rural populations from decimating surrounding forests and vegetation - most notably, in Sub-Saharan Africa, Central and South America, and Southeast Asia **[12]**. Because the infrastructure necessary to expand natural gas use has not been as widely established in the developing world as it has in the industrialized world, natural gas use is not expected to grow enough in the developing world to accommodate all of the increased demand for energy.

Electricity generation is expected to nearly double between 2001 and 2025. Strongest growth is projected for the countries of the developing world, where net electricity consumption rises by 3.5 percent per year in the *IEO2004* reference case, compared with a projected average increase of 2.3 percent per year worldwide. Robust economic growth in many of the developing nations is expected to boost demand for electricity.

4.6 Health and HIV/AIDS

The most important message of the latest World Health Report **[13]** is that, the international community today has the chance to change the history of health for future generations and open the door to better health for all. Unknown barely a quarter of a century ago, HIV/AIDS is now the leading cause of death for young adults worldwide. More than 20 million people have died from it and an estimated 40 million others are now infected with the virus. There is as yet no vaccine and no cure. The World Health Report 2004 - Changing History,

published by the WHO, calls for a comprehensive HIV/AIDS strategy that links prevention, treatment, care and long-term support. Until now, treatment has been the most neglected element in most developing countries: almost 6 million people in these countries will die in the near future if they do not receive treatment – but only about 400,000 of them were receiving it in 2003.

WHO and its partners have launched a drive to provide 3 million people in developing countries with antiretroviral therapy by the end of 2005 – one of the most ambitious public health projects ever conceived. Looking beyond 2005, how can international organizations, national governments, the private sector, and communities join efforts and simultaneously fortify health systems for the enduring benefit of all?

For understandable reasons the majority of OIC countries are in the green when it comes to AIDS…. That is at the moment (Figure 7).

5 MILLENNIUM DEVELOPMENT GOALS (MDGs)

5.1 The need for policies and actionable plans

Decision-makers in the North as well as the South are aware of the various global problems that face humanity, as partly outlined above. However, difficulties arise when policies need to be formulated and actionable programmes instituted to steer the countries in these domains.

The Millennium Development Goals may be considered as potential development 'yardsticks' that politicians can readily relate to when formulating/evaluating development policies.

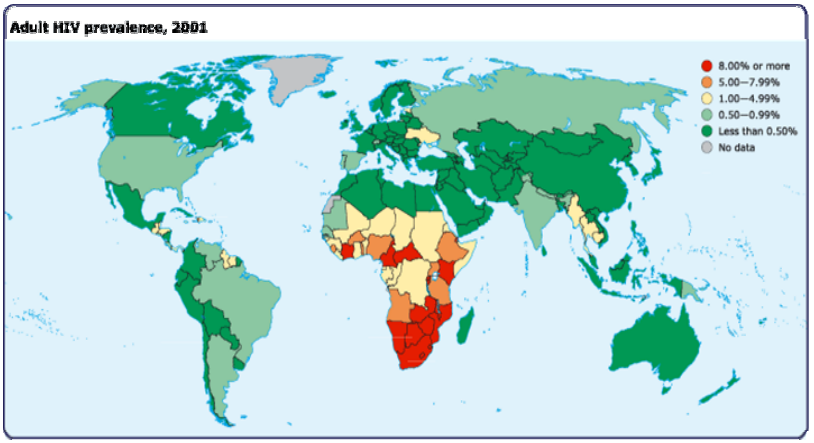

Figure 7. Adult HIV prevalence, 2001.

5.2 The MDGs as a benchmark for development effectiveness

The MDGs are set of 8 goals, 18 targets, and 48 performance indicators relating to poverty reduction, including income and non-income measures of well-being **[14]**.

The themes and issues embedded in the MDGs such as gender and environmental sustainability are well known to the international development community. The first of the MDGs, poverty reduction, has been the overarching objective for international organisations such as the World Bank since 1990. The focus on education and health has been a main tenet of the approach adopted by development agencies since the 1970s.

5.3 Significance of the MDGs

The newness of the MDGs lies in three main dimensions:

(a) By incorporating quantitative and time-bound targets, the MDGs demand specificity in development actions and emphasize systematic measurement;

(b) By defining the goals in terms of outcomes - as distinct from inputs and outputs - the MDGs draw attention to the multi-sectoral determinants of outcomes; and
(c) By including Goal 8, which aims at developing a global partnership for development, the MDGs emphasize the role of both developed *and* developing countries.

These new elements may warrant changes in some practices and programs adopted by countries.

The MDGs serve as a visionary challenge to help galvanize new energies and resources for the development agenda, with a focus on outcomes. Since it is clear that many countries and regions will not achieve the MDGs by 2015, the risk of disappointment and cynicism must be mitigated. And there are other challenges: customizing the MDGs to local conditions, harnessing contributions from sectors without explicit MDG goals or targets, focusing on outcomes among poor countries and population groups rather than on average outcomes, and addressing incentives for both achieving and monitoring *outcomes*.

MDGs manifest a commitment by countries - rich and poor - or - North and South - to doing all they can to eradicate poverty, promote human dignity and equality and achieve peace, democracy, and environmental sustainability. In other words, they represent the marriage of *POLITICS and POLICIES!*

6 OIC-COUNTRIES OWN SCIENTIFIC DEVELOPMENT GOALS: VISION 1441

In October 2003, the Government of Malaysia as Chair of the Organisation of the Islamic Conference (OIC) hosted the 10th OIC Summit in Putrajaya, Malaysia. The Summit was preceded by the OIC *Conference on Science and Technology for Industrial Development in*

Islamic Countries: Facing the Challenges of Globalisation, which declared Vision 1441 and its objectives as the guiding principles in steering OIC-member countries' S&T efforts for the next two decades.

Vision 1441 (1441 is the Hijri year corresponding to the year 2020) encompasses three key S&T objectives (measurable targets) that OIC-member countries must try to achieve by that year, in their quest to realise socio-economic development. They are:

- To achieve 14 percent of the world's scientific output by the year 1441 H;
- To achieve the ratio of 1441 RSEs (researchers, scientists and engineers) per million population by 1441 H;
- To achieve investment in R&D of at least 1.4 percent of GDP.

> ***Vision 1441***
>
> *OIC member states are committed to become a community that values knowledge and is competent in utilising and advancing S&T to enhance the socio-economic well being of the Ummah.*

Vision 1441 was then adopted by the 10th OIC Summit. Subsequent to that, a Task Force on Vision 1441 was formed by OIC Secretariat, in which the IAS is member.

The Islamic World Academy of Sciences is committed to promoting Vision 1441, and contributing to the national strategies that may be derived therefrom. Funding agencies, including the Islamic Development Bank, have expressed readiness to fund projects submitted by OIC-countries that are based on Vision 1441.

7 OIC-COUNTRIES: PLAIN TRUTHS AND DIFFICULT CHOICES

7.1 OIC Countries difficulties in brief

In most Organisation of the Islamic Conference (OIC) Countries, expenditure on science R&D is low: estimated at less than 0.2%, in marked contrast to that in many European countries **[15]**. This low level of investment has also been highlighted in the first Arab Human Development Report published by the United Nations Development Program in 2002 **[16]**. The Report also reiterates that Internet penetration rates are also low, estimated at 0.6% **[17]**. Flowing from this low investment level, the science output is similarly very low. From the 57 countries of the OIC, accounting for a population of more than 1.3 billion, only about 2% of the world's science citations originate from these countries and only about 1% of mainstream journal articles. Other statistics reinforce this analysis, with approx 226 scientists/engineers per million population, in stark contrast to the approximately 7000/million population in Japan, for example.

In terms of university education, there are 550 universities in the 57 OIC-Member Countries, most of which are of low standard. This contrasts with the over 1000 universities in Japan. The science and technology budgets of all the 550 universities together amounts to only half of that of the National University of Singapore.

Moreover, according to the 2004 study of the Institute of Higher Education, Shanghai Jiao Tong University, China **[18]**, no university from any OIC country was ranked amongst the world's top 500 universities.

The GDP statistics are equally sobering. The total GDP of 57 Islamic countries is less than half that of Germany and less than a quarter that of Japan.

7.2 The First Bottom Line: Global challenges are OIC challenges

Notwithstanding some success stories … with a population of around 1.3 billion inhabitants, Organisation of the Islamic Conference (OIC) countries face an unprecedented socio-economic development challenge. It is imperative for the science community in these countries to reach out and convince the political leaderships, as well as the public at large, of the value of science as one sure means to realise national development targets.

7.3 Academies of sciences: The Heritage I

Some academies in the developing world – for example, in Brazil and Malaysia – owe their success to strong and sustained financial support from the government matched by the government's willingness to detach itself from influencing academy affairs. Such a strategy has allowed these academies to enjoy both adequate levels of funding and independence.

Academies prosper in such an open environment while governments benefit from the objective and unbiased advice that they receive from expert institutions that they have decided to fund but not control.

In many OIC-countries today, academies are weak institutions. That, however, was not always the case. Indeed the Arab word, *majma*, meaning assembly, dates back to the 7th century. Moreover, Al-Ghazali's Nizamiyah Academy in Baghdad, catering to all fields of knowledge, including science, was one of the world's most renowned seats of learning at the turn of the first millennium. That's some 400 years before the creation of the West's first science academy, *Accademia Nazionale dei Lincei*, in Italy **[19]**.

A common feature of all the world's science academies is to seek nationwide economic and social advancements through wise application of science and technology. To fully realize this goal,

academy representatives must get their message across to both public officials and the public at large.

7.4 The Second Bottom Line: The Heritage II

In the Islamic World, knowledge-based institutions, which date back to the earliest days of the Islamic religion, constituted one of the major defining elements of Muslim society during its 'golden age' – a time when Muslim culture dominated the world and stood at the forefront of progress and development. Put so laconically by no other than Carly Fiorina, CEO, Hewlett Packard, 2001 **[20]**, who said:

> *"There was once a civilization that was the greatest in the world.*
> *A super-state that stretched from ocean to ocean. Within its dominion lived hundreds of millions of people, of different creeds and ethnic origins. This civilization was driven more than anything, by invention. Its architects designed buildings that defied gravity. Its mathematicians created the algebra and algorithms that would enable the building of computers, its doctors examined the human body, and found new cures for disease. Its astronomers looked into the heavens, named the stars, and paved the way for space travel and exploration. When other nations were afraid of ideas, this civilization thrived on them, and kept them alive. The civilization I'm talking about was the Islamic world from the year 800 to 1600."*

8 ISLAMIC WORLD ACADEMY OF SCIENCES (IAS)

8.1 Background

Science academies today have a critical role to play as a strong public voice for the promotion of both scientific excellence and science-based development.

The glorious history of academies in the Islamic world has been largely lost to history. For nearly 1000 years now, the concept of an assembly of intellectuals or a fellowship of scientists dedicated to the advancement of knowledge within their societies has remained relatively obscure, even among the political elite.

In response to the need for an international organisation that can play such a role and cater for the needs of the Islamic scientific community, the Islamic World Academy of Sciences* (IAS) came into being as a non-political, non-governmental organisation that represents Muslim scientists of the various parts of the world.

The establishment of the Academy was recommended by the OIC Standing Committee on Scientific and Technological Co-operation (COMSTECH), and approved by the Fourth Islamic Summit, Casablanca, 1984 **[21]**.

The Academy, which commenced its activities in 1986, is an independent body that enjoys international status comparable to learned bodies of similar nature in the world.

8.2 Mission and objectives

IAS's mission is to provide a dynamic institutional set up that can assist in the utilisation of Science and Technology for the general development of Islamic countries and humanity **[22]**. The main objectives of the IAS are to:

1. Serve as a consultative organisation of the Muslim *Ummah* and institutions of member states of the Organisation of the Islamic Conference (OIC), on matters related to science and technology;

* The IAS was originally launched as the Islamic Academy of Sciences in 1986. The IAS General Assembly decided to relaunch the Academy as the Islamic World Academy of Sciences in March 2005.

2. Initiate scientific and technological programmes and activities in science and technology, and to encourage co-operation among research groups in the various Islamic countries on projects of common interest;
3. Encourage and promote research on major problems of importance facing Islamic countries and to identify future technologies of relevance for possible adoption and utilisation; and
4. Formulate standards of scientific performance and attainment, and to award prizes and honours for outstanding scientific achievements to individuals and to centres of excellence in all science and technology disciplines.

8.3 Role

The Academy has, since 1986, managed to undertake a number of activities that form part of its programme of action, and to achieve two primary objectives that form cornerstones in its mission to assist in the development effort within OIC-member countries. As a policy-making body the Academy has been actively formulating and promoting science and technology policies that help countries streamline national development effort. Secondly, the Academy has been able to directly implement important scientific programmes that fall within its general mission, especially in the areas of the provision of experts to countries, publications, specialised training and Information Technology related activities.

The IAS has been actively pursuing this dual role in a focussed manner, and is constantly promoting its policies amongst OIC countries, while implementing specialised activities emanating form/based on these policies (Figure 8).

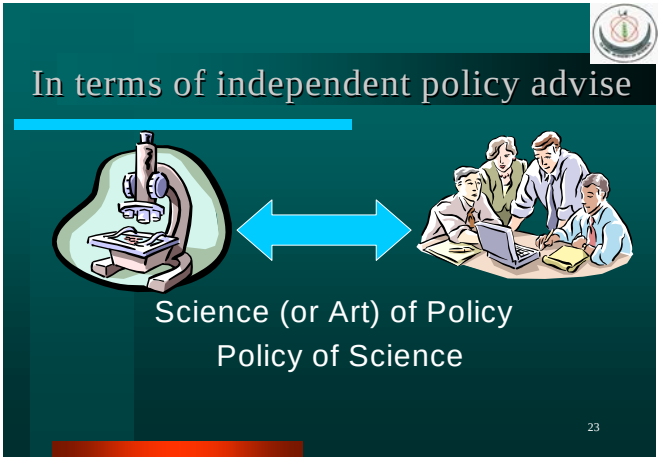

Figure 8. Science (or Art) of Policy/Policy of Science

8.4 Activities

8.4.1 General

The IAS has gradually built itself as an action-oriented institution of the *Ummah* utilising most of its resources to activities that accelerate the pace of development of OIC-member countries. The core objective of all such activities has been to promote the science and technology sector in OIC and developing countries

Operating on a year to year basis, the Academy has been promoting joint Islamic action through its specialised scientific conferences; publishing a series of Conference Proceedings (Policy Documents), journals, books, newsletters, and establishing a quality medical journal that is of an international standard. The Academy also undertook a number of quality training programmes and built it's own site on the Internet. Figure 9 below sums up most of the activities of the IAS.

Figure 9(a). Activities of the Islamic World Academy of Sciences I

Figure 9(b). Activities of the Islamic World Academy of Sciences II

8.4.2 International co-operation

Over the years, the Academy has built up scientific relations with a number of international non-governmental organisations, as well as governments throughout the world. These include:

- OIC Standing Committee for Scientific and Technological Co-operation (COMSTECH), Pakistan;
- The Islamic Development Bank (IDB), Saudi Arabia;
- The United Nations Educational, Scientific and Cultural Organisation (UNESCO), Egypt and France;
- The Islamic Educational, Scientific and Cultural Organisation (ISESCO), Morocco; and
- The Third World Academy of Sciences (TWAS), Italy.

These relations have helped the Academy to convene annual international conferences; each of which is held in a different country every year and supported by a number of international agencies. The host country normally provides local accommodation and hospitality for the participants whilst the Academy and the other co-sponsors pay the other expenses including the publishing of proceedings. The host country is also expected to contribute to the scientific content of the conference.

The conferences aim to provide OIC heads of state with a scientific roadmap for their national development in the context of the discussed topic.

8.4.3 Medical Journal of the IAS

The *Journal of the Islamic World Academy of Sciences*, which first appeared in August 1988, is a quality publication comparable to international scientific journals. The Journal has established itself as a major scientific publication in the Islamic world and has been granted an ISS number (ISSN 1016-3360). It is a forum for scientists and technologists in developing countries through which they can get their research work published.

In order to strengthen the Journal, and in response to the large number of medical articles that are normally sent to it, the IAS Council requested the Chief Editor to re-launch the IAS Journal as a primarily medical publication catering for the need of medical

scientists in the Islamic world and beyond. The re-launch was successfully completed in 2000.

In 2000 too, the electronic version of the Medical Journal of the Islamic World Academy of Sciences was launched **[23]**.

8.4.4 Conference Proceedings

In its efforts to disseminate scientific information, the Islamic World Academy of Sciences publishes annually the proceedings of the annual conference it organises. A process that was started with the publishing of the proceedings of the Academy's Founding Conference. Such a process ensures that the papers that are presented at the conferences are made available to the scientists and decision-makers that are concerned with Third world issues.

Since then, the Academy has established a tradition of annually publishing the proceedings of its conferences in the form of quality volume, both in terms of content and packaging. This is done after a specialised committee completes the task of refereeing and editing the included papers from scientific, linguistic and relevance point of view.

From 1988 to 1997, the Academy published seven books, which were the proceedings volumes of the 1988, 1989, 1990, 1991, 1992, 1993, and 1994 Academy Conferences.

During 2000, the Academy published the proceedings of its ninth Conference, *Science and Technology Education for Development in the Islamic World*, which was convened in Tehran (Iran) during July 1999.

That was followed by the proceedings book of the tenth Academy Conference, *Information Technology for Development in the Islamic World*, which was held in Tunisia in 2000.

In 2004, the IAS published the proceedings volumes of its 2001 *Biotechnology* conference and its 2002 *Materials Science* conference (Figure 10).

Figure 10. Intelligent outreach.

Figure 11. The future!

8.4.5 International outlook

A primary function of the Academy is to act as a Pan-Islamic affiliating body to the relevant international organisations. Through this, Muslim scholars can have a channel of communication, through the Academy, with many international academies of sciences and

agencies. This moreover helps the IAS to regularly identify specific international issues of importance and develop an understanding of the impact that such issues may have on countries of the South and the OIC in particular (Figure 11).

8.4.6 The IAS and Vision 1441

The Islamic World Academy of Sciences has, since it was founded in 1986, been lobbying for science and technology in decision-making circles, and has been energetically calling on OIC-Countries to develop and adopt long-term S&T policies. Moreover it has successfully attempted to secure all forms of support for the national science communities from the political leaderships in their countries.

As the academy of sciences of the OIC, the IAS is keen to promote Vision 1441, and more importantly, to work to implement the strategies and secure the finances that OIC-Countries require to realise the targets stipulated in Vision 1441.

9 9/11

The work of academies of sciences, and the international science and technology and academic systems are affected by the international political climate. There can be no doubt, for example, that North-South and South-South collaboration suffered a setback after the events of 9/11.

> "Some might argue that the war on poverty must take a backseat until the war on terrorism has been won. But they would be wrong. The need to eradicate poverty does not compete with the need to make the world more secure. On the contrary, eradicating poverty should contribute to a safer world…. **[24]**"
>
> **UNDP, Human Development Report 2003, p.1.**

10 CONCLUSION

Realising socio-economic development is/should the goal of governments and decision-makers. To convince decision-makers to pay more attention to and invest more in science and technology, lobbyists including academies of sciences and scientists must present a strong case for the positive impact of science and scientific advancement on society. They must provide historical and contemporary perspectives on how science can have a positive impact on the betterment of societies.

This paper does not address scientists or researchers. Rather, it is aimed at the decision-makers and politicians in countries of both the South and the North. It aims to reiterate the value of science as a tool for development and advancement. It presents political decision-makers in both the North and the South with an overview of what problems the world is likely to face in the 21st century. It promulgates the adoption of the Millennium Development Goals and Vision 1441 as yardsticks for development.

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State of Science and Technology in the Arab Region: A Graphical Sketch

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Jordan

BACKGROUND

The Arab world comprises 20 states and spans from Mauritania on the Atlantic coast in the West to the Arabian Sea in the East. The Arab states include some of the world's poorest (Somalia) and richest (Qatar).

A look at some of the internationally accepted S&T indicators for the Arab world and some individual Arab states may reveal a number of interesting facets. R&D expenditure of the Arab region is probably amongst the lowest at 0.2% of the global R&D expenditure, for example.

Military expenditure in the Arab world is probably is amongst the highest, compared to GDP, in the world.

The following tables and figures carefully compiled from various UN and other sources are self explanatory. They probably reflect the indifference that Arab countries show towards scientific and technological activities as not being a priority area or as a means to realizing socioeconomic development.

The aim of the presentation is thus to bring such important issues to the attention of decision-makers in Arab and Organization of Islamic Conference (OIC) countries.

* Since March 2005, Jordan's Prime Minister.

Table 1. GDP per capita in selected Arab states (US$)

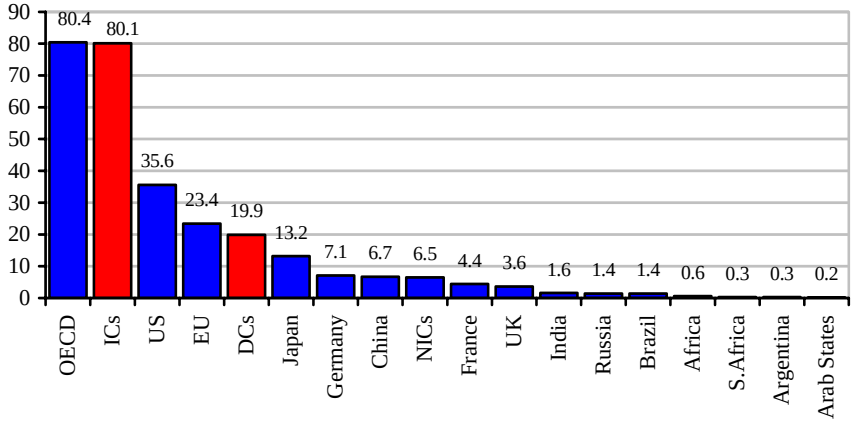
COUNTRY	1995	2002
Mauritania	463	334
Sudan	245	443
Yemen	332	508
Djibouti	858	819
Syria	1163	1180
Morocco	1252	1250
Egypt	1053	1286
Algeria	1456	1661
Jordan	1568	1744
Tunisia	2015	2367
Libya	6340	3292
Lebanon	3178	4552
Oman	6477	7933
Saudi Arabia	7577	8053
Bahrain	10120	11374
Kuwait	14118	14597
United Arab Emirates	17755	20509
Qatar	16642	29948
Average	**2144**	**2430**

Source: *Unified Arab Economic Report (2003).*

Table 2. Registered patents in the USA originating from selected Arab states and other countries

Country	1995	1996	1997	1998-1999	Total
Bahrain	0	0	1	0	1
Egypt	7	6	2	7	22
Jordan	0	2	5	4	11
Kuwait	2	3	2	12	22
Oman	0	0	0	2	2
Saudi Arabia	11	12	14	30	67
Syria	0	0	0	1	1
United Arab Emirates	2	1	2	3	8
China	91	78	103	201	473
S.Korea	1265	1603	2027	5089	9984
Israel	489	591	653	1343	3076

Source: *United States Patent and Trademark Office: www.uspto.gov*



Source: *UNESCO Global Investment in R&D Today (2003).*

Figure 1. R&D expenditure of the Arab region, other regions and selected countries as a share of global expenditure, 2000.

Table 3. Defence expenditure in the Arab region, Developing and Least Developed countries, 1996

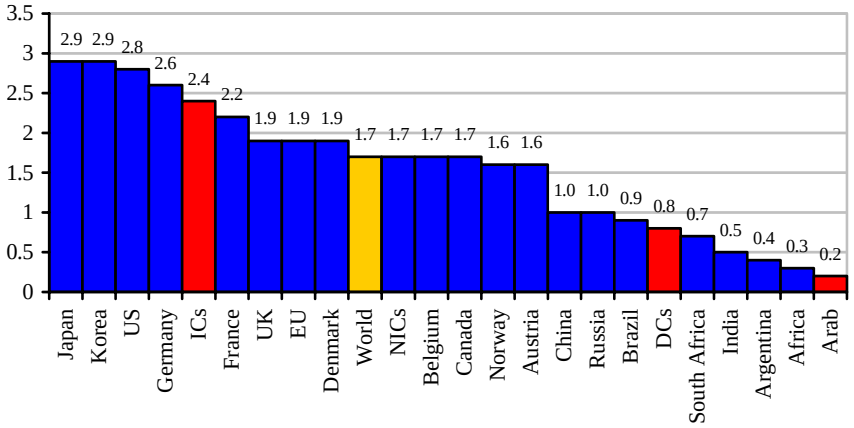
Country	per capita (US $)	As % of GDP	Total US$ million
Arab States	151	7.1	37 433
World	137	2.9	781 093
Least Developed countries	10	2.5	5
Developing countries	39	3.7	171 934

Source*: Atta. R. (ed.) (2003): Strategy for the Development of Science & Technology in Arab OIC Countries; and UNDP Human Development Report, 2003.*

Table 4. Military expenditure in selected Arab states, 2001

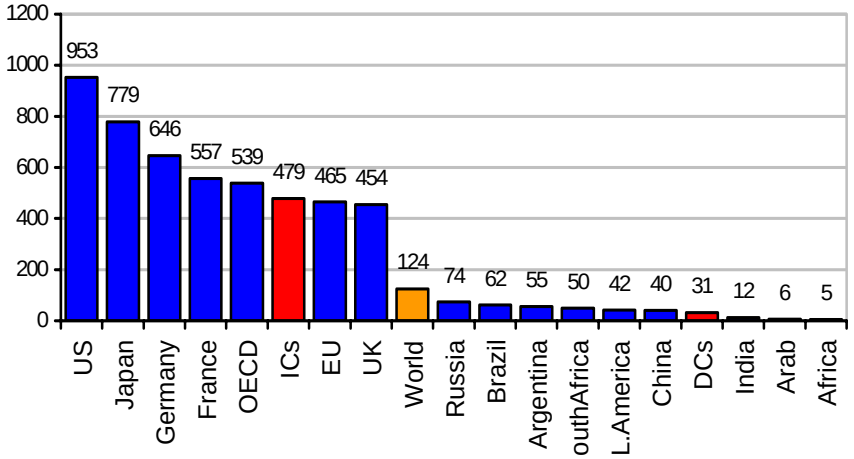
Country	As % of GDP
United Arab Emirates	2.5
Kuwait	11.3
Bahrain	4.1
Saudi Arabia	11.3
Oman	12.2
Lebanon	5.5
Tunisia	1.6
Jordan	8.6
Algeria	3.5
Egypt	2.6
Morocco	4.1
Syria	6.2
Djibouti	4.4
Yemen	6.1
Sudan	3.0
Mauritania	2.1

***Source**: UNDP Human Development Report, 2003.*



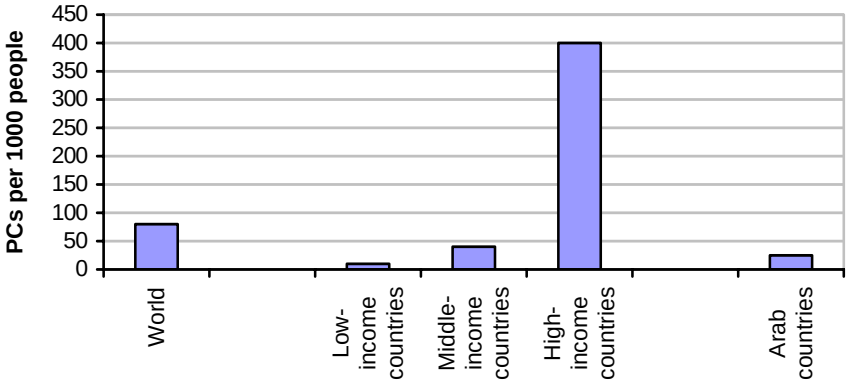
***Source**: UNESCO (2003): Global Investment in R&D Today.*

Figure 2. R & D expenditure in the Arab region, other regions and selected countries as a share of GDP, 2000.



ICS: Industrialized countries;
NICs: Newly Industrialized countries;
DCs: Developing countries.
***Source**: UNESCO (2003): Global Investment in R&D Today.*

Figure 3. R&D expenditure per capita in the Arab region, other regions and selected countries, 2000.



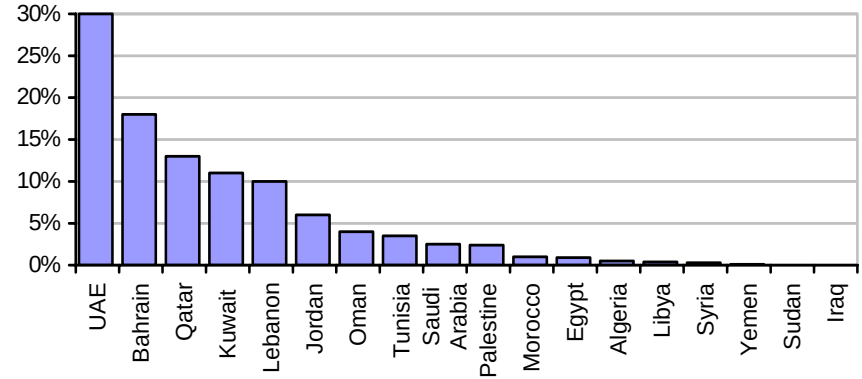
***Source**: World Bank (2002) World Development Indicators; UNDP (2003) Arab Human Development Report.*

Figure 4. Personal computers in the Arab region and other groups of countries, 2001.

Table 5. The digital gap in selected Arab states compared to other countries

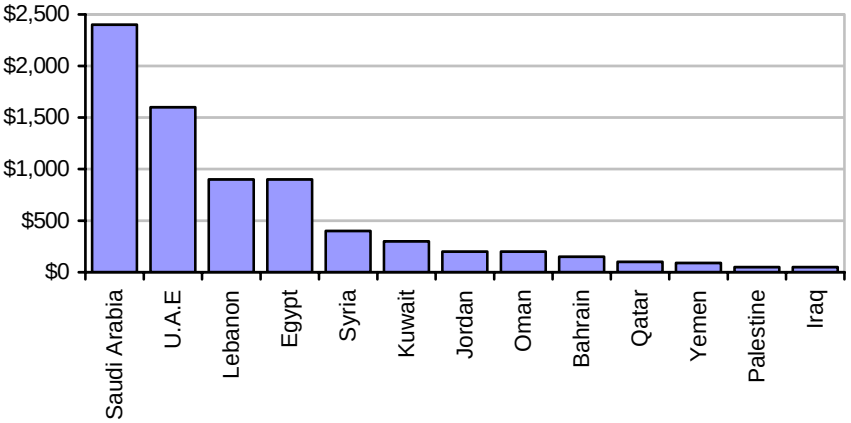
Country	Score	Position in Networked Readiness Index
USA	5.50	1
Switzerland	5.06	7
France	4.60	19
Malaysia	4.19	25
Tunisia	3.67	40
Jordan	3.53	46
Turkey	3.32	56
Morocco	3.19	64
Egypt	3.13	65
Nigeria	2.92	79
Algeria	2.75	87

***Source**: Dutta, S. Lanvin, B. and Paua, F(eds) (2003): Global Information Technology Report 2002,2003; Readiness for Networked World.*



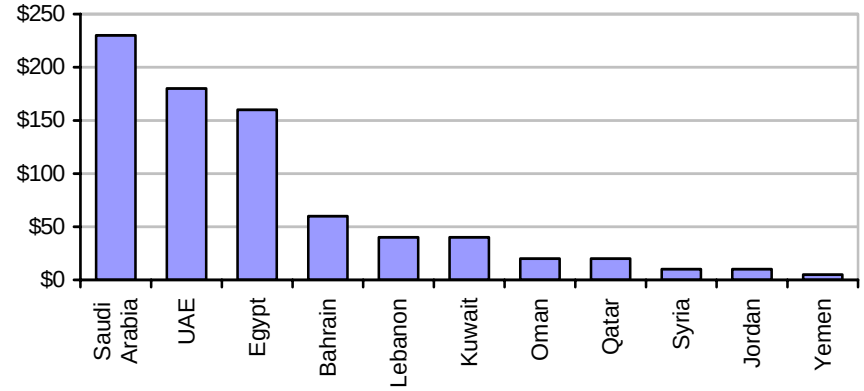
***Source**: World Bank (2002) World Development Indicators; UNDP (2003) Arab Human Development Report.*

Figure 5. Internet penetration in selected Arab states, 2001.



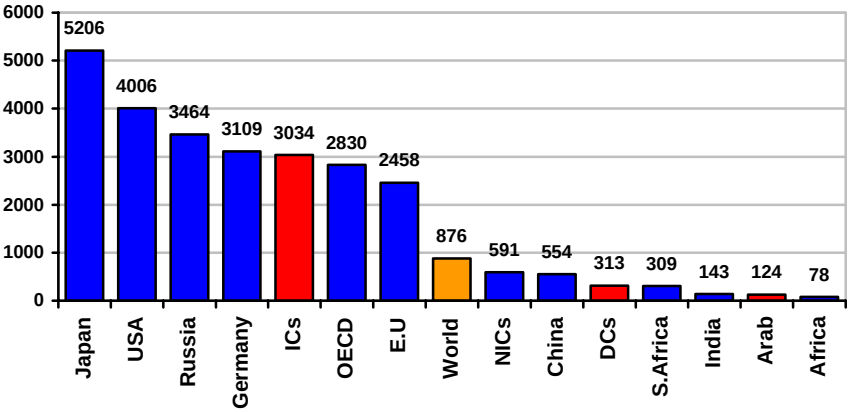
***Source**: Middle East Economic Digest (MEED), 1999.*

Figure 6. Value of contracts involving transfer of ICT, selected Arab states, 1992-1998 (per capita).



***Source**: Middle East Economic Digest (MEED) 1999.*

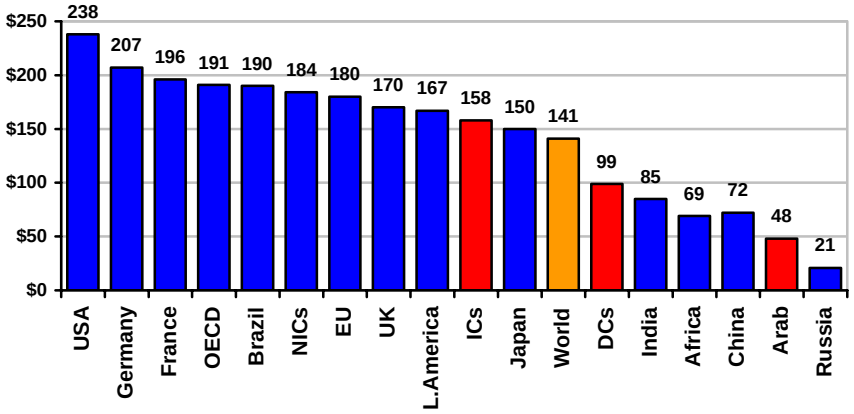
Figure 7. Value of consultancy contracts in selected Arab states, 1992-1998 (per capita).



ICs: Industrialized countries;
NICs: Newly industrialized countries;
DCs: Developing countries.

***Source:** UNESCO (2003) Global Investment in R&D Today.*

Figure 8. Researchers in the Arab region and other selected regions and countries, 2000.



ICs: Industrialized countries;
NICs: Newly industrialized countries;
DCs: Developing countries.

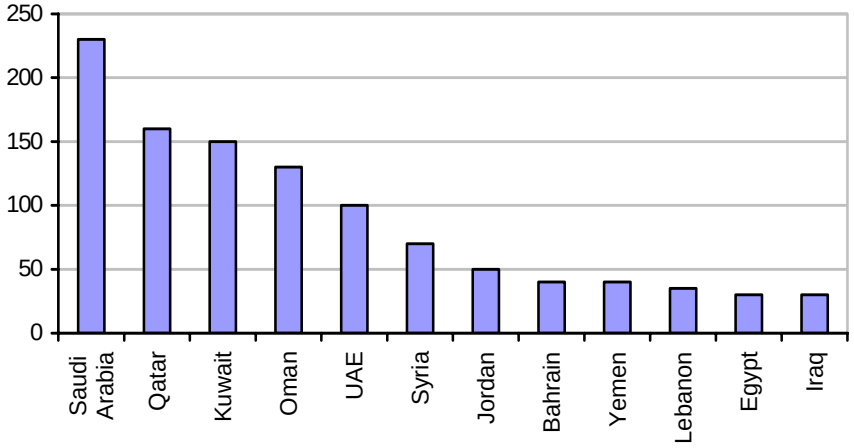
Source: *UNESCO Institute for Statistics (estimates), 2003.*

Figure 9. R&D expenditure per researcher in the Arab region and selected other regions and countries, 2000.

Table 6. Distribution of FTE (full-time equivalent) researchers in ESCWA Arab states, 1998.

	Public sector			University			Private sector			
State	**PhD**	**MSc**	**Total**	**PhD**	**MSc**	**Total**	**PhD**	**MSc**	**Total**	**Total**
Bahrain	5	22	27	29	30	59	0	0	0	86
Egypt	4708	3366	8074	1627	757	2384	114	172	286	10744
Iraq	189	540	729	366	296	662	0	0	0	1391
Jordan	86	129	215	98	42	140	15	31	46	401
Kuwait	117	217	334	81	2	83	8	15	23	440
Lebanon	28	65	93	65	47	112	0	0	0	205
Oman	17	39	56	19	7	26	0	0	0	82
Qatar	2	2	4	18	12	30	0	0	0	34
Saudi Arabia	84	224	308	363	175	538	0	0	0	846
Syria	95	115	210	109	37	146	0	0	0	356
United Arab Emirates	12	44	56	26	25	51	0	0	0	107
Yemen	115	89	204	44	22	66	0	0	0	270

***Source**: ESCWA (1999) Science and Technology Policies in the 21st Century.*



***Source**: Qasem, S (1998): Development of Science and Technology Indicators.*

Figure 10. R&D expenditure per researcher in selected Arab states, 1998.

Table 7. Researchers in the Arab region by sector of activity, 1998

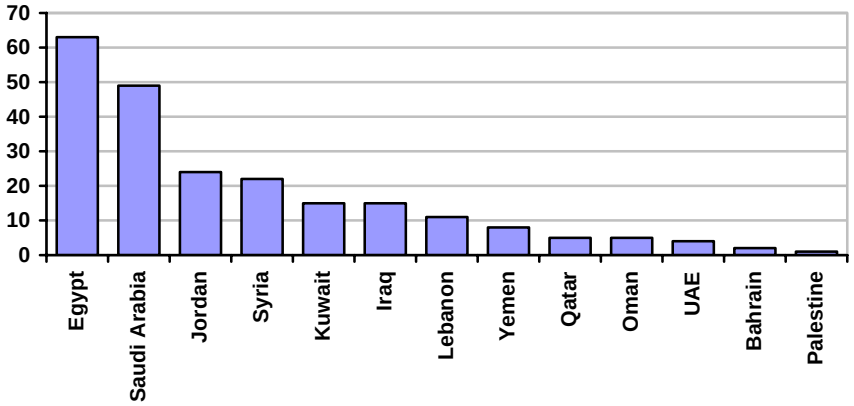
Agriculture	44.2%
Health and food	13.3%
Social and economics	10%
Industry	8.5%
Basic science	8%
Engineering	6.3%
Energy	5%
Petrochemicals	2.8%
R&D management	1.9%
Total	100%

***Source**: Qasem, S (1998): Development of Science and Technology Indicators.*

Table 8. Number of R&D units by economic sector in the Arab region, 1996

Sector	Government	University	Private	Total	% Of Total
Agriculture	97	19	1	117	36.3
Health	43	16	0	59	18.3
Industry	34	2	16	52	16.1
Energy	27	1	0	28	8.7
Basic science	12	8	0	20	6.2
Social science	13	7	0	20	6.2
Petrochemicals	11	2	0	13	4.1
Engineering	6	7	0	13	4.1
Total	243	62	17	322	100
%Distribution	75.4	19.3	5.3	-	100

***Source**: Qasem, S (1998): Development of Science and Technology Indicators.*



***Source**: ESCWA: Science and Technology Policies in the 21st Century.*

Figure 11. Number of R&D units in selected Arab states, 1998.

Table 9. Expenditure on education in selected Arab states, 1996-2001

Country/Region	Expenditure as %of GDP	As % of total expenditure
Saudi Arabia	9.3	22.8
Yemen	7.0	-
Tunisia	6.7	19.9
Egypt	5.2	14.7
Morocco	5.2	20.9
Algeria	5.1	16.4
Jordan	5.1	24.2
Kuwait	4.7	14.0
Mauritania	4.5	19.1
Oman	4.5	9.1
Bahrain	3.7	12.0
Syria	3.5	13.6
Djibouti	3.4	-
Lebanon	1.9	8.2
United Arab Emirates	1.8	16.4
Sudan	0.9	-

***Source**: UNESCO (1999) Statistical yearbook 1999. Arab Fund for Economic and Social Development (2002), Unified Arab Economic Report.*

Table 10. Student enrolment in higher education in Arab states, 2000

Country/ Region	Males	Females	Total
Libya	51.7	50.6	51.2
Lebanon	35.2	38.2	36.7
Qatar	13.7	46.2	27.7
Jordan	26.8	30.6	28.6
Bahrain	19.6	31.1	25.2
Palestine	29.2	17.9	24.0
Saudi Arabia	19.6	25.4	22.4
Egypt	27.1	17.8	39.0
Kuwait	13.0	30.0	21.1
Tunisia	19.6	19.0	19.3
Syria	17.6	12.6	6.1
Algeria	15.8	11.0	15.0
Iraq	17.5	9.5	13.6
United Arab Emirates	4.9	20.7	12.1
Yemen	16.7	4.6	10.8
Morocco	10.6	8.0	9.3
Oman	8.8	7.1	8.0
Sudan	7.1	6.6	6.9
Mauritania	6.6	1.3	5.6
Somalia	3.6	1.1	2.3
Djibouti	0.4	0.3	0.4

Source: *Unified Arab Economic Report: Database (2003).*