

TOWARDS A CULTURE OF SCIENTIFIC EXCELLENCE IN THE SOUTH

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It is indeed an honour and a pleasure to be here today to speak before such a distinguished group of scientists and scholars. The Pontifical Academy of Sciences is a unique institution bringing together the world's most eminent scientists and scholars – here at the spiritual centre of Christianity – to examine some of the world's most critical social and moral issues. One rarely has an opportunity to examine such deep and complex problems in such a serene, yet rarefied, atmosphere. For this I am deeply grateful.

The theme of this plenary session – ‘The Cultural Values of Science’ – has assumed even greater import in light of the events of the past year. The rise of religious extremism in a number of countries represents not only a challenge to these countries but to the entire world – threatening to create an enduring barrier to the prospects for global peace and harmony. At the same time, unprecedented advances in science and technology – first in physics and, more recently, in biology and chemistry – have drawn science and cultural values closer together in a difficult but enlightened debate over fundamental principles concerning nothing less than the meaning and sanctity of life. No genetic scientist can blithely ignore the ethical dilemmas posed by biotechnology, just as no religious authority can turn a blind eye to the potential for healing that this technology could bring to hundreds of thousands – indeed millions – of people suffering from such chronic, often debilitating, diseases as diabetes and malaria.

These are some of the reasons that the topic of my presentation, ‘Towards a Culture of Scientific Excellence in the South’, is such a critical yet complex issue for all of us. It is a topic that poses far-reaching ethical and cultural concerns. It is topic that has become more, not less, critical

with each passing day. It is a topic that sheds revealing light on practical issues that extend well beyond intellectual fora like this one. And it is a topic that carries important implications shaping the real lives of people throughout the world, especially in the developing countries. After all, I am sure that we all agree the developing world will not break out of its unending cycle of poverty and material deprivation unless it embraces a culture of excellence in science and technology.

The truth is scientific innovation and traditional cultural values must be considered partners, not adversaries, in the South's quest for a better future. Unless common ground is found between the world of spirituality and the world of science, countries throughout the South will continue to be marginalized.

For the developing world, the search for common ground is not simply a matter of intellectual curiosity and debate; it is a matter of survival and material well-being.

While some fanatics have led others to believe that religion and science are at odds with one another, history tells us there need be no contradiction between religious fervour and scientific excellence. Embracing one does not lead to a rejection of the other. There are numerous examples of eras when science and religious beliefs stood as twin beacons of understanding, intensifying the light that was cast on God, nature and the place of human beings within the order of the universe. Let me cite two times and two places both very different from one another. One that occurred a thousand years ago and is now largely forgotten (at least until recently); the other unfolding as I speak. Both serve as primary examples of successful marriages between dedication to religious values and the pursuit of scientific excellence that served not just their societies but the entire world as vital, reinforcing sources of change, which at their best brought all of us closer together.

The first example comes from the Islamic world.

More than a thousand years ago at the height of global influence, the Islamic world represented the most dynamic force on earth, spreading its influence throughout north Africa, east Asia and southern Europe. It was a world marked not only by conquest but also by fine art and literature, respect for the glories of Greek and Roman antiquities, breathtaking architecture and design, and an unquenchable thirst for knowledge that found expression in an extraordinary range of learning, research and teaching. Indeed it was a time when virtually all of the world's greatest names in philosophy and science came from the Islamic world, including:

- Al-Khwarazmi (780-850) whose book on mathematics gave birth to the word 'algebra' and whose accomplishments are commemorated today in the name of one of the most fundamental tools of mathematics, 'algorithm'.

- Followed by El-Farabi (878-950), a philosopher second only to Aristotle in the Islamic world in terms of the respect and influence that he exerted on thought and culture.

- Followed by ibn-Sina (980-1037), the renowned medical doctor and researcher who is known in the West as Avicenna; and

- Followed by Omar Khayyam (1048-1122), the ingenious mathematician and poet.

Religion and science did indeed occupy common ground during this golden age of Islamic culture working in an atmosphere of mutual respect that allowed the faithful to express their fidelity to religious teachings while fervently embracing a culture of scientific excellence.

The second example comes from the present situation in the developed world.

Today, most surveys indicate that people in the United States are among the most religious people in the developed world, wilfully embracing the power of faith expressed in Christianity, Judaism, Islam, and other forms of spiritual expression. Whether the question relates to a personal belief in the existence of God, or the number of times one attends a house of worship each month, or whether God plays a direct and tangible role in a person's daily life, Americans have consistently shown themselves to be more closely affiliated with deeply rooted religious principles than their contemporaries in Europe.

At the same time, there is no doubt that the United States is the most advanced scientific and technological power on earth unmatched in the breadth of its scientific knowledge and, perhaps more importantly, in its ability to transform that knowledge into products and services that continually improve the lives of its people. In fact, the United States' ability to develop and harness science and technology represents its most distinguishing characteristic - a primary factor that separates the United States even from its closest cultural brethren in Europe.

While important to recognize, it is not sufficient simply to assert that history shows religious fervour and scientific excellence need not be contradictory - and leave it at that. Other factors come into play when examining the deep spirituality and broad material success of Islamic society a thousand years ago and U.S. society today.

First, both societies displayed remarkable tolerance for those who did not share the dominant religious attitudes. Early Islamic society welcomed those of all religions, including Christians and Jews, into their communities, often allowing them to live and prosper in peace and harmony within the prevailing Islamic culture. And I don't need to tell you that an unflinching tolerance for varied cultures and religions is one of the hallmarks of contemporary society in the United States, where those of all faiths and creeds are welcome. Indeed some observers cite this open attitude as one of the U.S.'s most important competitive advantages in today's globalized world. That advantage may have been put at risk by the security measures that have been taken in the aftermath of the terrorist attacks on 11 September. If these measures remain in place and prove an enduring insult and burden to targeted communities and foreign visitors, the U.S. may begin to lose one of its greatest assets.

Second, both Islamic society in the distant past and U.S. society today have had the good fortune to be shaped largely by social and political systems that encouraged and supported the pursuit of scientific knowledge. These systems helped to reinforce prevailing cultural attitudes and, in the process, helped to nurture and sustain a mindset that allowed each society – each culture – to progress while still maintaining a heartfelt allegiance to traditional values. As a result, each moved ahead by warmly embracing the future without coldly abandoning the past.

Third, both Islamic society of a thousand years ago and U.S. society of today accepted science as an integral part of their cultures. This lesson is particularly important for today's Islamic societies to understand and appreciate because all-too-often science is seen by Islamic extremists as a Western and Northern phenomenon alien to their own sensibilities and values. Nothing, in fact, could be farther from truth. Civilization began in what is now the Third World, including the Islamic world and, as we have seen, science flourished there at a time when Europe found itself lost in the dark ages.

Equally important, traditional knowledge continued to play a critical role in 'developing countries' – long after their ability to pursue cutting-edge scientific inquiries had been compromised by political and social conflicts and a host of other forces – some self-inflicted, others created by factors beyond the society's control and influence.

Traditional knowledge, acquired and tested over centuries of time, is now proving increasingly important as we try to tailor our global concerns for economic and social well-being to a myriad of local circumstances. Respect for such knowledge, in fact, could provide an entryway for re-

establishing a culture of scientific excellence in the developing world while simultaneously giving today's universities and research institutions valuable time-tested information and techniques for examining some of the world's most difficult health and environmental problems.

Where does all this leave us? More specifically, what lessons can be learned from these experiences of past and present for institutions such as the Third World Academy of Sciences (TWAS), which is dedicated to building scientific capacity and promoting scientific excellence in the developing world?

I am pleased to note that these institutions include the Pontifical Academy of Sciences, which, as many of you know, was instrumental in facilitating the founding of TWAS nearly 20 years ago. Your Academy, in fact, provided the forum where the idea of creating an academy for Third World scientists was first discussed in 1981. TWAS was born two years later. I am also pleased to note that 24 members of your Academy – nearly one third of its membership – are also members of TWAS.

In this spirit, I think it is important for all of us to recognize – as the founding president of TWAS and member of your Academy, Pakistani-born, Abdus Salam often said – 'science is the cultural heritage of all humankind'. No culture has a monopoly on science and technology. And all cultures have a great deal to learn from exchanging experiences and knowledge concerning the wonders of the natural world and the benefits of science and technology.

I think it is also important for us to recognize, particularly for those of us concerned about the relationship between cultural values and science, that great civilizations have often flourished when the two – traditional cultural values and contemporary science – were being sincerely embraced and cherished by their leaders and citizenry.

Given all this, what practical steps should the developing world take to ensure and maintain a culture of scientific excellence? Put another way, what factors could help the South knit scientific excellence into the fabric of its cultures in ways that would enable traditional values and science to be threaded together in a pleasing harmonious pattern?

Let us first acknowledge that the task is not an easy one. Here are some snapshots that reveal the depth of the challenge.

- The South is home to 80 percent of humanity but produces just 10 percent of the articles published in international peer-reviewed journals.
- Since the Nobel prize was initiated over a century ago, only three scientists who have conducted research in the developing world have been

awarded science's most coveted prize: C.V. Raman in India; Bernardo Houssay in Argentina; and Luis F. Leloir in Argentina.

- Israel, which has only four million people, publishes more research papers in science and technology in international peer-reviewed journals than the entire 57 countries belonging to the Organization of Islamic Conference (OIC), with a total population of nearly 1 billion.

Yet, we should not be discouraged by the challenges we face. Several countries - notably, Brazil, China, India, Mexico and South Korea - have planted seeds for scientific excellence that are not only bearing fruit today but have enriched these nations to the point where these seeds are now likely to regenerate and grow even stronger in the years ahead. These countries and several others have expressed strong desire and commitment to engage in South-South cooperation programmes in education and research that aim at helping less privileged countries to develop their capacities.

Such experiences - along with more effective strategies for North-South cooperation - suggest that the road to scientific excellence in the developing world may no longer be marked by wrong turns and dead ends.

In fact, we know what it takes to succeed and we now have examples of how to get there:

- First, we need to provide - not just for one year or two, but year-after-year - generous research and travel grants based on competition and a peer review system that does not rely on nepotism or seniority in the selection process. Here the efforts of such organizations as TWAS and the African Academy of Sciences to provide competitive research grants in a variety of fields bodes well for the future of science in many places throughout the developing world. Such programmes, however, need substantial additional funding if we are to build and sustain a critical mass of world-class scientists in every country of the South.

- Second, we need to develop sustainable institutions of excellence that can attract, train and retain scientific talent. Here the work of the Third World Network of Scientific Organizations (TWNSO) may prove particularly significant. TWNSO, which operates under the administrative umbrella of TWAS in Trieste, first identified and then involved institutions of high standing in the South in the building of networks dedicated to addressing real-life concerns in the developing world. To date, TWNSO has launched networks in indigenous and medicinal plants, dryland biodiversity, water management and, most recently, renewable energy. These networks closely track the critical problems - water, energy, health, agriculture and biodiversity - that UN Secretary-General Kofi Annan recently cited as

a framework for action in events leading to the Johannesburg summit on sustainable development held earlier this year.

- Third, we need to nurture an environment that fosters cooperation between leading organizations that support the pursuit of excellence in science and technology. Here the initiatives of the InterAcademy Panel for International Issues (IAP), also located in Trieste and operating under the administrative umbrella of TWAS, to bolster merit-based national science academies in the South and North could help transform a vastly under-utilized source of scientific expertise into a strong and effective voice for science-based decision-making.

- Fourth, we also need to devote sufficient resources to the problems of least developed countries whose scientific communities have become increasingly isolated and marginalized in recent years. Here's where TWAS's recent programme to recognize and support the best research groups in the LDCs could prove to be a critical strategy for developing and sustaining scientific excellence under difficult conditions. The programme offers grants of up to US\$30,000 a year for three years to research groups in universities and research institutions.

- And, fifth, scientists need to communicate, in an atmosphere marked by mutual respect and understanding, with the keepers of other forms of knowledge - notably, practitioners of traditional knowledge in health, the environment and natural resources. Here TWAS's call for greater interaction with indigenous sources of knowledge, as outlined in its most recent strategic plan, could help bridge the divide between two reputable sources of knowledge - melding the universality of modern science with the localism of traditional knowledge in ways that serve both these noble pursuits.

We must also devise effective strategies for conveying the benefits of scientific excellence to our political leaders. This means putting science to work to solve practical problems. Not only will such a strategy clearly convey the value of science to the larger public, but it will also put scientific endeavours more closely in line with a society's cultural and social values. This also means giving scientists the opportunity to provide objective and credible advice to governments on issues of local, national and international concern. Here again national science academies, if given the know-how and training, can play a pivotal role.

In all these endeavours, we must never lose sight of the fact that promoting a culture of scientific excellence generates benefits beyond a society's material well-being - that, in effect, a culture of scientific excellence is a boon to the entire culture. Through opportunities to interact with indi-

viduals associated with educational and research systems beyond one's national borders, science, in a broader sense, promotes greater understanding of the cultural values of different societies. This interaction, in turn, enriches and transforms cultural attitudes and customs.

These are some of the experiences, lessons and observations that the developing world – and I should add the developed world – should heed in their desire to protect traditional cultural values while finding lasting peace with the material benefits that only science and technology can bring.

In the spirit and purpose that guides the Pontifical Academy of Sciences, the Third World Academy of Sciences, and all other institutions that share our vision, let us all pray and reason together that – at this critical juncture of history, marked by increasing cross-cultural suspicions and hostilities – we can create a successful pathway, through science, to a new level of global understanding.

Thank you.

DISCUSSION ON THE PAPER BY HASSAN

MENON: May I just make just one remark, Mr. Chairman? Dr. Hassan is now the moving spirit behind the Third World Academy of Sciences. Its President is sitting here right next to me, Prof. C.N.R. Rao. The Academy should know that the Pontifical Academy was the birthplace of the Third World Academy of Sciences. I was showing Dr. Hassan and Prof. C.N.R. Rao, along with my founder fellow colleague Tom Odhiambo, the places down below where we used to have breakfast and lunch in the old days where the discussions took place among scientists from the Third World who belong to the Pontifical Academy which gave birth to the Third World Academy of Sciences. I think this was a major accomplishment of this Academy for developing science in the Third World, for which the Pontifical Academy can take the credit.