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SCIENCE, TECHNOLOGY AND INNOVATION: BUILDING HUMANITY'S COMMON FUTURE

MONEEF R. ZOU'BI

NAJWA F. DAGHESTANI

EDITORS

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SCIENCE, TECHNOLOGY AND INNOVATION: BUILDING HUMANITY'S COMMON FUTURE

Proceedings of the 20th IAS Science Conference on
Science, Technology and Innovation:
Building Humanity's Common future
organised in Tehran/ Iran;
26-27 December 2015

Edited by

Moneef R. Zou'bi
Najwa F. Daghestani

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of the
ISLAMIC WORLD ACADEMY OF SCIENCES
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Photo:Mohammad Namazi


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ZOU'BI

Some of the participants and sessions of the 20th IAS Conference;
Tehran/ Iran; 26-27 December 2015.

Editors:

Dr Moneef R. Zou'bi has been an advocate of Science and Technology for Development for around 30 years. Born in Amman, Jordan, he studied for his undergraduate and postgraduate degrees in Civil Engineering Technology and Management at Brighton and Loughborough Universities in the United Kingdom, 1980 - 1987. After becoming involved in global development issues, he successfully pursued further post-graduate work at the Department of Science and Technology Studies at the University of Malaya.

After serving in various capacities at the IAS, he was appointed by the IAS Council as Director General, IAS, in May 1998. He also serves as the Science Advisor to the Interaction Council (IAC) which is an independent international organization that mobilizes the experience and international contacts of a group of statesmen who have held the highest office in their own countries.

He has written extensively on science and technology issues, science education and sustainable development, as well as on water issues from a Middle Eastern perspective, and has given lectures on such topics in over 25 countries including Canada and the United States. He has published over 60 publications and edited and co-edited 10 books on topics such higher education, the environment as well transformational technologies. In 2010, he co-authored the ground-breaking Arab States Chapter of the 2010 UNESCO Science Report.

Moneef is a member of many international organizations including the UNESCO International Centre for South-South Co-operation in Science, Technology and Innovation (ISTIC), Malaysia; the New York Academy of Sciences; World Academy of Art and Science and the European Association for the Study of Science and Technology; and is a Founding Fellow, of the Academy of Engineering and Technology for the Developing World (AETDEW), based in Kuala Lumpur (Malaysia). He is also a member of the Advisory Committee of the Rosenberg International Water Forum, USA, since 2007; member (Ex-Officio) of the Council of the Islamic World Academy of Sciences, since 2009; member of the Advisory Board, Muslim-Science.Com, since 2011, and a member of the American Association for the Advancement of Science (AAAS), since 2013; member - Board of Judges for the Templeton Prize involved in the selection of the Templeton Prize Laureate for 2018, 2019 and 2020.

Najwa F. Daghestani is a Programme Officer at the Islamic World Academy of Sciences (IAS). She earned her Master of Business Administration (MBA) from the German Jordanian University, Jordan, and her BSc in Computer Science from Princess Sumayya University, Jordan.

She previously worked at the Royal Scientific Society as an Applications Programmer.

IAS Publications

Medical Journal of the Islamic World Academy of Sciences (Quarterly)
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Books

The Essentials of Science, Technology and Innovation Policy – Published by the Islamic World Academy of Sciences
Omar Abdel Rahman (Author)
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Reverse Engineering: The Permissible but not Well-Recognized
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Islamic Thought and Modern Science
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Qur'anic Concepts and Scientific Theories
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PREFACE

The Organization of Islamic Co-operation (OIC), formerly known as the Organization of the Islamic Conference, was founded in 1969 as a political organization grouping Islamic countries. In 1981, the heads of state of the OIC decided to establish a number of specialized organs to enhance co-operation between the OIC-Member countries in the fields of culture, trade and science and technology. The science and technology role was assigned to the Islamabad-based COMSTECH; the Ministerial Standing Committee on Scientific and Technological Co-operation.

In 1984, the heads of state of the OIC approved the launch of the Islamic World Academy of Sciences (IAS) as an independent autonomous S&T Think Tank of the OIC to be based in Amman, Jordan. Of the issues that the IAS has been concerned with since its launch has been bridging the divide that has historically existed between the science community and the decision-making community in OIC-Member countries. Moreover, as an advocate for science, the IAS has always viewed science and technology – including the history of science – as an enterprise that can contribute to bridging divides between cultures and civilizations.

This publication includes the majority of the papers that were presented at the 20th IAS Conference, which was held in Tehran, Iran, during December 2015, under the patronage of His Excellency the President of the Islamic Republic of Iran. A conference in which over 50 participants including IAS Fellows and invited speakers from outside Iran, academics, decision-makers, scientists, researchers as well as presidents/representatives of academies of sciences from all over the world, took part.

In his address during the opening session of the conference, Dr Sattari, Vice-President of Iran for Science and Technology Affairs, said what probably sums up the underlying objective of the event:

With the peoples of so many Islamic nations victims of violence and extremism, their leaders had a responsibility to show that another world is possible. Islam advanced knowledge when the world was ignorant, and it can and must do so again. Improving the low level of scientific collaboration between OIC nations was an important step to take in this respect.

At the same time, collaboration could also be a means to achieving solutions to problems that are common to many if not all developing nations, such as water scarcity. Science must be used to overcome local and global challenges.

This proceedings has been divided into seven parts.

Part One includes the statement of IAS President as well as the statement of the Vice-President of Iran for Science and Technology Affairs during the inaugural session of the conference.

Part Two embraces keynote addresses by Dr Shaukat Hameed Khan, Coordinator General, COMSTECH, Pakistan, entitled ‘COMSTECH Revisited: Some Recommendations for S& T in the OIC Countries, 2016-25;’ by Prof. Adnan Badran FIAS, Former Prime Minister of Jordan and IAS Treasurer, who presented a paper entitled ‘Science Education and Research for Innovation in OIC Countries;’ and one by Tan Sri Prof. Omar Abdul Rahman FIAS, Founding President of the Academy of Sciences of Malaysia and former Science Advisor to Malaysia’s Prime Minister, entitled ‘Building Our Sustainable Common future: The Smart Partnership Way.’

Part Three includes the papers presented in the session on the topic of ‘Health for Humanity,’ in which three papers were presented; by Dr Seyed Alireza Marandi, Iran; Prof. Abdallah Daar FIAS, Oman/Canada, and by Prof. Rabia Hussain FIAS, Pakistan, on ‘Emerging Infectious Diseases: The Researchers’ Guide.’

Part Four is dedicated to the Mustafa Prize laureates; Prof. Omar Yaghi, Jordan/USA and Prof. Jackie Ying, Singapore. Both laureates were invited to speak at a special session and present their latest work and research.

Part Five addresses the topic of 'The African Take on Sustainable Development' and includes papers by Prof. Mohammad Hassan FIAS on 'Promoting STI for Sustainability and Economic Transformation in Africa;' a presentation by Prof. Ousmane Kane; a presentation by Prof. Berhanu Abegaz, and by Prof. Yves Quère, Académie des sciences, France, entitled 'A Brief Story of La main à la pâte.'

Part Six is entitled 'An Outlook on Current Research,' and includes a number of presentations by IAS Fellows and invited speakers.

Part Seven of the book is the 'appendices' including the list of participants in the conference, the conference scientific and organising committees, names of IAS Fellows and Council members, as well as other details about the Islamic World Academy of Sciences (IAS).

Moneef R. Zou'bi
Najwa F. Daghestani

ACKNOWLEDGEMENTS

The Islamic World Academy of Sciences (IAS) is grateful to His Excellency Dr Sorena Sattari, Vice President of Iran for Science and Technology Affairs, Iran, for his patronage and support of the conference.

The IAS extends its appreciation to all the organisations that have sponsored the conference, foremost among which is the Vice-Presidency for Science and Technology, Tehran, Iran; and the Embassy of the Islamic Republic of Iran, Amman, Jordan.

IAS would also like to thank the Islamic Development Bank (IDB), COMSTECH, for sponsoring the conference, and Dr Shaukat Hameed Khan and all the IAS Fellows who participated in the event.

The dedicated staff of the IAS in Amman including, Ms Lina Jalal, Ms Taghreed Saqer and Mr Hamza Daghestani, all deserve our thanks and appreciation.

Moneef R. Zou'bi
Najwa F. Daghestani

IAS 2015 CONFERENCE
on
Science, Technology and Innovation:
Building Humanity's Common Future

SPONSORS OF THE IAS 2015 CONFERENCE

- Islamic World Academy of Sciences (IAS), Amman, Jordan;
- Vice-Presidency for Science and Technology, Tehran, Iran;
- Embassy of the Islamic Republic of Iran, Amman, Jordan;
- Islamic Development Bank (IDB); and
- The OIC Ministerial Standing Committee on Scientific and Technological Cooperation.

ISLAMIC-WORLD ACADEMY OF SCIENCES (IAS)
2015 TEHRAN DECLARATION
ON
SCIENCE, TECHNOLOGY AND INNOVATION: BUILDING HUMANITY'S COMMON FUTURE
adopted at Tehran, Iran
on
27 December 2015

1. Science, Technology and Innovation (STI) represent primary forces behind the advancement of human civilisation. Productivity gains and achievements of humankind have been derived chiefly from innovation based on scientific discovery and invention, technological and engineering development as well as the utilisation of S&T in all walks of life;

2. A new economic paradigm has emerged worldwide in which the most important factor is the intensive application of knowledge. Comparative advantage is increasingly determined by knowledge and innovation. This centrality makes knowledge a pillar of the wealth and influence of nations in the 21st century;

3. The creation and transfer of scientific knowledge are critical to building and sustaining socio-economic welfare and integration into the global economy. No region or nation can remain a 'user' of new knowledge but is expected to become a 'generator' of new knowledge. Closing the innovation gap is an indispensable role of universities in OIC and developing countries; promoting innovation must become as important as teaching and research;

4. Despite noticeable advances in some emerging economies, the knowledge and economic divides between OIC countries in general and the developed world have widened and are restricting the potential of science and technology to contribute to global development;

5. Against such a backdrop, countries of the Organisation of Islamic Co-operation (OIC) and other developing countries have to create the paradigm shift to again become a community that values knowledge and proficient in utilizing and advancing S&T to enhance their socioeconomic well-being as well as humanity's;
6. Despite political diversity, regional economic and scientific co-operation at the level of the OIC is essential to build capacities to harness modern science particularly through leveraging well established OIC S&T agencies including COMSTECH, the IDB, the ISESCO, the IAS as well as universities, national research centres and national academies of sciences. Such collaboration should not be at the expense of North-South collaboration in STI. Newly launched initiatives such as the Technology Bank for LDCs and the IPR Bank must also be leveraged as part of this effort;

7. The international development agenda manifested by the recently adopted Sustainable Development Goals (SDGs) with the cross-cutting STI component thereof, the international research agenda on climate science emanating from COP21 as well as other development targets such as water, food, energy and health security remain priority areas for OIC and developing countries and elsewhere;

8. For science, technology and innovation to become effective and transformational, a culture of science appreciation has to be engendered; people's talent and skills need to be enhanced essentially through promoting science, technology, engineering, mathematics and medicine (STEMM) education at all levels;

9. OIC and developing countries' governments have to act to establish long-term sustainable and balanced mechanisms for the funding of scientific research especially in the context of budgetary constraints;

10. Archetypal as it may sound, governments must improve the governance of science at the national level by building up their STI systems, engaging the science community, adopting and adapting promptly their national STI policies, developing innovative ways to raise Gross Expenditure on R&D to that elusive 1% by involving stakeholders from the private sectors, strengthening networks of centres of excellence, empowering women and young scientists, stimulating policy debates, exchanging knowledge of best practices and lessons learned and by strengthening local institutions;

11. Implementing the above national STI agenda requires the collaboration of all stakeholders. To ensure a greater chance of success, the 'Smart Partnership' principles and practices are proposed to be adopted by interested OIC and developing countries. 'Smart Partnership' can be an appropriate framework to enhance national and international endeavours to promote STI governance;

12. Many developing countries have been striving to achieve a balanced investment in science while respecting the need for both curiosity-driven and demand-driven research. To stimulate transformative science – which is unpredictable and requires openness to new and unforeseen pathways – and aim to promote a paradigm change in technological and social development, funding mechanisms that allow for innovative research should be part of funding schemes;

13. The IAS calls upon OIC and developing countries to smartly distribute national research expenditure to finance curiosity-driven research as well as demand-driven research with its two components; problem-solving at the national level and the development of products and services. Needless to say that the equitable participation of women, young scientists in the practice and application of science is an essential panacea in the success of this process. The 2015 UNESCO Science Report provides updated information on the participation of women in science;

14. The IAS recognises the crucial role of champions of STI; and the presence of a sound, independent scientific advisory system that can improve the quality of science-based decisions on policy-making. The IAS welcomes recent global trends for the more pronounced use of science in policy-making and the efforts to bridge the divides in the roles of scientists and policy makers. Needless to say the launch of national science academies in OIC countries where such entities do not exist is an imperative in this regard;

15. Notwithstanding the magnanimous efforts made by refugee-hosting countries in terms of the provision of shelter, food, water; to ensure the adherence to the universal right to education such governments are urged to provide education for all displaced people residing in their countries with the full support of the UN, the other relevant agencies and the international community.

IAS 2015 Tehran Conference
on
Science, Technology and Innovation: Building Humanity's Common Future

Tehran, Iran.
27 December 2015
15-Rabi al-Awwal-1437 Hijri

CONFERENCE REPORT

General

Under the patronage of His Excellency the President of the Islamic Republic of Iran, the Islamic World Academy of Sciences (IAS) convened its 20th International Science Conference in Tehran, the capital of the Islamic Republic of Iran, during 26-27 December 2015. The conference addressed the theme of *Science, Technology and Innovation: Building Humanity's Common Future*.

The conference was inaugurated by His Excellency Dr Sorena Sattari, Vice President of Iran for Science and Technology Affairs.

Organized at the Azadi Hotel Tehran, the IAS Conference was an open activity in which over 50 local and international participants representing over 25 countries participated. Among the participants were Fellows of the IAS, local scientists from the various universities, expatriate Iranian scientists as well as representatives of Asian, African and Western academies of sciences.

The 20th IAS Conference was organised by:

- Islamic World Academy of Sciences (IAS), Amman, Jordan;
- Vice-Presidency for Science and Technology, Tehran, Iran; and
- Embassy of the Islamic Republic of Iran, Amman, Jordan.

NOTES ON THE CONFERENCE*

"Few politicians understand the importance of science but Iran does not seem to have this problem."

Few could have better described Iran's determination to grow its knowledge based economy better than Professor Abdel Salam Majali, Jordan's former Prime Minister as he opened the 20th conference of the Islamic World Academy of Sciences. Economic sanctions, he added, seem to have been the proverbial silver lining as it enabled Iran to sets its sight on the things that matter to its economy and its people.

Using science to overcome local and global challenges was very much the theme of the morning's opening address from Dr Sorena Sattari, Iran's Vice-President for Science and Technology Affairs. With the peoples of so many Islamic nations victims of violence and extremism, their leaders had a responsibility to show that another world is possible. "Islam advanced knowledge when the world was ignorant," he said and it can and must do so again. Improving the low level of scientific collaboration between OIC nations, Dr Sattari added, was an important step to take in this respect.

At the same time, collaboration could also be a means to achieving solutions to problems that are common to many if not all developing nations, such as water scarcity.

*Contributed by Ehsan Masood, a science policy journalist and broadcaster.

Turning to Iran's STI system, Dr Sattari and later Dr Adnan Badran described the country's 20-year road map to knowledge based economic and social development. These have twin elements at its core. One is a massive programme of human resources development, including expanding universities and ramping up the numbers of young people at all levels of university education. The second is a significant programme of state support for knowledge-based enterprises.

Such support includes an innovation venture fund worth $1 billion, R&D tax credits, a network of science and technology parks and significant rollout of mobile broadband. The objective, according to Dr Sattari, is to give aspiring young Iranians (those at home and those living abroad) the tools with which to build, sustain and grow their high tech companies. These companies he added will eventually become the national and multinational employers of the future.

More efforts at boosting collaboration while nurturing young minds were also the twin themes of Dr Shaukat Hameed Khan's address, as he outlined plans for COMSTECH's next decade. Collaboration for the OIC states according to Dr Khan should not be seen as a luxury as so much of new science is the result of the work of large, interdisciplinary and distributed teams.

He outlined a number of planned projects for member states to consider. These include building and launching small satellites; creating a small network of observatories; establishing additional synchrotron sources in addition to SESAME in Jordan and to map the OIC marine environment.

A hint of caution was sounded by Tan Sri Omar, Malaysia's former chief scientific adviser and by Dr Rabia Hussain, professor emerita in the department of pathology at Aga Khan University in Karachi. The choice of whom to collaborate with, Dr Hussain said, was not necessarily a function of geography, and, in her own case, had been made on the basis of scientific excellence. "I wanted to set up a state of the art immunology lab and went where the top experts were to be found," she said, describing her own experiences of collaborating largely with colleagues from the US, the UK and India.

At the macro-level, Tan Sri Omar warned that the governments of OIC states did not as yet possess either the frameworks or the capacity to collaborate. He recalled the Vision 1441 document which was agreed after much debate in October 2003 and the 10-year plan of action signed in Makkah in 2005. Both of these documents failed to translate into national policies, Tan Sri Omar said, because "they belonged to everyone and hence to no one". There was no ownership of the outcomes and at the same time little or no accountability.

He also cautioned against misplaced confidence in ministries of S&T as agents of change. Often, they are politically too weak to effect change. At the same time they may be resistant if change means a different or perhaps diminished role. What is more effective is a level of oversight at the level of a head of state, or equivalent.

The far-reaching impact of such top-level ownership of STI policy was demonstrated in the first of the afternoon's talks. Dr Seyed Alireza Marandi, president of Iran's Academy of Medical Sciences, explained how a decision of the late Ayatollah Khoemeini shortly after the 1979 revolution resulted in the creation of a nationwide primary healthcare system.

Until the revolution, the nation had just 9 medical schools, 3 of which were in Tehran and virtually no facilities for modern healthcare in rural areas. Today, Iran has 80 universities teaching and researching medicine. Faculty numbers have jumped from 3000 to 18,000; and medical students number 40,000 from 6,000 in 1979.

As if to illustrate Tan Sri Omar's point, Dr Marandi explained that these gains were the result of moving responsibility for medical education out of the higher education ministry and into a combined ministry of health and medical education. This had the additional benefit of embedding community healthcare inside the work programmes of universities, when often universities can want to be aloof from local problems and concerns.

Moving from the local to the global Dr Abdallah Daar surveyed the landscape of grand challenges in public health. In the decade since the Bill and Melinda Gates Foundation encouraged donors to focus their resources on a smaller number of potentially bigger problems, Dr Daar, an adviser to the foundation, described some of the wins from this approach. They included vaccines for Meningitis and Dengue; and significant reductions in deaths from Measles, TB and HIV/AIDS. What was once seen as a death sentence (HIV) is now a chronic illness, which can be managed, Dr Daar explained.

However, he also warned of looming threats ahead unless action is taken now. These include Ebola for which many of the developing world's large megacities are ill-prepared to handle and mental ill-health, which far too many countries do not recognize as a problem in need of solving.

Professor Majali said that science and scientists have never been more needed than now. They embody what so many of our societies are missing: the values of trust, tolerance and optimism, and they must play their part.

PRESENTATIONS

The first day, Saturday 26 December 2015, started off with the inaugural session that included an address by H E Prof. Abdel Salam Majali, former Prime Minister of Jordan and IAS president, and an address by H E Dr Sorena Sattari, Vice President of Iran for science and Technology Affairs, Iran.

The conference was divided into a number of main sessions: Keynotes, Health for Humanity, Laureates', the African Take on Sustainable Development, and An Outlook on current Research.

The first day included keynotes by Dr Shaukat Hameed Khan, Coordinator General, COMSTECH, Pakistan, entitled *COMSTECH Revisited: Some Recommendations for S&T in the OIC Countries, 2016-25;* a presentation by Prof Adnan Badran FIAS, former Prime Minister of Jordan and Chancellor, University of Petra, entitled *Science Education and Research for Innovation in OIC Countries;* and a presentation by Tan Sri Prof. Omar Abdul Rahman FIAS, Founding President of the Academy of Sciences of Malaysia and former Science Advisor to Malaysia's Prime minister, who spoke about *Building Our Sustainable Common Future: The Smart Partnership Way.*

Dr Shaukat Hameed Khan stressed that Science and Technology will play a critical role in addressing contemporary challenges of development across multiple dimensions including poverty alleviation, better health, preservation of the environment, and ensuring food, water, and energy security, today and in the years to come.

The second session was entitled 'Health for Humanity' and included presentations by Dr Seyed Alireza Marandi, President, Iran Academy of Medical Sciences, Iran, on *The Health Landscape of Iran*; a presentation by Prof. Abdallah Daar FIAS, Professor of Public Health Sciences and Surgery, University of Toronto, Canada, entitled *Pertinent Issues in Global Health*; and a presentation by Prof. Rabia Hussain FIAS, Department of Pathology and Microbiology, Aga Khan University, Karachi, Pakistan, on *Emerging Infections Diseases: The Researchers' Guide.*

Prof. Daar, in his presentation, defined global health, equity, social determinants of health, innovations, research funding, and the challenges and opportunities of improving health systems and health care delivery. He used Ebola as an example of how we need to think globally, and pointed out some region-specific threats that cannot be ignored. He also talked about how to create a "Pandemic of Health" and highlighted recent trends in global health education.

The third session was the 'Laureates' session, where the two laureates of the Mustafa Prize (which is a Science and Technology award, granted to top researchers and scientists from OIC member states, biennially held in Tehran), were invited to speak about their research work. The laureates are Prof. Omar Yaghi and Prof. Jackie Ying.

Prof. Omar Yaghi, James and Neeltje Tretter Chair, Department of Chemistry, University of California, Berkeley, California, USA, presented a paper on *Understanding Metal Organic*

Frameworks. Prof. Yaghi's work encompasses the synthesis, structure and properties of inorganic and organic compounds and the design and construction of new crystalline materials. He is widely known for the discovery and for pioneering the development of several extensive classes of new materials: Metal-Organic Frameworks (MOFs), Covalent Organic Frameworks (COFs), and Zeolitic Imidazolate Frameworks (ZIFs). These materials have the highest surface areas known to date, making them useful in many applications. He has successfully taken the field of reticular chemistry all the way from discovery to applications, and changed the way scientists think about making and using new materials. This field is being widely studied by chemists, physicists, materials scientists and engineers in hundreds of laboratories in academia and industry worldwide.

The second prize laureate, prof. Jackie Ying, Department of Chemical Engineering, Massachusetts Institute of Technology (USA), presented her paper on *Stimuli Responsive Systems for Controlled Drug Delivery*. Prof. Ying's research has made a major impact in the field of nanostructured materials through major breakthrough in the synthesis of nanoparticles, nanocomposites and nanoporous materials. She has created a nano tool box that is successfully applied towards drug delivery, cell and tissue engineering, biosensors and diagnostics, pharmaceuticals synthesis, green chemistry and energy. Remarkably, besides her 340 publications in leading journals, she has over 150 primary patents issued or pending, many of which have been successfully licensed for commercialization.

Sunday 27 December 2015, the second day of the conference, included session four on 'The African Take on Sustainable Development', and included presentations by Prof. Mohammad Hassan FIAS, IAP Co-Chair and President of the Sudan National Academy of Sciences, Sudan**,** entitled *Promoting STI for Sustainability and Economic Transformation in Africa*; a presentation by Prof. Ousmane Kane, Senegal Academy of Science and Technology, on *International Collaboration in Science: The African Perspective*; a presentation by Prof. Berhanu Abegaz, African Academy of Sciences, Nairobi, Kenya**,** entitled *Science, Technology and Innovation in Africa: A Snapshot*, while the last presentation of this session was by Prof. Yves Quère, Académie des Sciences, France, entitled *A Brief Story of La main à la pâte.*

In his presentation, Hassan discussed the critical role of STI in promoting sustainable development for social and economic well-being in Africa, especially for the poorest and most vulnerable communities. He also focused on three important and interconnected issues: the global challenges that Africa faces in addressing critical sustainability issues, the new emerging opportunities for accelerated development initiatives in Africa, and the role to be pursued by institutions such as centres of excellence and academies of science to take full advantage of the opportunities to find STI-based solutions to sustainability challenges.

The last session of the conference, included three presentations; a presentation by Prof. Aini Ideris FIAS, Director, Corporate Strategy & Communications Office (CoSComm), Universiti Putra Malaysia, entitled *Swiftlets and their Gold Mine Saliva: Edible Bird-Nest - Towards Competitiveness and Sustainability;* a presentation by Prof. Mohammad Abdollahi FIAS, Department of Toxicology and Pharmacology, Faculty of Pharmacy, Tehran University of Medical Sciences, Iran, on *The Potential of Interdisciplinary Research in Toxicology*. The last presentation of the conference was by Prof. Liaquat Ali, Vice-Chancellor, Bangladesh University of Health Sciences (BUHS), Bangladesh, entitled *Biomedical Research and Large-Scale Health Care: A Perspective from Bangladesh.*

DECLARATION

At the conclusion of the 20th IAS Conference, the IAS adopted the IAS 2015 Tehran Declaration on Science, Technology and Innovation: Building Humanity's Common Future. The declaration particularly stressed that:

1. Science, Technology and Innovation (STI) represent primary forces behind the advancement of human civilisation. Productivity gains and achievements of humankind

have been derived chiefly from innovation based on scientific discovery and invention, technological and engineering development as well as the utilisation of S&T in all walks of life;

2. A new economic paradigm has emerged worldwide in which the most important factor is the intensive application of knowledge. Comparative advantage is increasingly determined by knowledge and innovation. This centrality makes knowledge a pillar of the wealth and influence of nations in the 21st century;
3. The creation and transfer of scientific knowledge are critical to building and sustaining socio-economic welfare and integration into the global economy. No region or nation can remain a 'user' of new knowledge but is expected to become a 'generator' of new knowledge. Closing the innovation gap is an indispensable role of universities in OIC and developing countries; promoting innovation must become as important as teaching and research;
4. Against such a backdrop, countries of the Organisation of Islamic Co-operation (OIC) and other developing countries have to create the paradigm shift to again become a community that values knowledge and proficient in utilizing and advancing S&T to enhance their socioeconomic well-being as well as humanity's;Despite political diversity, regional economic and scientific co-operation at the level of the OIC is essential to build capacities to harness modern science particularly through leveraging well established OIC S&T agencies including COMSTECH, the IDB, the ISESCO, the IAS as well as universities, national research centres and national academies of sciences. Such collaboration should not be at the expense of North-South collaboration in STI. Newly launched initiatives such as the Technology Bank for LDCs and the IPR Bank must also be leveraged as part of this effort;
6. For science, technology and innovation to become effective and transformational, a culture of science appreciation has to be engendered; people's talent and skills need to be enhanced essentially through promoting science, technology, engineering, mathematics and medicine (STEMM) education at all levels;
7. OIC and developing countries' governments have to act to establish long-term sustainable and balanced mechanisms for the funding of scientific research especially in the context of budgetary constraints;
8. Archetypal as it may sound, governments must improve the governance of science at the national level by building up their STI systems, engaging the science community, adopting and adapting promptly their national STI policies, developing innovative ways to raise Gross Expenditure on R&D to that elusive 1% by involving stakeholders from the private sectors, strengthening networks of centres of excellence, empowering women and young scientists, stimulating policy debates, exchanging knowledge of best practices and lessons learned and by strengthening local institutions;
9. The IAS calls upon OIC and developing countries to smartly distribute national research expenditure to finance curiosity-driven research as well as demand-driven research with its two components; problem-solving at the national level and the development of products and services. Needless to say that the equitable participation of women, young scientists in the practice and application of science is an essential panacea in the success of this process. The 2015 UNESCO Science Report provides updated information on the participation of women in science;
10. The IAS recognises the crucial role of champions of STI; and the presence of a sound, independent scientific advisory system that can improve the quality of science-based decisions on policy-making. The IAS welcomes recent global trends for the more pronounced use of science in policy-making and the efforts to bridge the divides in the roles of scientists and policy makers. Needless to say the launch of national science academies in OIC countries where such entities do not exist is an imperative in this regard; and

11. Notwithstanding the magnanimous efforts made by refugee-hosting countries in terms of the provision of shelter, food, water; to ensure the adherence to the universal right to education such governments are urged to provide education for all displaced people residing in their countries with the full support of the UN, the other relevant agencies and the international community.

As part of the follow-up action to the conference, the Academy will circulate the IAS 2015 Tehran Declaration to concerned individuals and relevant agencies throughout OIC and developing countries, so that measures are taken to put into action the ideas proposed at the conference. The IAS will also publish the complete proceedings of the conference online.

Address of
His Excellency Prof. Abdel Salam Majali FIAS
President of the
Islamic World Academy of Science

بسم الله الرحمن الرحيم
الحمدلله والصلاة والسلام على رسول الله المصطفى وعلى اله

Excellencies
Ladies and gentlemen
Dear friends

- Here in the city of Tehran, at the foot of the Elburz Mountains, we meet to venerate our great prophet, al-Mustafa (PBUH), and honour in his name scientists from far and wide – scientists who have excelled and achieved unique scientific feats;

- In our continuing quest to deepen and broaden the bonds and relations between OIC countries, we assemble here today. I wish to extend appreciation to Iran and its leadership; the leadership that envisioned and instituted the Mustafa Prize and initiated hosting this gathering;

- In a multidisciplinary fashion, typical of the Islamic World Academy of Sciences, and indeed typical of the great polymaths of our Islamic civilisation, allow me to discuss some ideas germane to our state of the world today: to humanity, and talk about the current turmoil in which we live;

- Let me start with a few words of wisdom for the benefit of the young among us and quote Omar Khayyam عمر الخيام who said that; “When I want to understand what is happening today or try to decide what will happen tomorrow, I look back;”

- Indeed, we in the Islamic world often look back, look back to our glorious past; we see human beings belonging to our great civilisation excelling in all fields, without due regard to their race, colour, creed, faith or indeed religious school of thought;

- Here, let me reiterate the words of Dr Ali Shariati علي شريعتي who said that ‘the enlightened soul is a person who is self-conscious of his **human condition** in his time and historical and social setting, and whose awareness inevitably and necessarily gives him a sense of social responsibility;’

- Our meeting today is a manifestation of our social responsibility towards ourselves, towards our countries, towards our religion and towards humanity;

- Today, violence on the world stage has reached unprecedented heights. We wake up every day expecting some act of violence, some act of terror! Sadly also, there always seems to be some connexion to our great faith, to Islam. Islam which states that: ‘If anyone slays a soul unjustly or for no overarching reason, it would be as if he slew the whole people.’

مَن قَتَلَ نَفْسًا بِغَيْرِ نَفْسٍ أَوْ فَسَادٍ فِي الْأَرْضِ فَكَأَنَّمَا قَتَلَ النَّاسَ جَمِيعًا

- The question thus rises as to why Islam has become associated with terror? Or indeed, why have Muslims (not Islam) become associated with terrorism?

- A UN panel, on March 17, 2005, described terrorism as any act 'intended to cause death or serious bodily harm to civilians or non-combatants with the purpose of intimidating a population or compelling a government or an international organization to do or abstain from doing any act;'

- International human rights law lays down the obligations of states to promote and protect human rights and freedoms of individuals or groups. So, how do we bridge the divide? How do we balance counter-terrorism and human rights?

- Let me note here that the Constitution of India addresses this issue. It allows a citizen to seek the punishment of anyone who shows the citizen disrespect "on grounds of religion, race, place of birth, residence, language, caste or community or any other ground whatsoever." The laws specifically forbid anyone from outraging someone's "religious feelings." Can we develop this notion, the notion of not crossing the line!

- In the twenty-first century we are living in the so-called 'globalized world.' Surely, we must build solidarity for a global civilization to live the spirit of Islam; which is for the whole world. This can help us to overcome the ignorance and prejudices which exist towards 'the other;'

- Counter-terrorism cannot only be carried out by force; it needs ideas and it needs dialogue. Afterall, aren't we Muslims the sons of the civilization of the 'word.' Aren't we the Ummah of (اقرأ); and our prophet was sent as 'mercy to all the worlds.'

وَمَا أَرْسَلْنَاكَ إِلَّا رَحْمَةً لِّلْعَالَمِينَ

- Talking of ideas and dialogue in the context of the Middle East, I say that we should all realize that we are destined to be neighbours forever. Why don't we put our differences aside and work together to achieve socioeconomic development for all our countries? Let us all try to seek peace for our peoples, promote harmony and good neighborly relations. In the words of Bishop Desmond Tutu, "Do your little bit of good where you are; it's those little bits of good put together that overwhelm the world." Or in the words of Gibran Khalil Gibran, "Tenderness and kindness are not signs of weakness and despair, but manifestations of strength and resolution;"

- Similarly, His Majesty King Abdullah II of Jordan, in a recent speech before the European Parliament, said that, "Humanity must arm itself with ideas, with justice and with economic and social inclusion;"

Ladies and gentlemen
Dear friends

- The murder by *Daesh* (داعش) of Jordan's pilot outraged all Jordanians, and horrified the world. Jordan's response has been swift and determined. At the same time, the danger of extremism must be seen for what it is: global. The threat is not only in Syria and Iraq. It has struck Libya, Yemen, Sinai, Mali, Nigeria, the Horn of Africa, Asia, the Americas and Australia. Europe too has suffered despicable attacks the latest of which struck in Paris very recently;

- Today, we are fighting a war against an expansionist ideology that feeds on hate; committing murder masked by religion to justify evil actions that no religion tolerates;

- Here, I invite young people to lead the way; they must be inspired by values that reject violence, create peace and build inclusive societies. Let me suggest three areas of importance for us to think about;

- **The first** key to global harmony is an international system that gives all people the respect they deserve. People ask me all the time: what about the mother of all quandaries or problems? Why is there no peace in the Middle East? Why doesn't the world defend Palestinian rights?

- Time after time, the peace process has stalled; more Israeli settlement building, more hopelessness for the occupied Palestinians and more bloodshed;

- This failure sends a dangerous message. It erodes trust and threatens world peace and has given the extremists a powerful rallying cry. They exploit the injustices and the lingering conflict, to build legitimacy and recruit foreign fighters across the world;

- **The second** is meaningful interfaith outreach, engaging peoples where they live. A dialogue of respect of all societies. Attacking and excluding others, insulting other peoples and their faiths and convictions is no way forward;

- The world must stop the global rise of Islamophobia. This poison is based on false ideas and plays into the hands of the extremists;

- Muslims have to illuminate what it really means to be a Muslim. Islam demands respect and caring for others. The Prophet Mohammad, peace be upon him, said: "None of you has faith until you love for your neighbour what you love for yourself;" Thirteen centuries before the Geneva Conventions, Muslim soldiers were ordered not to slay a child, a woman or an old person, not to destroy a tree, not to harm a priest, not to destroy a church;

- Muslims have a critical role in global understanding. Islam, like all faiths, commands mercy, peace and tolerance. It upholds the equal human dignity of every person — men and women, neighbours and strangers;

- **The third** quandary is economic: radicalisation thrives on economic insecurity and exclusion. To create stakeholders in a peaceful world, people need opportunities to fulfil their potential and build good lives. Helping them is a powerful message of respect;

- Speaking of economic hardship; Jordan – despite its meagre resources - has given shelter to 1.5 million Syrian refugees, which is 20 per cent of the population, over the past few years. This is more than the equivalent of China hosting the entire population of Indonesia of 250 million; Jordan is now the world's third-largest refugee host;

Excellencies
Ladies and Gentlemen

- Science and Technology is a tool of socioeconomic advancement. For science to blossom, it needs to be nourished and supported. This is not the case in the majority of OIC countries according to the latest UNESCO Science Report published on 10 November 2015.

- Moreover, we have to build the human capital which is active in science. Indeed, the critical mass of researchers is not there in many countries. Furthermore, most OIC countries hardly export any high technology products;

- The Report shows that less than 25 OIC countries have a national academy of sciences or play host to a supranational academy. This is an astounding fact, as academies of sciences, are strong advocates of science and impartial advisory bodies, have been at the vanguard of the scientific enterprise in many countries. They are also part of the S&T landscape in economically emerging economies such as Iran, Brazil, China, India, Malaysia and Mexico;

- Speaking of Iran, the country has always insisted on the civil nature of its nuclear programme and its compliance with the Nuclear Non-Proliferation Treaty. Civil nuclear science is a source of pride, in much the same way that Iranians are proud of their prowess in nanotechnology, stem cell technology and satellite technology;

- They say that every cloud has a silver lining. Indirectly, international sanctions on Iran have accelerated the shift to a knowledge economy and have helped to reconcile R&D with problem-solving and public-centered research. Moreover, it has galvanized innovation; and that can only be viewed as an outstanding success;

- Back at the OIC level, we cannot help but notice that OIC countries face an uphill challenge in terms adopting science-based development policies to raise their socioeconomic level. More importantly perhaps, we are not using science to combat our immediate health, water and energy problems;

- Let me provide a time-line for some of the difficulties that we have faced and have had to overcome in our history;

- For over a millennium, the Islamic world was a dominant global player in the domain of science and technology;

- The remarkable advancement made by the Islamic world in science ushered in the renaissance in Europe, yet during the 17^{th} and 18^{th} centuries, the Islamic world was dormant in terms of generating knowledge. Our patenting culture was non-existent and the decline of the culture of science contributed to our decline in science and technology;

- Suffice to say, a major factor that has contributed to the turmoil in our part of the world has manifested itself in the inability of economies to develop the appropriate value chain and create jobs required to meet the increasing number of graduates. That was further compounded by the inability of economies to achieve sustainable economic growth. In both domains, science and technology could have and can help;

Fellow Scientists
Dear Friends

- There is a problem when it comes to the relationship between scientists and technologists – on the one hand- and politicians, on the other;

- Few politicians understand the possibilities of science. Iran does not seem to have this problem though because His Excellency President Rouhani is a distinguished scholar in his own right, and thus exposed to the trials and tribulations of a scientist's career. Also, the fact that Iran has a Vice-

President responsible for Science and Technology in the person of Dr Sattari is a clear demonstration of the political will of the country to leverage science for prosperity and development;

- It is also true that the majority of scientists do not understand the restrictions of political office or have a clear idea of the political processes. Both camps recognize the importance of each other but there is no natural dialogue between the two because they come from different educational backgrounds;

- Some scientists are good communicators and could be considered as role models for others. Indeed many academics from Iran have excelled in not only projecting themselves internationally and have achieved very high status, but have also succeeded in building bridges between our civilisation and the West;

- Bridging the gap by creating better communications between the science and non-science worlds, between the scientific and the political communities, should be a priority;

Dear friends

- Where do we go from here? There is no denying that today, there is a feeling of hopelessness. However, optimism can best be described as a light in darkness which widens the horizon. The need to acquire other's trust is essential. In order for trust to exist between individuals, optimism must become part of their lives;

- We have to develop a culture of tolerance. We must utilize the tools at our disposal including science and technology to address our human needs, to realize a better future for our children and our grandchildren. Here, I would like to recall Almighty saying,

{يرْفعِ اللهُ الذينَ آمَنُوا مِنكمْ والذينَ أوتوا العلْمَ دَرجات} المجادلة الآية: ١١

- This verse tells us that Allah will raise in ranks those of you who believe and those who have been given knowledge. This is the motto that we should adopt for real development for all. To all of you I say, let us keep dreaming of peace and socioeconomic advancement, peace for all; let us all aim for peace and let us all work for peace.

Thank you.

COMSTECH REVISITED: SOME RECOMMENDATIONS FOR S&T IN THE OIC COUNTRIES, 2016-25

SHAUKAT HAMEED KHAN
Coordinator General, COMSTECH
Islamabad, Pakistan

Science and technology will play a critical role in addressing contemporary challenges of development across multiple dimensions including poverty alleviation, better health, preservation of the environment, and ensuring food, water, and energy security, today and in the years to come. This is the great game in the 21st Century and Muslims must take active part in this venture.

The salient features of the recommendations and basic priorities for S&T will be presented. Science is disruptive, and this must be recognised if we wish to attempt to build a scientific culture, which is generally missing in most OIC countries. The recommendations include, among other, upgrade of research infrastructure, big science multi-country initiatives, and venture funds for high technology start-ups, by OIC Member States. Other features include paying more attention to basic sciences, while attempting to build a knowledge and competitive economy, exchange of scientific workers, and implementation mechanisms these with timelines and costs.

PRESENTATION

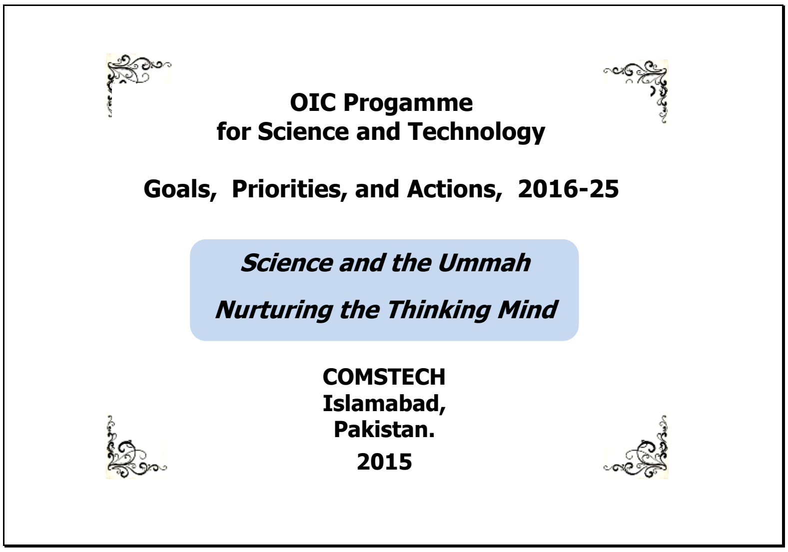

Figure 1. OIC Programme for Science and Technology.

Figure 2. Mandate of COMSTECH.

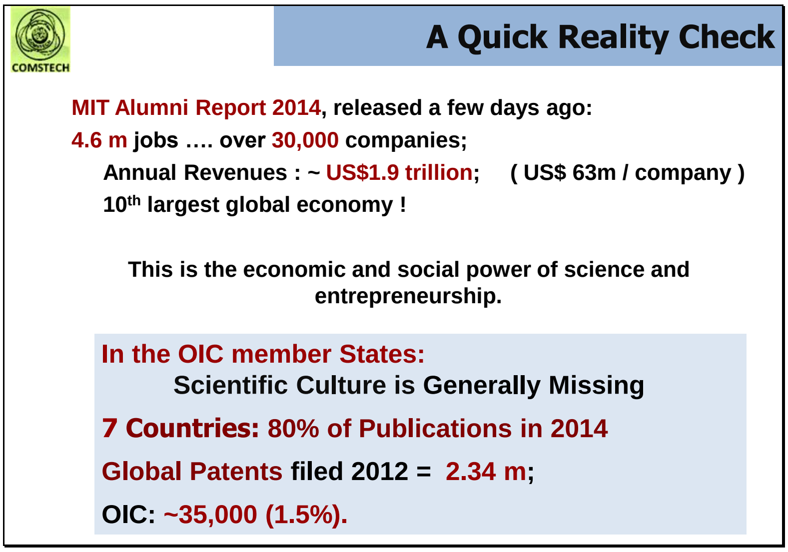

Figure 3. A Quick Reality Check.

Figure 4. Some Major COMSTECH Programmes.

COMSTECH

Comstech Investment In Research

Category	Research Grants	No of Countries
Res. Financing Within OIC	630	38
▪ Directly OR ▪ With TWAS ▪ With IFS ▪ With WHO-EMRO ▪ With ISESCO ▪ Inter Islamic Networks ▪ IWAS	COMSTECH Financial Assistance for: ➢ Conferences /Thematic Workshops ▪ 183 in Islamabad in Last 20 Years ▪ 475 participants, 32 countries ➢ Travel Grants ▪ Several hundred	
Over US$ 14 million spent		

Figure 5. COMSTECH Investment in Research.

COMSTECH

COMSTECH Activities (*continued*)

- COMSTECH Directory of Active Scientists in OIC Member States and their Recent Scientific Publications up to 2012
  - Massive Publication: Internationally Abstracted Information from Thousands of Scientific Journals Arranged According to Fields and Sub - Fields Offering Library Search Facility.
  - Wide Acceptability : Active Role In Creating Joint Programs & Collaborations Among the OIC Scientific Community.
- 16 *Volumes* Completed (21,997 pages)
  - http://www.comstech.org with electronic search facility.

UPDATE CURRENTLY UNDER WAY

Figure 6. COMSTECH Activities.

COMSTECH Inter-Islamic Networks

#	Network / Location	Status
1	Water Resources Dev.& Management (INWRDAM), Amman, Jordan	Active
2	Space Sciences and Technology (ISNET), Karachi, Pakistan	Active
3	Oceanography (INOC), Izmir, Turkey	Active
4	Tropical Medicine (INTROM), Kuala Lumpur, Malaysia	Active
5	Information Technology ; (INIT), Islamabad, Pakistan	Active
6	Biosaline Agriculture (INBA); Dubai, UAE	Active
7	Virtual Universities (CINVU); Tehran, Iran	Active
8	Science and Technology Parks (INSTP); Rasht, Iran	Active
9	Nano-Technology (INN); Tehran, Iran	Active
10	Environment (INE); Khartoum, Sudan	Suspended
11	Veterinary Science Research (INVSR); Khartoum, Sudan	Suspended
12	Renewable Energy Sources (INRES); Niamey, Niger	Suspended
13	Genetic Engineering & Suspended by Executive Committee at Present	led

Figure 7. COMSTECH Inter-Islamic Networks.

Pakistan's Space Programme & ISNET:

info@isnet.org.pk

- 16 Annual Seminars & Workshops
- 27 Training Courses on RS & GIS
- 6 Advanced Technology Training Courses
- 2 Trainers Graduated from ITC, Netherlands under ISNET Train the Trainer (TTT) Programme launched in 2011

- 25 Countries
- 350 Research Papers Presented
- 275 Scientists And Researchers Underwent Training
- 1300 Professionals Attended The Seminars & Workshops

Figure 8. Pakistan's Space Programme & ISNET.

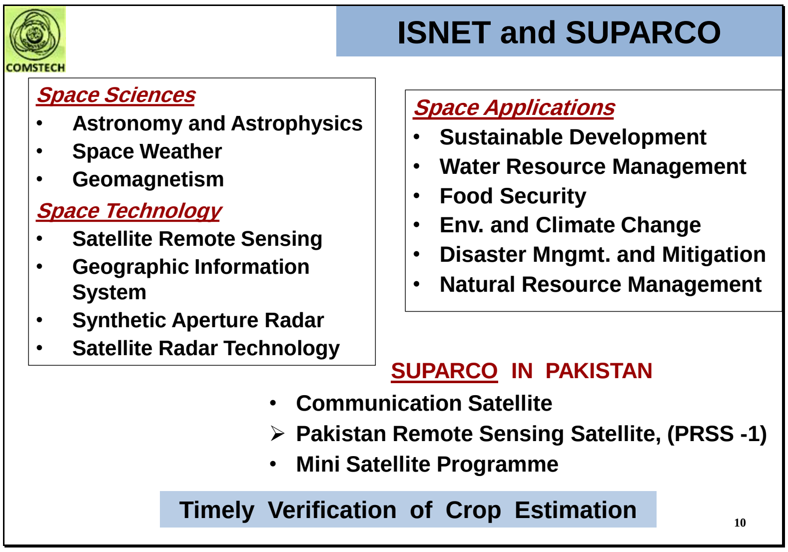

Figure 9. ISNET and SUPARCO.

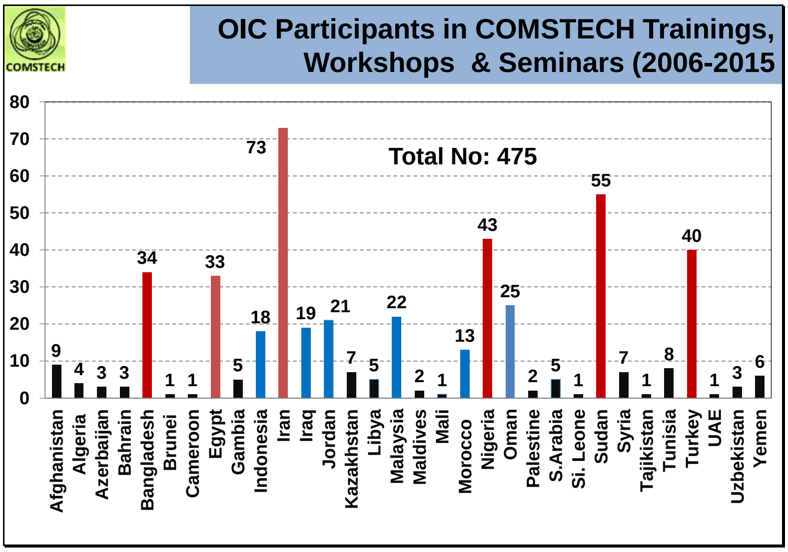

Figure 10. OIC Participants in COMSTECH Trainings, Workshops & Seminars (2006-2015).

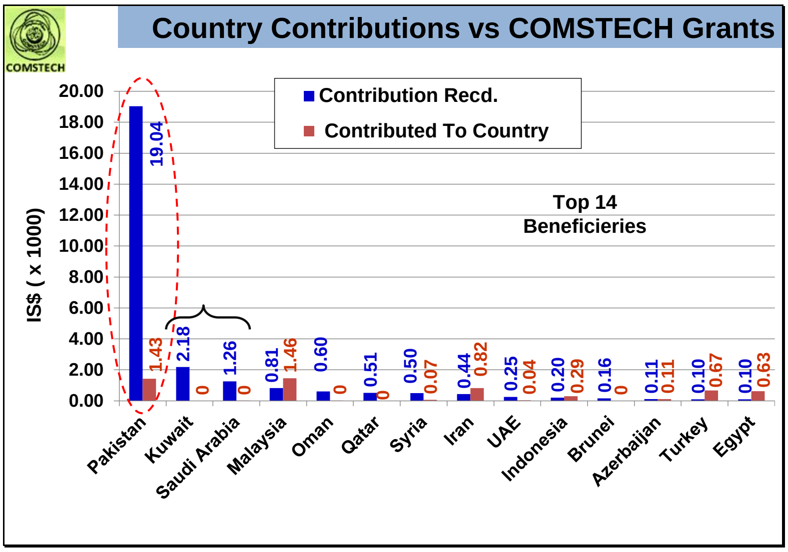

Figure 11. Country Contributions vs COMSTECH Grants.

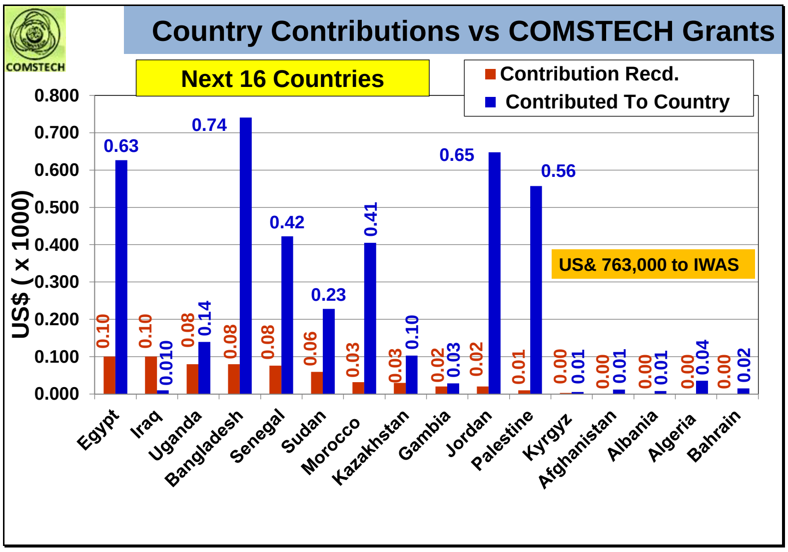

Figure 12. Country Contributions vs COMSTECH Grants.

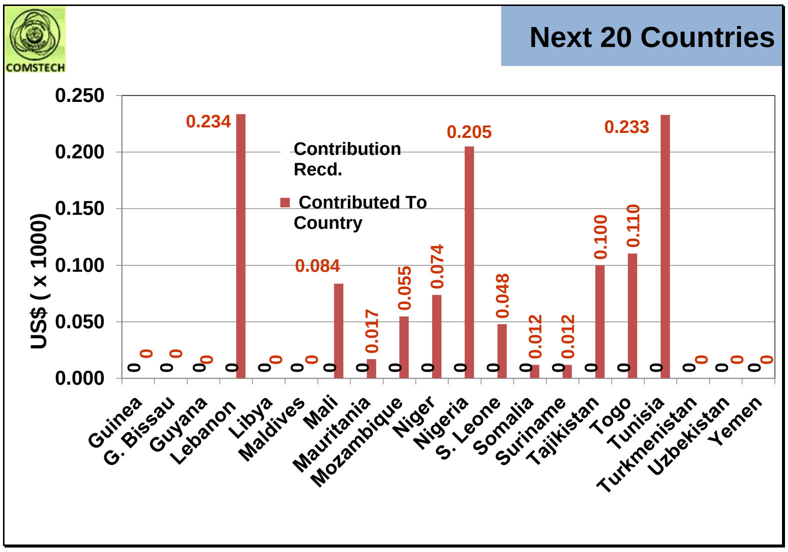

Figure 13. Next 20 Countries.

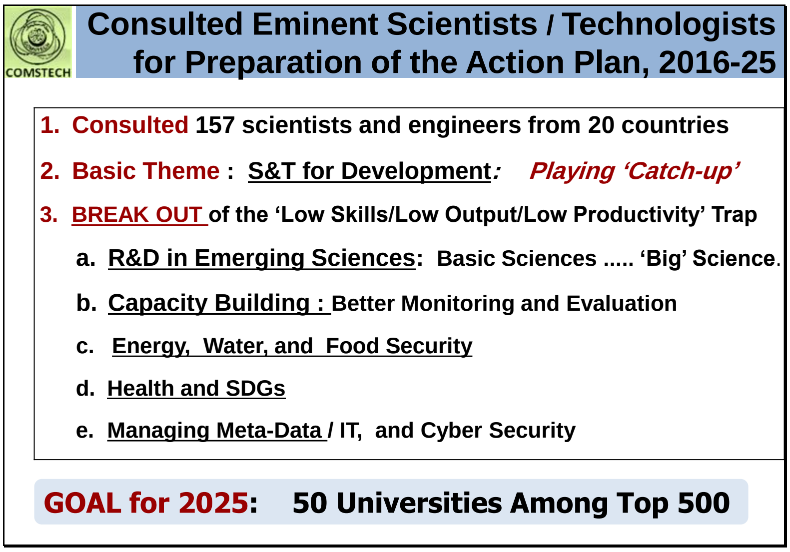

Figure 14. Consulted Eminent Scientists/ Technologists For Preparation of the Action Plan, 2016-25.

COMSTECH

➢ Basic Priorities and Goals, 2016 – 2025

1	Nurturing the 'Thinking Mind' ; Build a Scientific Culture.
2	Making People Employable; Education and Skills.
3	Ensuring Healthy Lives
4	Security of Water, Food and Agriculture; Gene Banks

➢ Infrastructure and Research: (~US$ 1100 m)

1	Infrastructure / HR Development / Research Grants
2	➢ Ibn Al Haitham Award ...... Mobility of Scientists ➢ Lindau Nobel Laureates Council; 1st 11 being sent June 2016
3	Training of Technicians in Research Labs and Industry
4	Energy: Efficiencies, Nuclear ; Ren. Energy, Storage Systems (RE)
5	Big Data, Cyber Security and the Digital Economy
6	Improved Laboratory Equipment / Aids

➢ Venture Cap./ Angel Funds for Hi-Tech SMEs: US$ 160m

Figure 15. Basic Priorities and Goals, 2016-2025.

COMSTECH

'Joint' Big Science Programmes

1	Space, Astronomy, Accelerators and Synchrotrons
2	Mapping of : Marine Environment of OIC States (10 m Sq Km) and Minerals Directory of OIC States
3	High Performance Computer Facilities
4	The Challenge of Climate Change
5	Consortiums: • Communications and Industrial Equipment • Equipment for Energy and Power • Joint Manuf. of Teaching Aids & Laboratory Equipment
6	Training of Managers for Large Scientific Projects
7	Urabanisaton and Planning of Megacities
8	Harmonising Trade Laws, Industrial Standards, and IP Laws

Figure 16. 'Joint' Big Science Programmes.

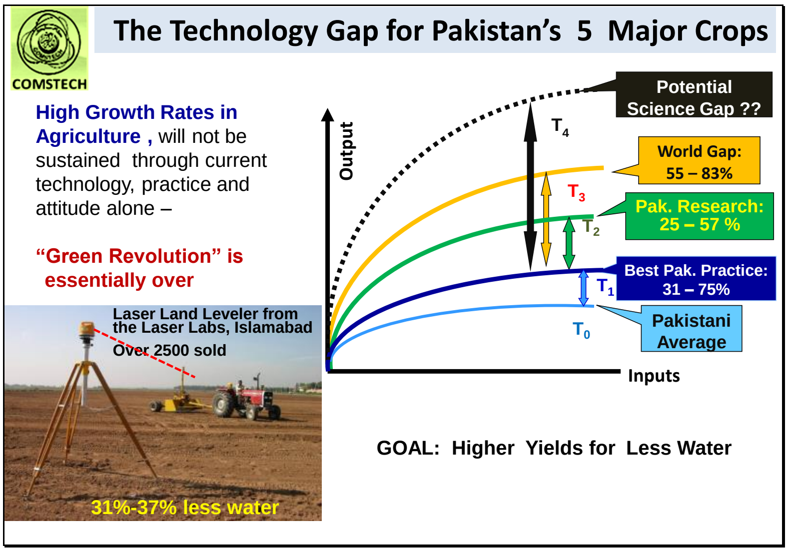

Figure 17. The Technology Gap for Pakistan's 5 Major Crops.

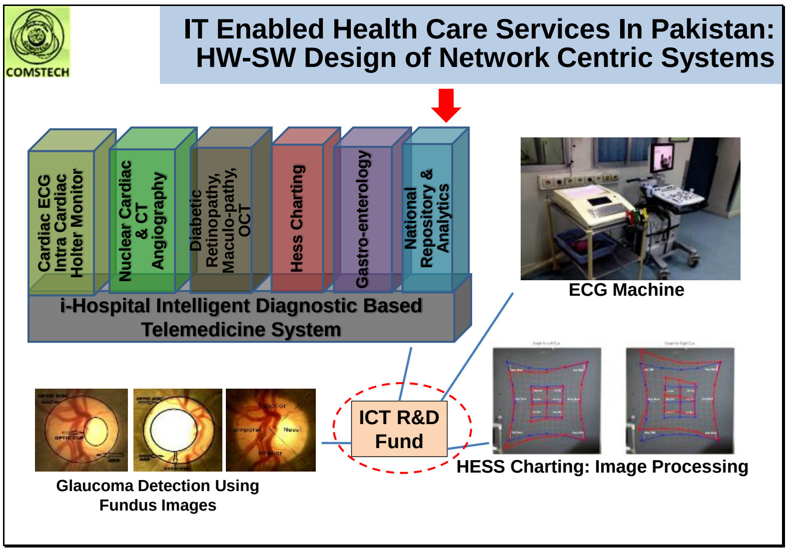

Figure 18. IT Enabled Health Care Services in Pakistan.

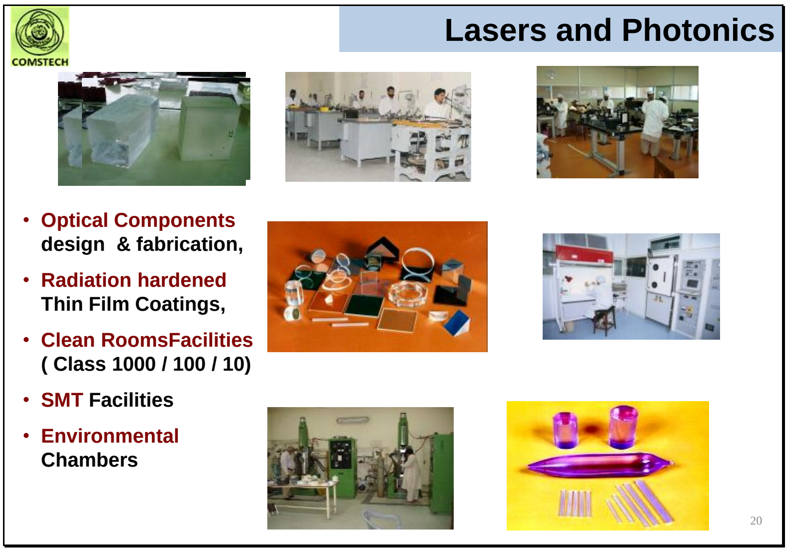

Figure 19. Lasers and Photonics.

Figure 20. Complete Laser Systems.

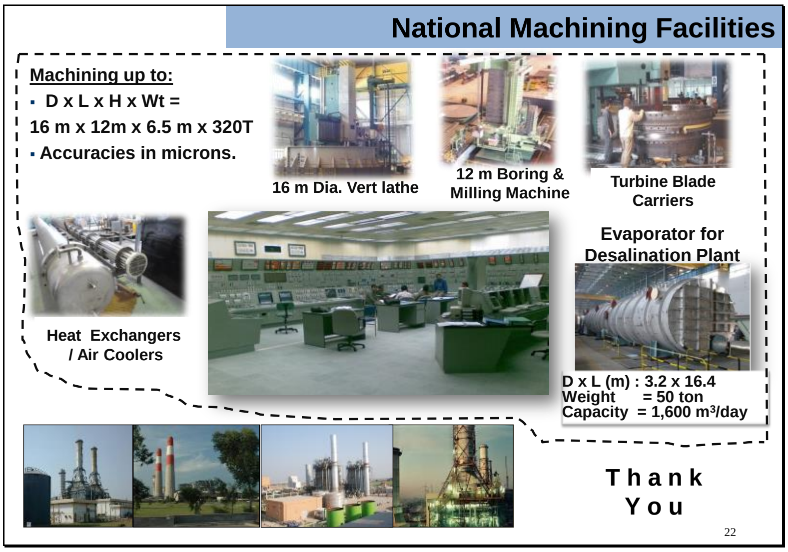

Figure 21. National Machining Facilities.

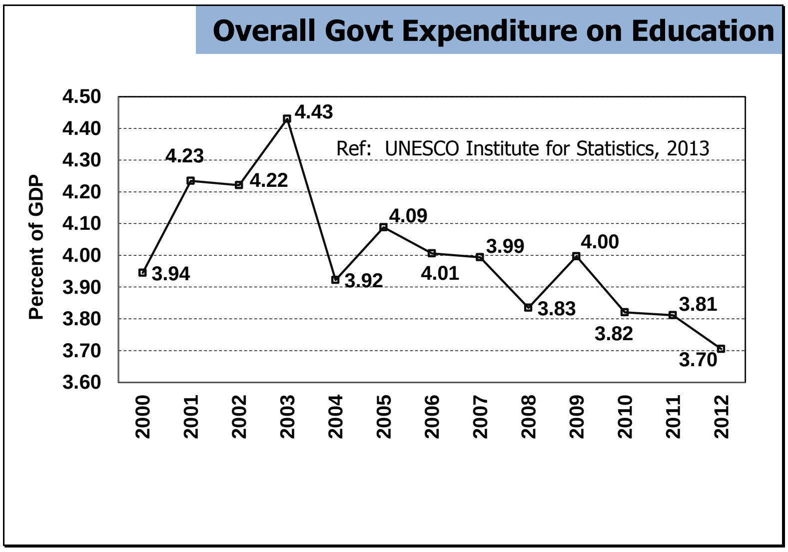

Figure 22. Overall Government Expenditure on Education.

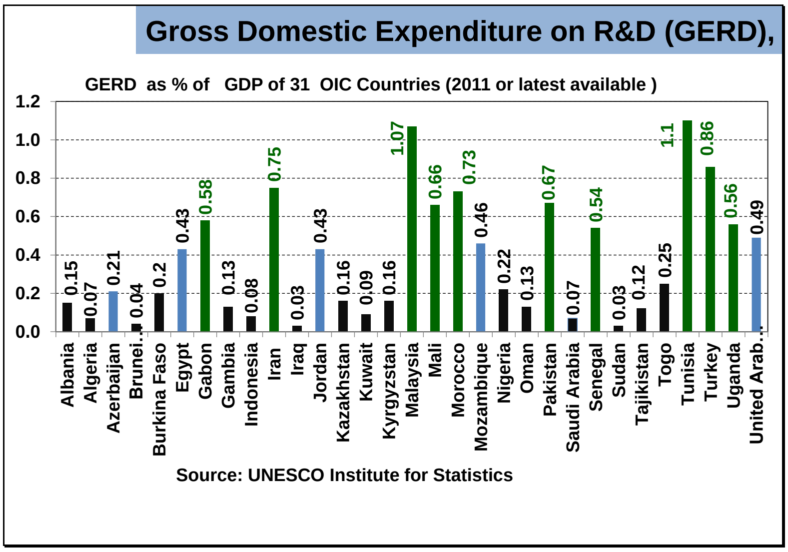

Figure 23. Gross Domestic Expenditure on R&D (GERD).

Science Education and Research for Innovation in OIC Countries

ADNAN BADRAN FIAS
Former Prime Minister of Jordan
Chairman of the Board of Trustees/ University of Jordan
The Chancellor/ University of Petra
President of Arab Academy of Sciences
President of the Board of AFED in Beirut
Former Deputy Director General of UNESCO-Paris
Amman, Jordan

ABSTRACT

Science Education, technology and innovation, throughout basic education is a perquisite for sound higher education and R&D for development. Therefore, literacy in science and skills in mathematics are essential for achieving science education for all. Countries who have achieved the goals of *Education for All* since its inception 1990 should move to a new era of **science education for all,** so as to have the knowledge society and knowledge economy abreast of vast scientific and technological advances, understanding nature of science, concepts, principles, theories and interacting with universe: using problem-solving, analysis, critical thinking and logics which will lead to innovations, discovery and decision making of friendly use of environmental and human resources.

Science, technology and society (STS) is not only learning to live together, but also interacting and learning to live with nature.

Looking at OIC countries, there are success stories where literacy rate in some countries like *Iran*, *Malaysia* and *Turkey* and in the Arab states such as *Lebanon*, *Tunisia*, *Jordan* and *United Arab Emirates* have reached 98% comparable to developed countries, but the gap in quality of education is apparent.

Iran has 92 universities, 512 on-line branches and 56 R&D institutes with 3.7 million students; one million of them in medical and 31% of them in engineering considered to be one of the highest rates in the world. There is no doubt that some of OIC countries have shown progress in science and converting technology into innovations, which resulted in creation of wealth, prosperity and enhancing sustainable development, but there is an urgent need for other countries to catch up, to invest in science and technology and upgrade their human resources in capacity building and unleashing the human brain potentials for discovery, innovation and entrepreneurship, to raise their capita-income and overcome unemployment and poverty.

PRESENTATION

For Science Education, technology and Innovation, basic education is prerequisite for a sound higher education and R&D for development, it should achieve the goals of Education for All:

GOAL 1: Early childhood care & education
Improving comprehensive early childhood care & education.

GOAL 2: Universal primary education
Ensuring that by 2015 all children, have access to and complete free and compulsory primary education of good quality.

GOAL 3: Youth & Adult skills
Learning needs of all young people and adults are met, appropriate learning and life skills programs.

GOAL 4: Adult literacy
Improvement in levels of adult literacy by 2015, especially for women.

GOAL 5: Gender equality
Eliminating gender disparities in primary and secondary education.

GOAL 6: Quality of Education
Improving all aspects of the quality of education and ensuring excellence.

2

Badran, Adnan: Science Education & Research for Innovation in OIC Countries

Figure 1.

For fostering science education, one has to analyze:

- Lack of interest by the young.
- Lack of qualified teachers.
- Gap between modern science and current science education and educators.

We need to:

- Start at early childhood for motivating pupils to inquiry and discovery and develop critical thinking, logics, problem-solving through interactive–blended learning using math and science.
- Deep reforms in math and science education using multimedia to promote innovations and entrepreneurship
- Change the classroom into interactive facilitation of development of skills through group participation for solving the buzz and working for practical solutions.
- Promote free thinking to develop the minds to new horizon of learning at the pre-university level (K – 12)
- Bridge the gap between scientists and science educators.

Badran, Adnan: Science Education & Research for Innovation in OIC Countries

3

Figure 2.

We've got to realize that:

- Science and technology skills are truly the catalyst for change and development.
- Capacity building in S&T is the future for economic, social and quality of life.
- Science and technology literacy is imperative.
- Science education should fulfill personal, societal, academic and career needs.
- Science for all "continuously abreast of vast scientific and technological advances".
- Understanding nature of science, concepts, principles, theories and interacting with universe: using problem-solving, analyses, critical thinking, logics, and making decisions. This will lead to exciting views of nature and universe leading to innovations and discovery.

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Figure 3.

Four pillars of literacy in science:

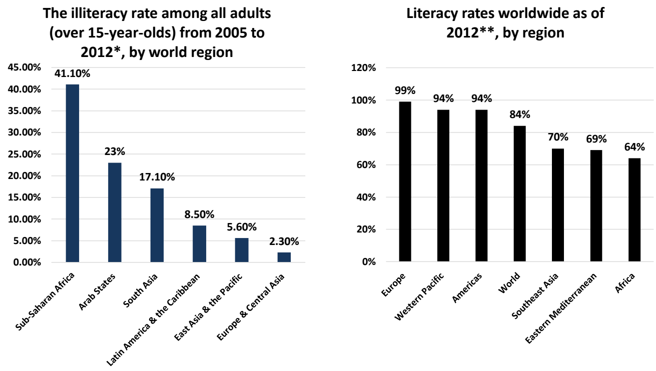
- Nature of science: **to be**
- Knowledge & skills of science: **to know**
- Science through doing technology: **to do**.
- Science, technology and society (STS): **to live and interact together**.

Leads to:

- Prosperity**.**
- Creation of wealth.
- Appreciation of nature and universe.
- Joy of life-long education and enlightment.
- Creating culture of scientific-method toward participatory democracy.
- Enhancing sustainable development and friendly–environmental-use.
- Empowerment of women in a modern world.

Badran, Adnan: Science Education & Research for Innovation in OIC Countries 5

Figure 4.



- Source: UNDP, ID 262886

** Source: WHO, ID 280189

6

Badran, Adnan: Science Education & Research for Innovation in OIC Countries

Figure 5.

Facts about Iranian Society

Higher Education:

Iran has 92 universities, 512 online University branches, and 56 research and technology institutes around the country. There are currently some 3.7 million university students in Iran. One million of them are medical students. 31% of them studying in Engineering and construction programs, one of the highest rates in the world.

In 2011, majority of students (65%) enrolled in Iranian Universities were women. Each year, 20% of government spending and 5% of GDP goes to education, a higher rate than most other developing countries. 50% of education spending is devoted to secondary education and 21% of the annual state education budget is devoted to the provision of tertiary education.

Literacy rate:

In 2006 the United Nation announced Iran as the 9th in line of the highest rate of literacy among all nations. 82% of the Iranian adult population is now literate, well ahead of the regional average of 62%. This rate increases to 97% among young adults (aged between 15 and 24) without any gender discrepancy.
A *Literacy Corps* was established in 1963 to send educated conscripts to villages. During its first 10 years, the corps helped 2.2 million urban children and 600,000 adults become literate.

Source: www.forusa.org

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Badran, Adnan: Science Education & Research for Innovation in OIC Countries

Figure 6.

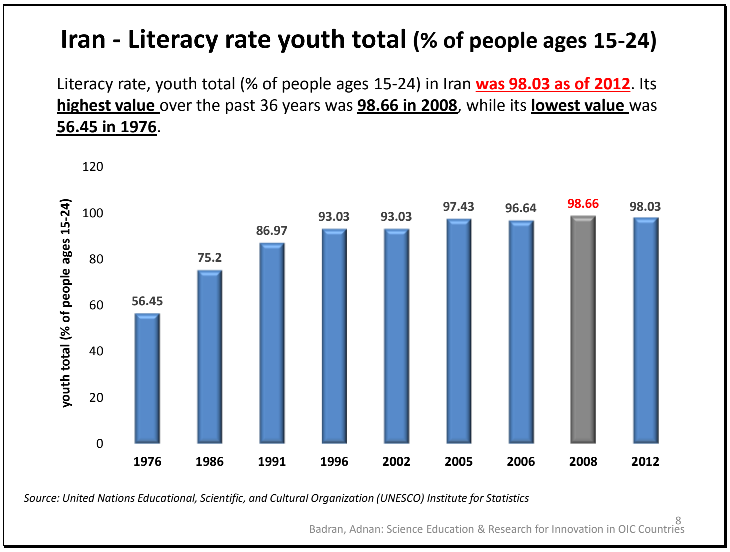

Figure 7.

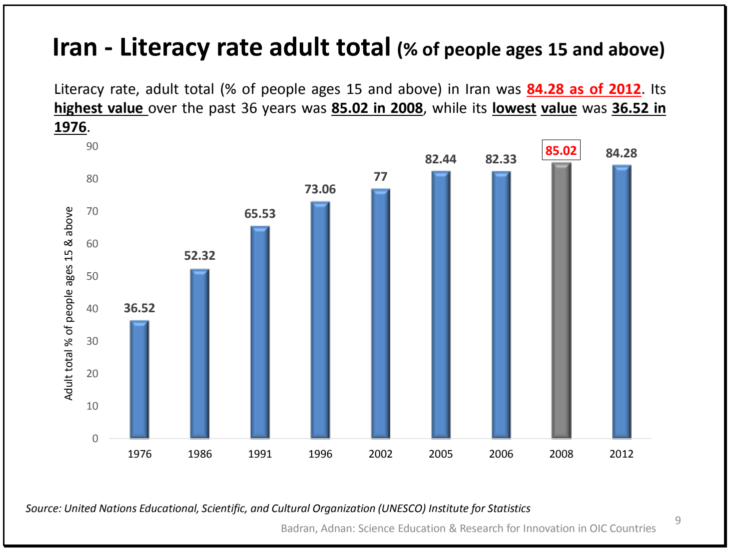

Figure 8.

Status of science education in the Arab region:

I. Access to science education:

- Hi level of illiteracy, females in particular in Morocco, Egypt and Yemen (40%).
- Arab region is not catching up with new frontiers of science and technology.
- Consumer-based turn-key technology: created by others.

II. Quality of science education:

- Statistics show there is an increase in students enrollment in basic, general and tertiary education, but a huge decline in quality.
- Outdated curricula and pedagogy dominated by religious dogmatic memorization curricula.
- Emphasis on theoretical science dictation neglecting hands-on practice.
- Outdated teachers, disseminators rather than facilitators, low salary failing to attract good teachers, lack of training and updating skills of teachers i.e. continuing education.
- Lack of funds to improve science education.

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Figure 9.

Status of science education in the Arab region: *continue*

III. Science education reforms:

Some countries are making reforms by their own experts as Jordan, Morocco, Tunisia, Lebanon. Others are adapting UNESCO and ALECSO framework. Gulf States have adapted science education reforms developed in the West and some have contracted experts from abroad to reform their science education.

1. Science quality curricula:

- at present, theoretically focus and less experimental and practical.
- at present, less focus on investigation, problem–solving and thinking skills.
- at present, absence of creativity, innovation and entrepreneurship.
- at present, myth and superstition.
- at present, facts without applying knowledge on solving-problems.
- at present, lack of inquiry with no emphasis on local environmental problems associated with science and technology.

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Figure 10.

Status of science education in the Arab region: *continue*

2. **Achievement of students in math and science:**
   - World indicator on quality of science education is the achievement of pre-college students in math and science.
   - Trends in International math and science study (TIMSS) developed by the international association for the evaluation of educational achievement (IEA), show the Arab states lag behind. Only Jordan achieved International average while Bahrain, Palestine, Egypt, Saudi Arabia, Morocco and Lebanon scored lower rank of international average. (2003), Jordan fell behind at later years.
3. **Quality of Science teachers:**
   - Lack by teachers to use reflection and problem solving.
   - Teachers are conserving the status-quo rather than becoming agents of creativity.
   - Overloading students with information and memorization rather than structuring knowledge to develop skills.

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Figure 11.

Status of science education in the Arab region: *continue*

4. **Improve quality of science education:**
   - Updating teachers: in-service and out-service training and continuing education in skills and pedagogy.
   - Computer literacy.
   - Follow-up and assessment.
   - Hand-books and teacher guides, training of teachers on e-learning, interactive blended learning.
   - Hands-on to create innovators and inventors.

   From results of TIMSS in countries like Singapore, Taiwan, Korea, Japan, England, Ireland and Finland, it is useful to derive lessons for reforms and improvement of science education in the Arab states.

Badran, Adnan: Science Education & Research for Innovation in OIC Countries

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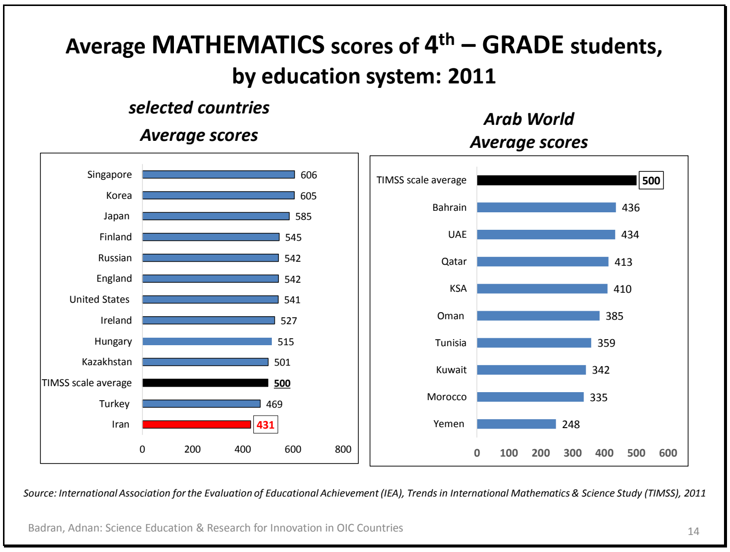
Figure 12.



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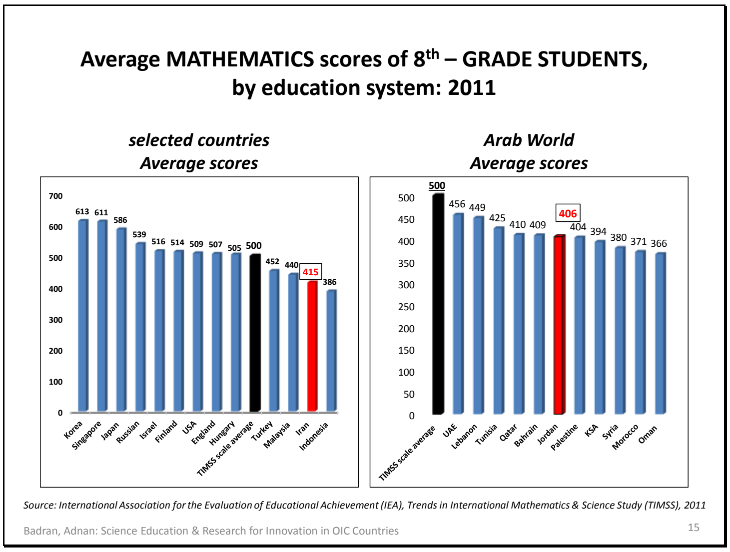

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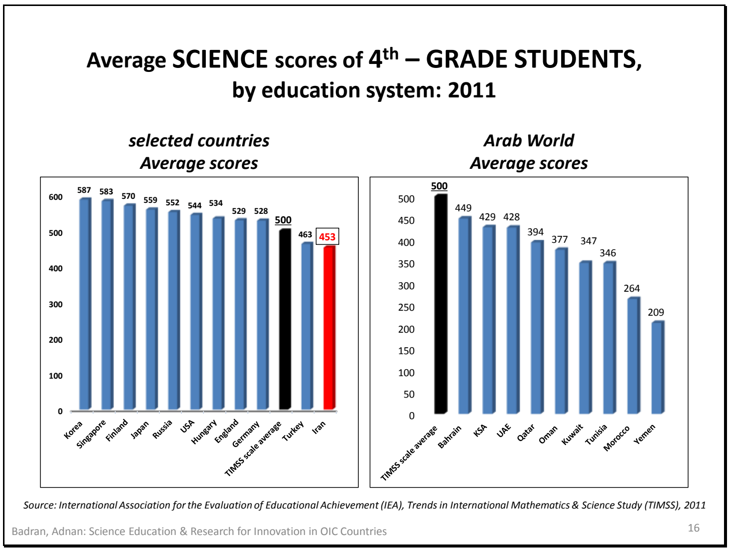

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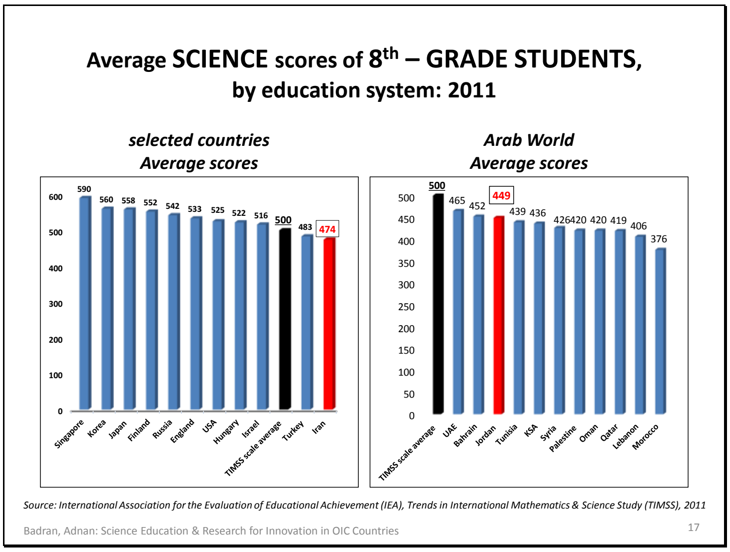

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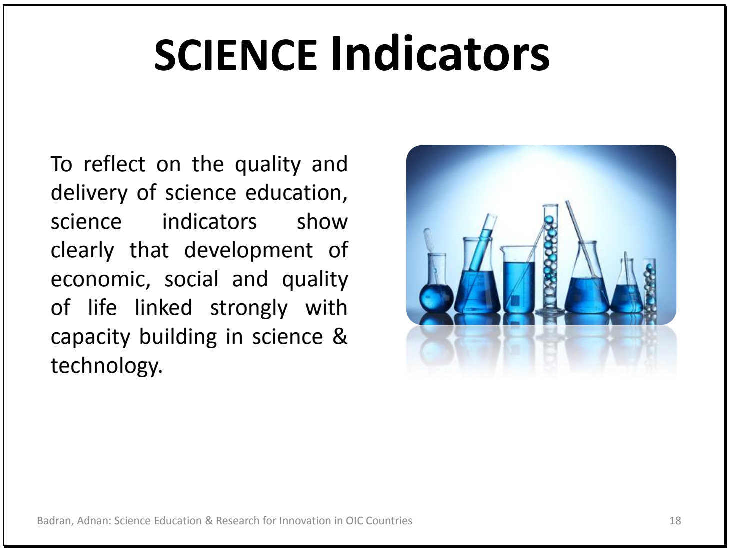

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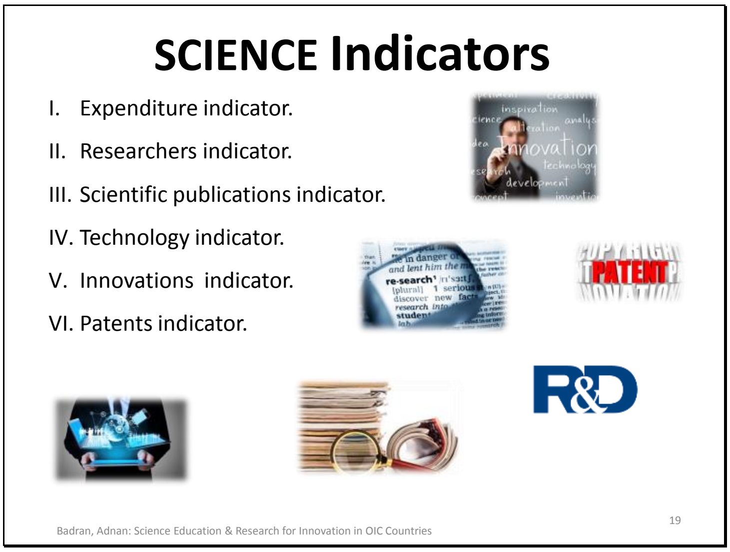

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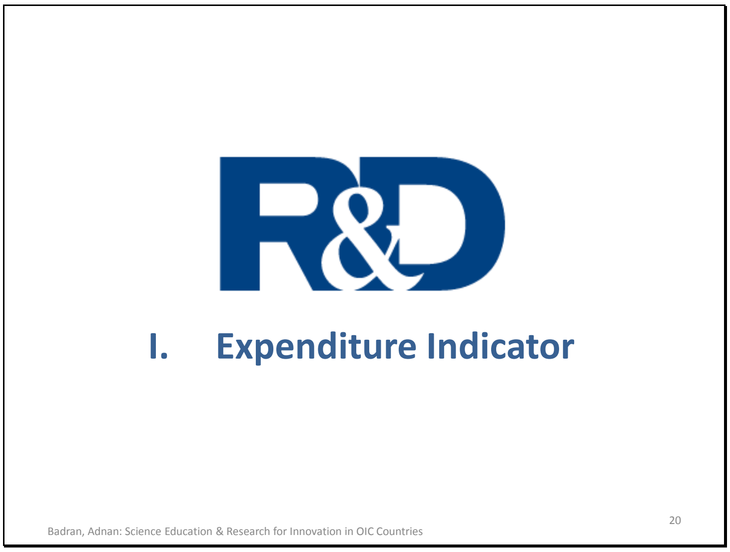

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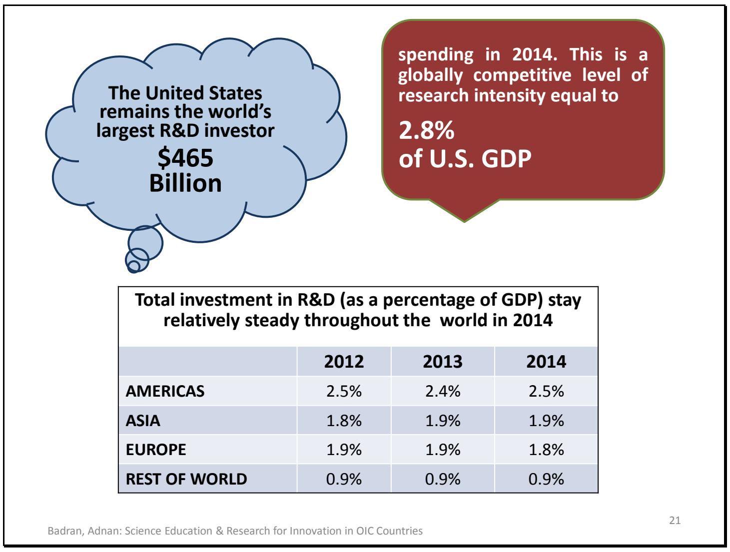

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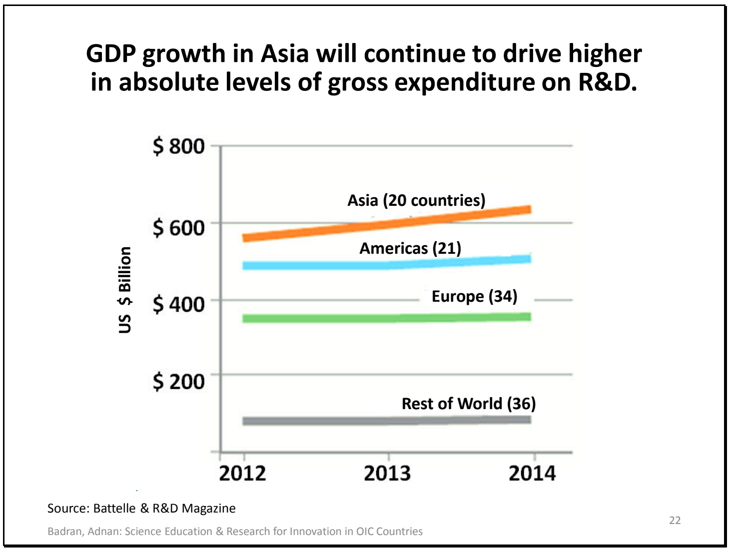

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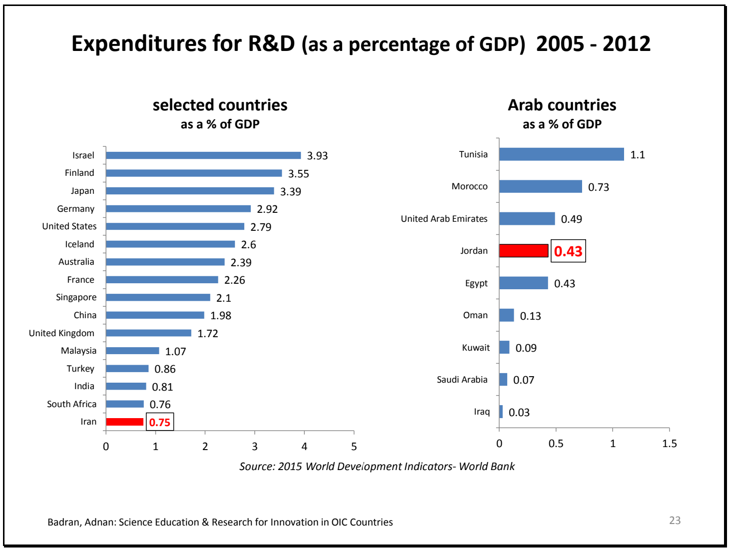

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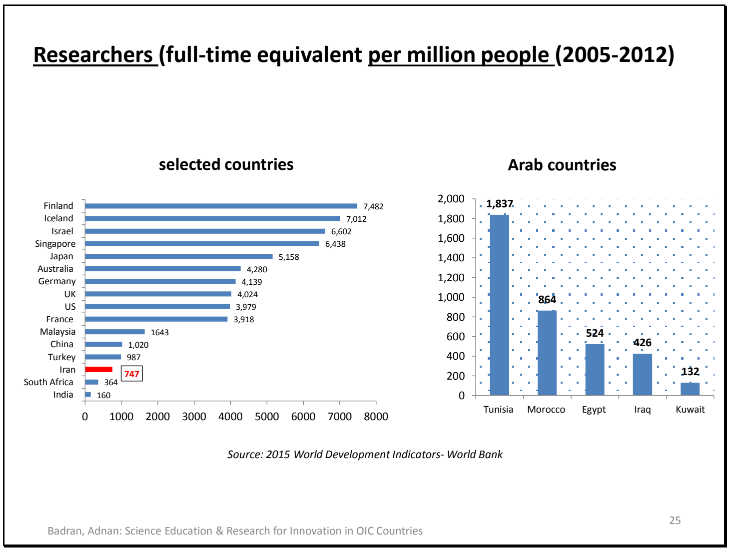
Figure 23.



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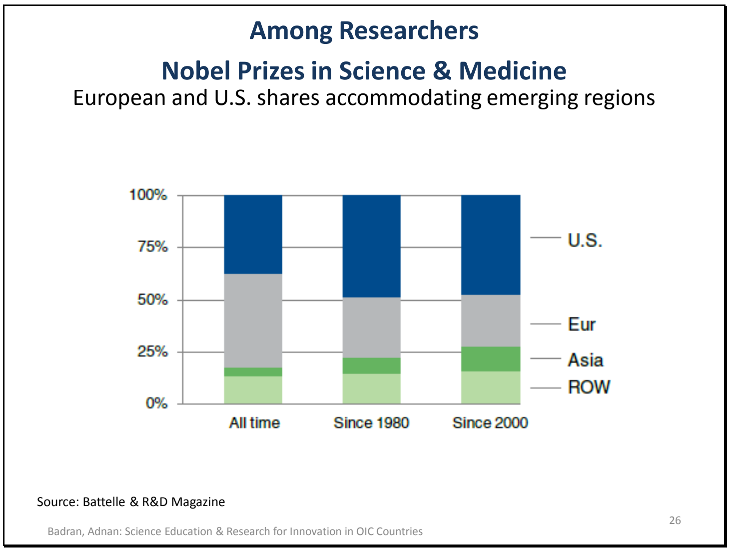
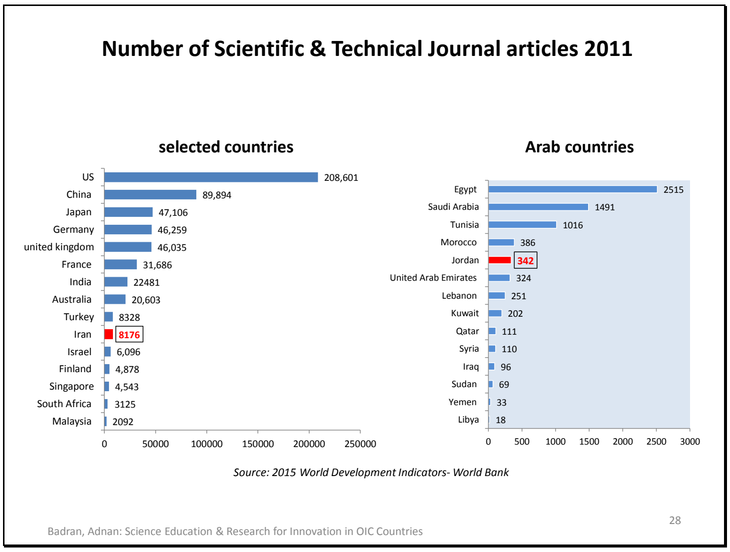


Figure 25.

Figure 26.



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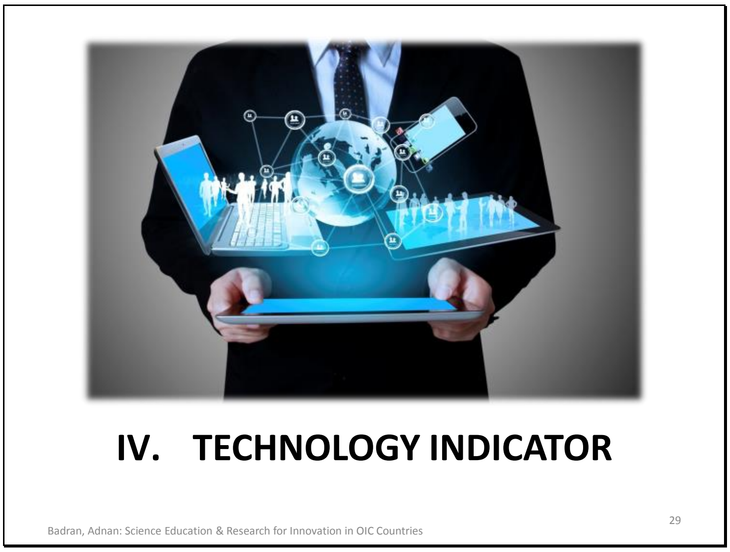
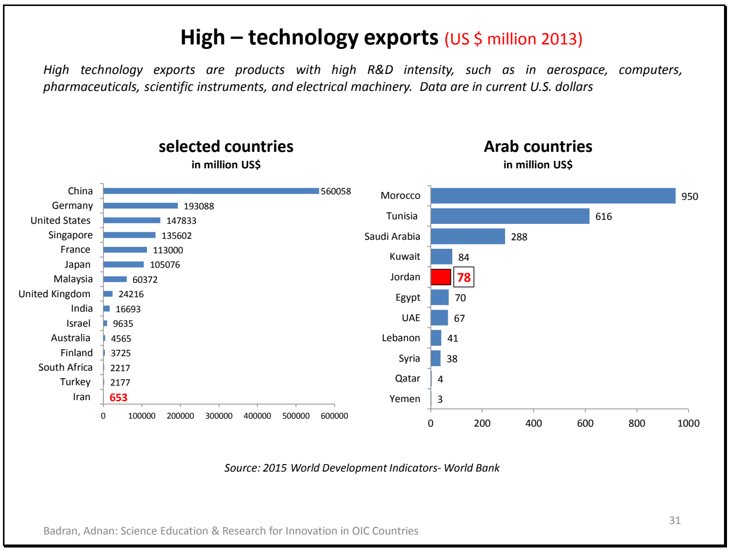


Figure 28.

Figure 29.



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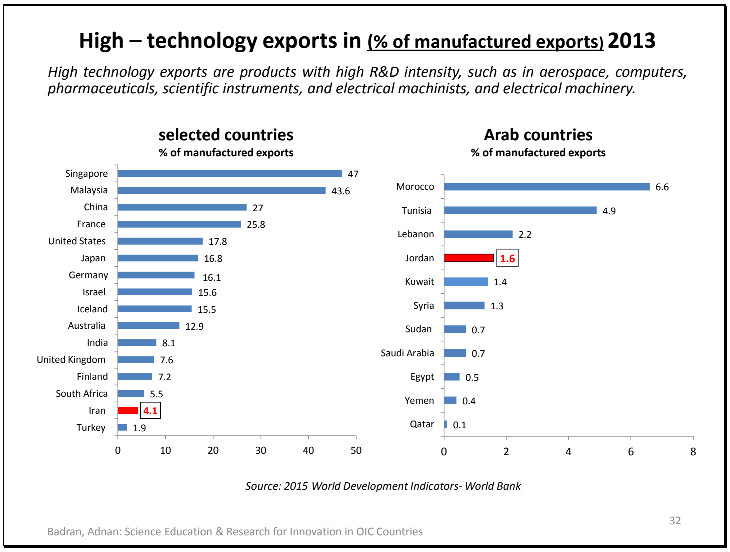
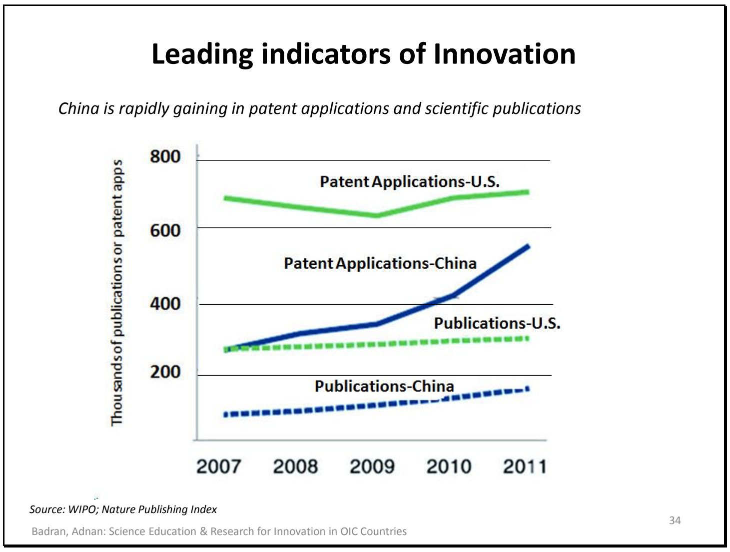


Figure 31.

Figure 32.



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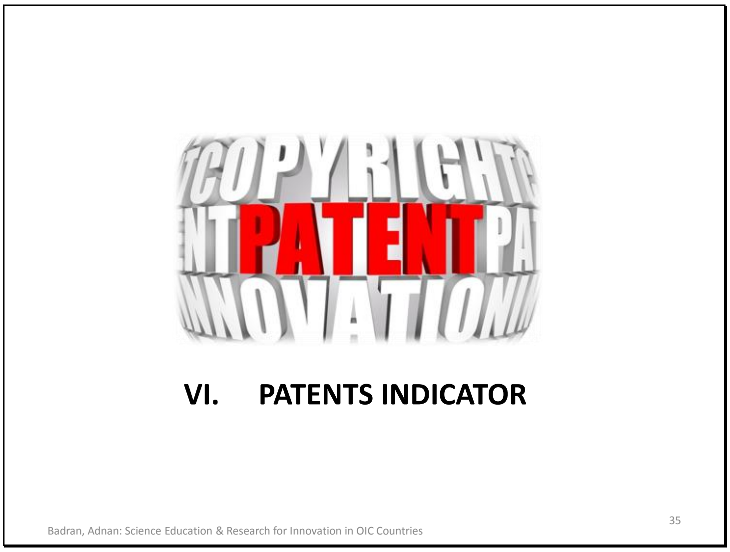

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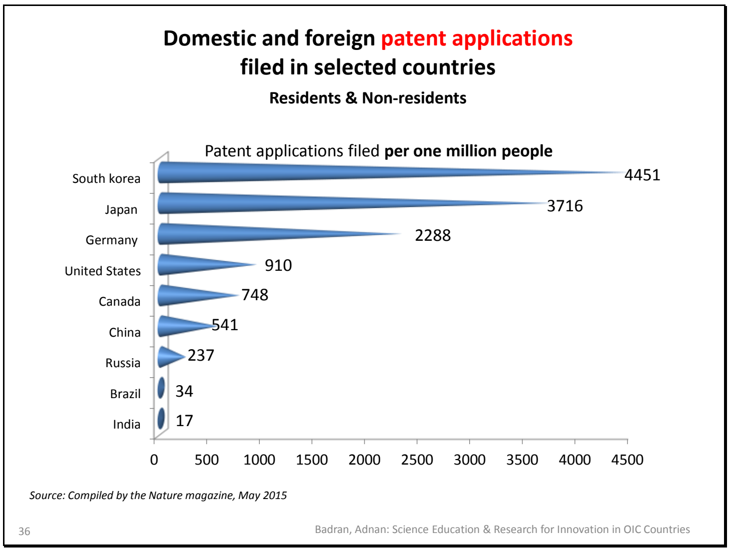

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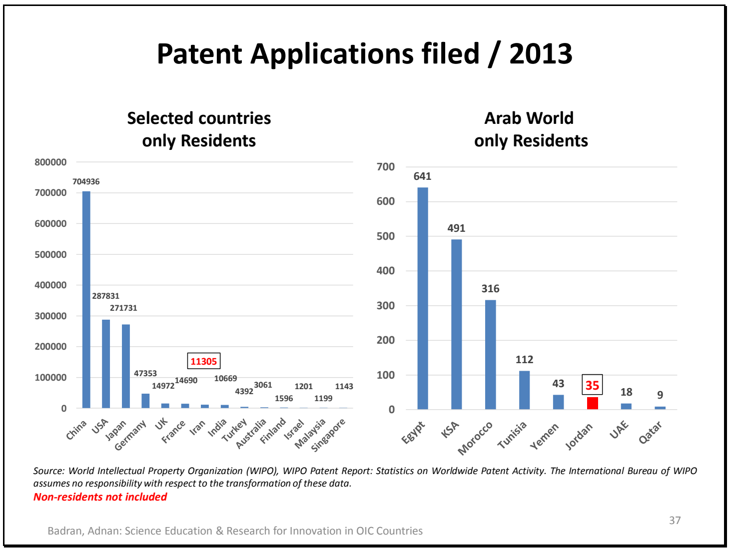


Figure 36.

Building Our Sustainable Common Future: The Smart Partnership Way

OMAR ABDUL RAHMAN FIAS
Founding President, Academy of Sciences Malaysia
Former Science Advisor to the Malaysian Prime Minister
Kuala Lumpur, Malaysia

ABSTRACT

All of Humanity has one home, Earth, and therefore one destiny. Building a Sustainable Common Future is our single Mission. However there is growing disparity between the top and the bottom billions of the global population. The Bruntland Report was a strategy for achieving sustainable development for all by 2000 and beyond. Failure to achieve its objectives led to the MDG now succeeded by the SDG, again addressing the unmet needs of the Bottom Billions of the world population. All the three UN global strategies call for international collaboration and partnering in order to succeed. Poor national capacity in STI policy and management results in failure to translate the concerns of the three global strategies into national priorities for action, and for meaningful effort in international collaboration. 'Smart Partnership' is proposed as the robust framework for collaboration. And a Supreme STI Champion is urgently required in all developing countries in order to build a strong STI capacity.

PRESENTATION

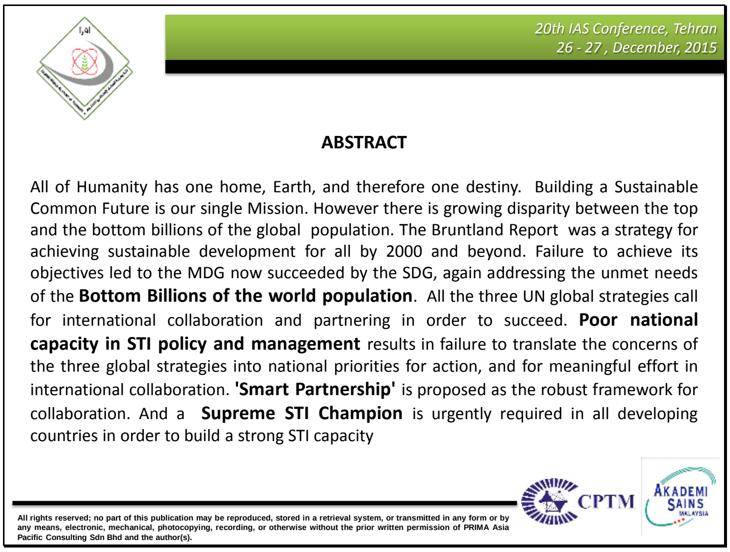


Figure 1. Abstract.

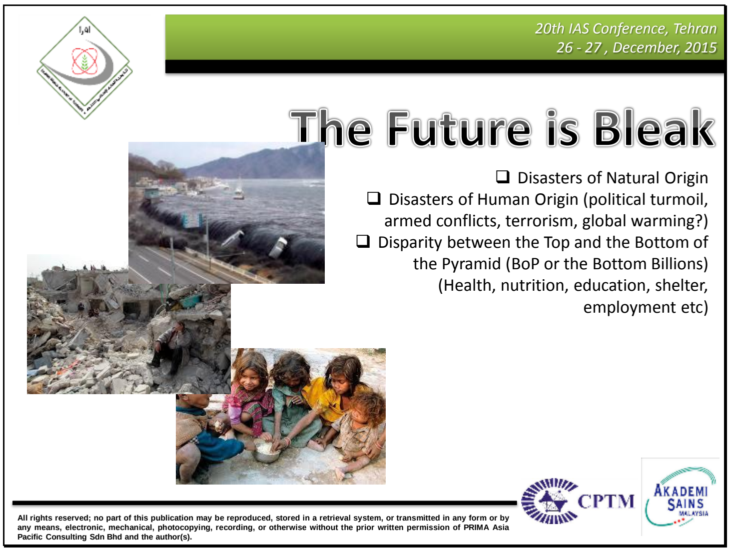


Figure 2. The Future is Bleak.

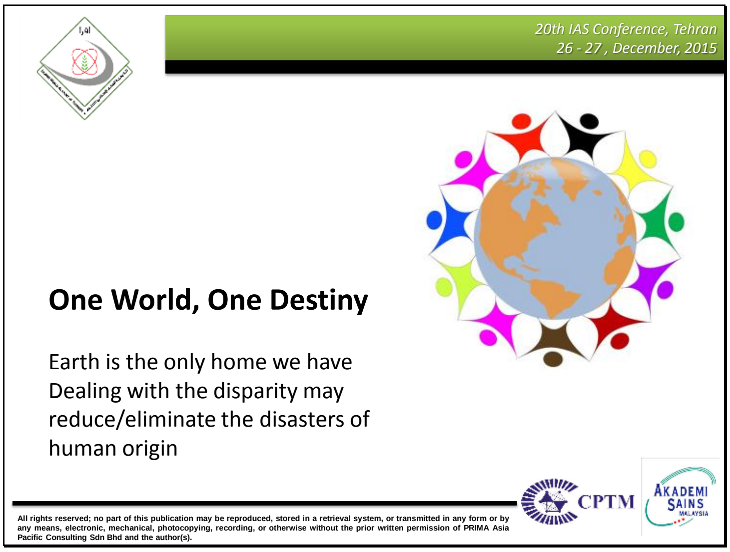


Figure 3. One World, One Destiny.

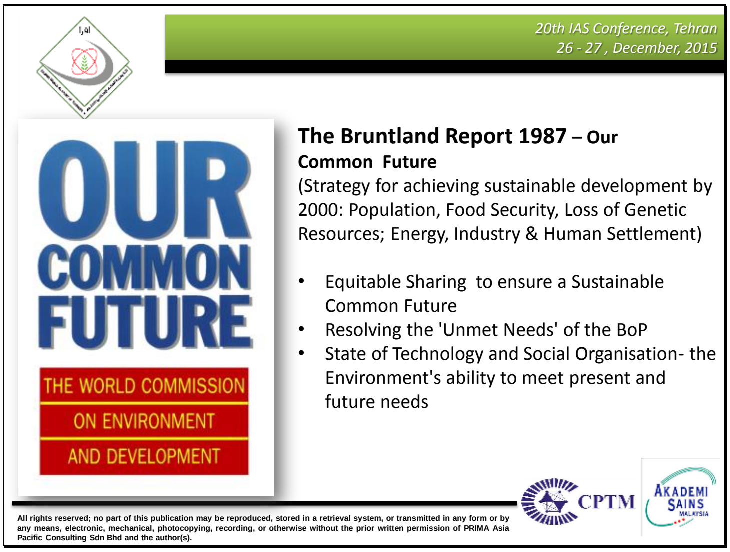


Figure 4. the Bruntland Report.

Figure 5. UN Millennium Development Goals 2000-2015.

Figure 6. UN Sustainable Development Goals – UN Agenda 2030.

Figure 7. Foundation and Pillars for the UN Development Goals.

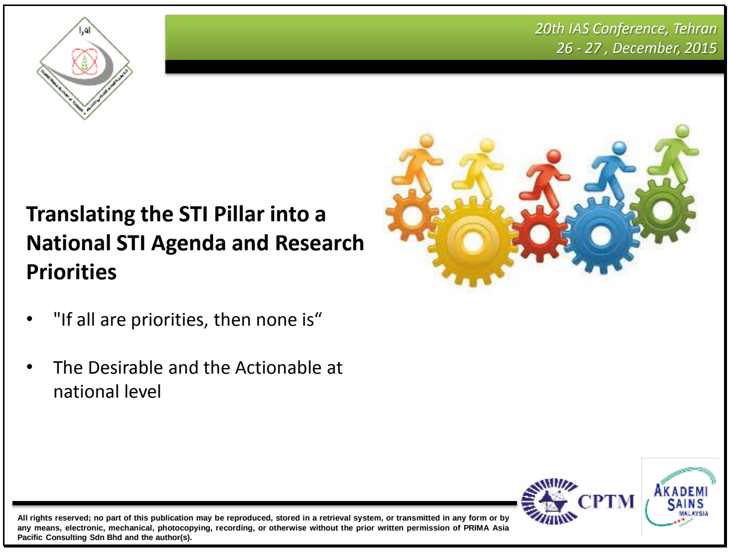


Figure 8. Translating the STI Pillar into a National STI Agenda and Research Priorities.

Figure 9. The Four Critical Technologies of the STI Pillar at National Level.

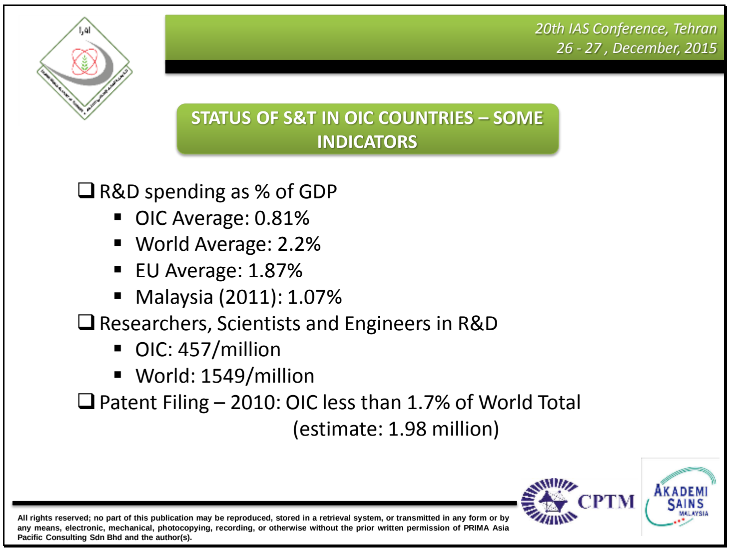


Figure 10. Status of S&T in OIC Countries-Some Indicators.

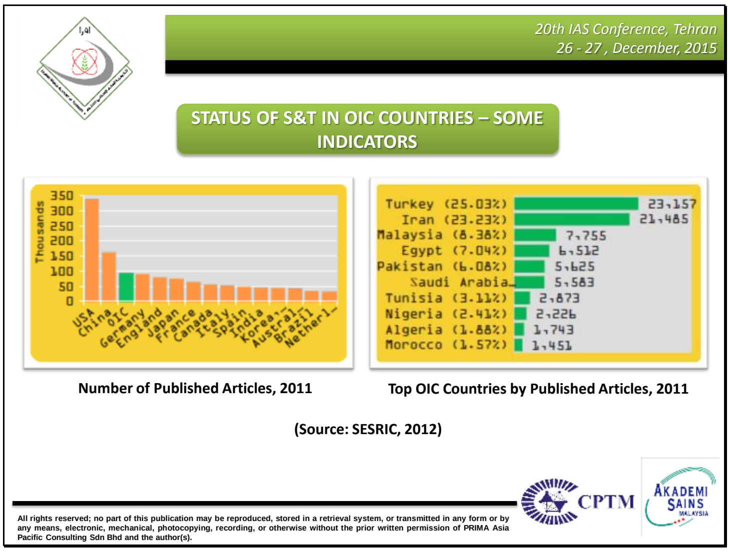


Figure 11. Status of S&T in OIC Countries-Some Indicators.

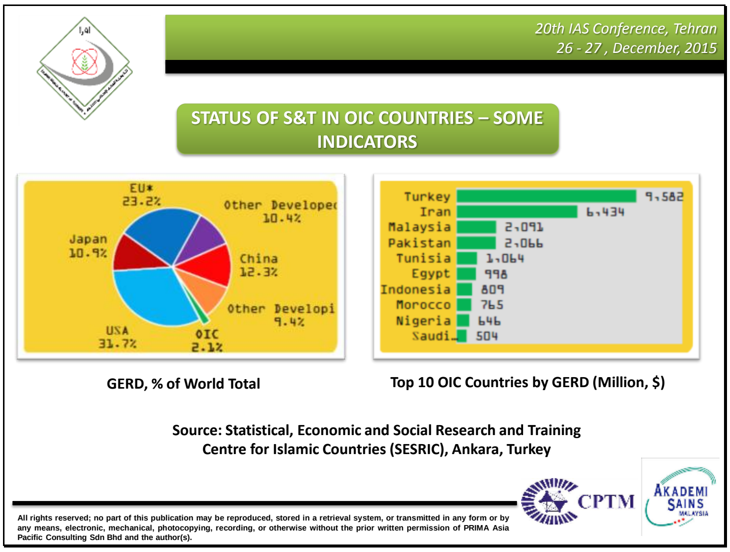


Figure 12. Status of S&T in OIC Countries-Some Indicators.

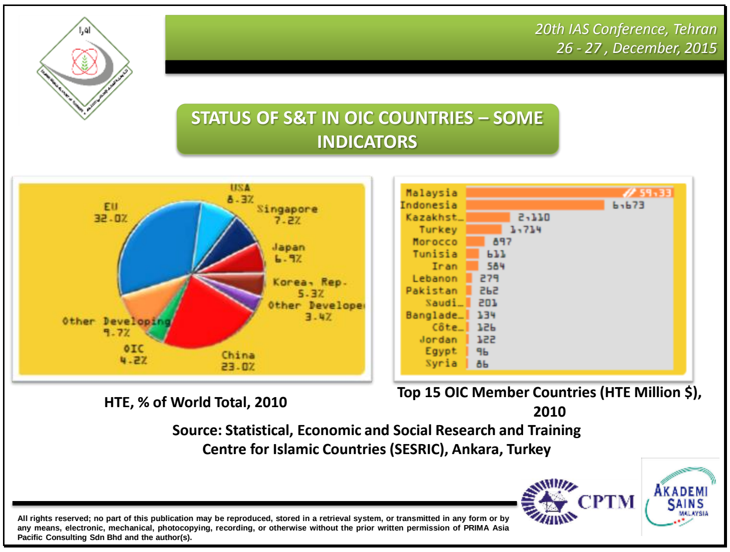
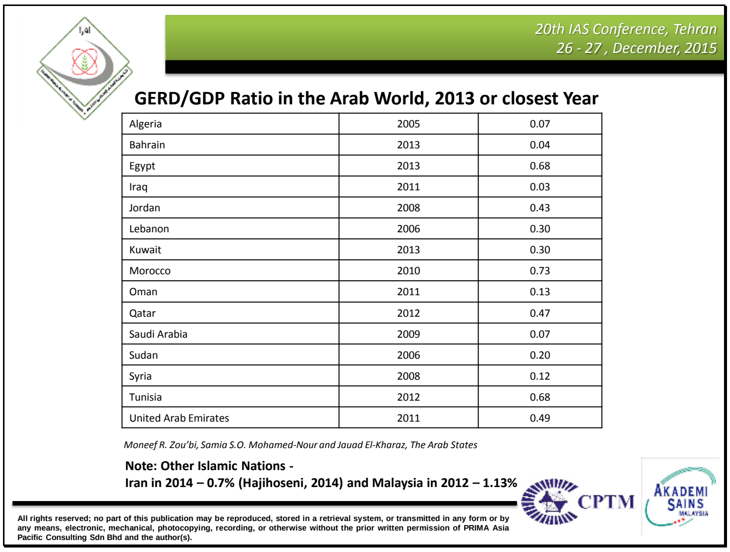


Figure 13. Status of S&T in OIC Countries-Some Indicators.

Figure 14. Status of S&T in OIC Countries-Global comparison.


20th IAS Conference, Tehran
26 - 27 , December, 2015

GERD/GDP Ratio in the Arab World, 2013 or closest Year

Algeria	2005	0.07
Bahrain	2013	0.04
Egypt	2013	0.68
Iraq	2011	0.03
Jordan	2008	0.43
Lebanon	2006	0.30
Kuwait	2013	0.30
Morocco	2010	0.73
Oman	2011	0.13
Qatar	2012	0.47
Saudi Arabia	2009	0.07
Sudan	2006	0.20
Syria	2008	0.12
Tunisia	2012	0.68
United Arab Emirates	2011	0.49

Moneef R. Zou'bi, Samia S.O. Mohamed-Nour and Jauad El-Kharaz, The Arab States

Note: Other Islamic Nations -
Iran in 2014 – 0.7% (Hajihoseni, 2014) and Malaysia in 2012 – 1.13%

CPTM
AKADEMI SAINS MALAYSIA

Figure 15. GERD/GDP Ratio in the Arab World, 2013 or closest year.

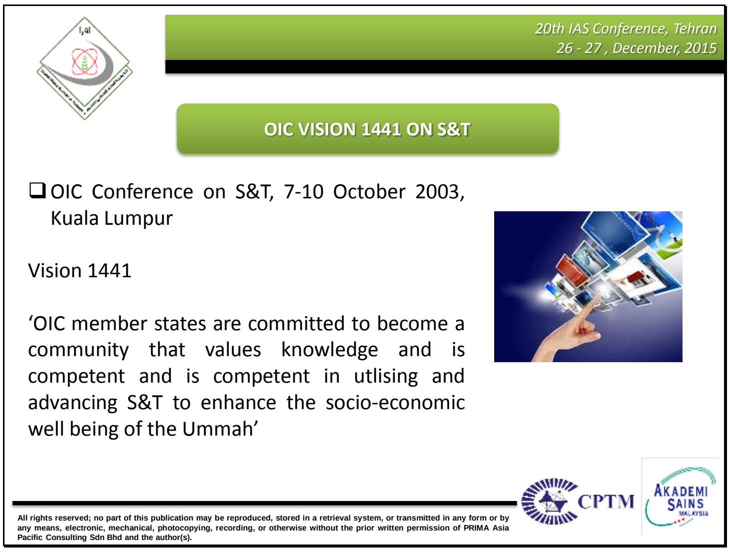


Figure 16. OIC Vision 1441 on S&T.

Figure 17. Strategic Thrusts for Vision 1441.

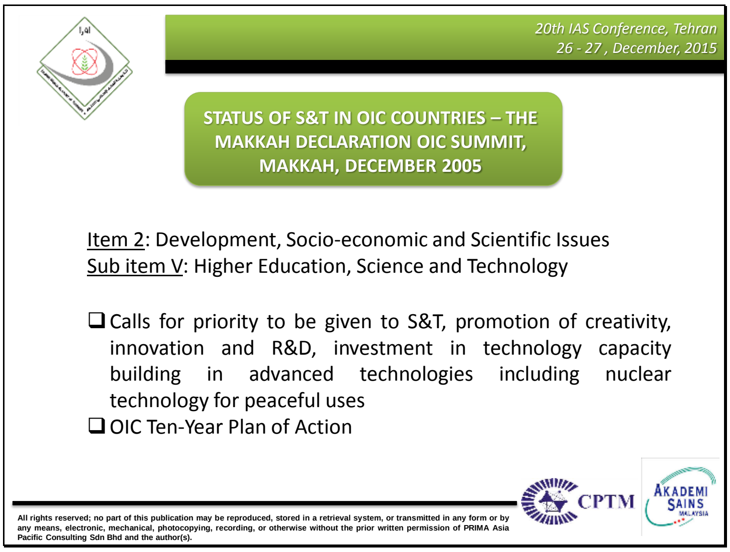


Figure 18. Status of S&T in OIC Countries-The Makkah Declaration OIC Summit.

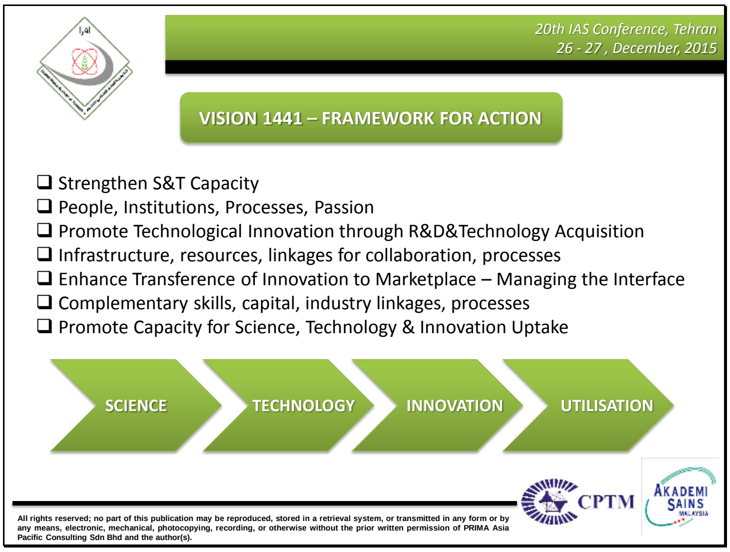


Figure 19. Vision 1441-Framework for Action.

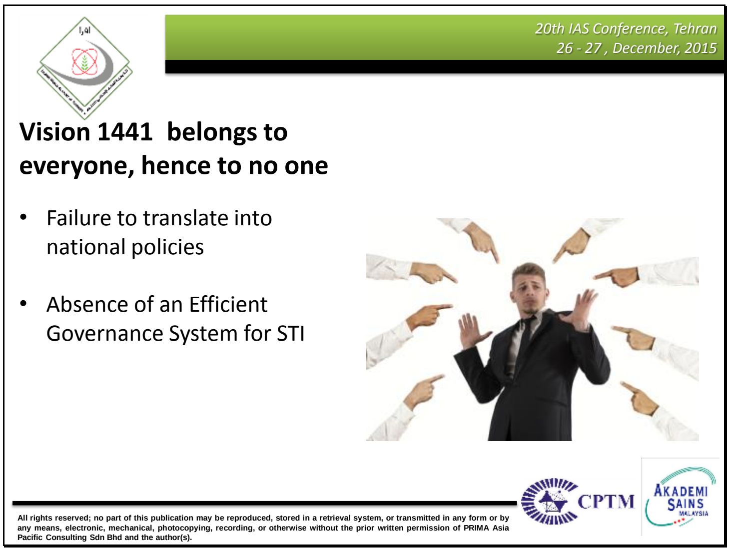


Figure 20. Vision 1441 belongs to everyone, hence no one.

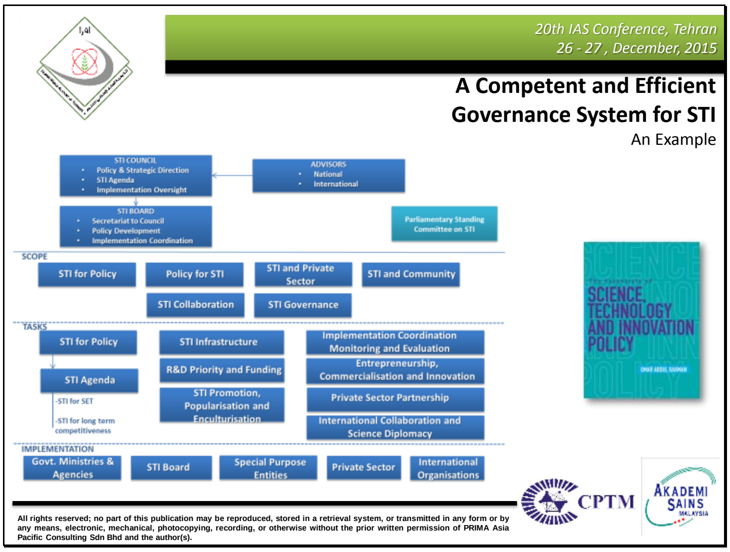


Figure 21. A competent and Efficient Governance System for STI.

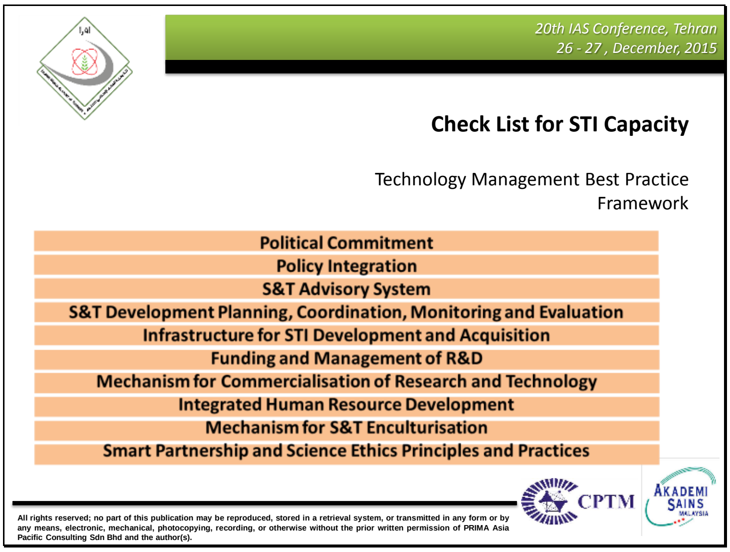


Figure 22. Check List for STI Capacity.

Figure 23. Achieving the Targets of Our Sustainable Common future.

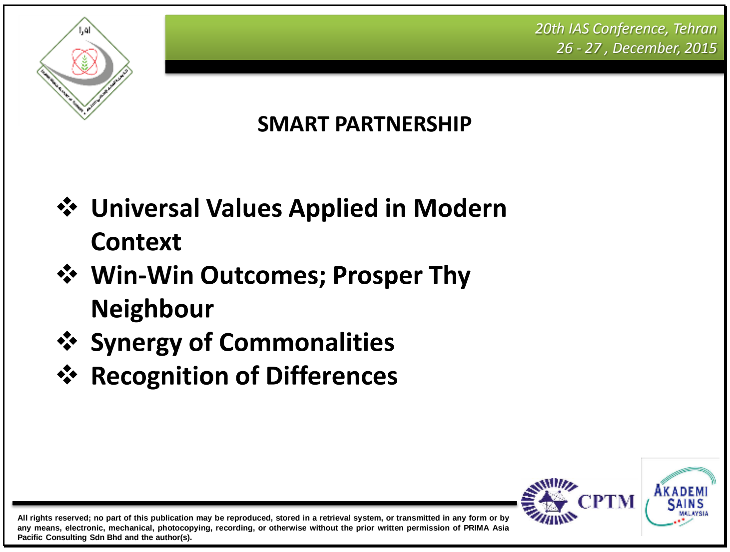


Figure 24. Smart partnership.

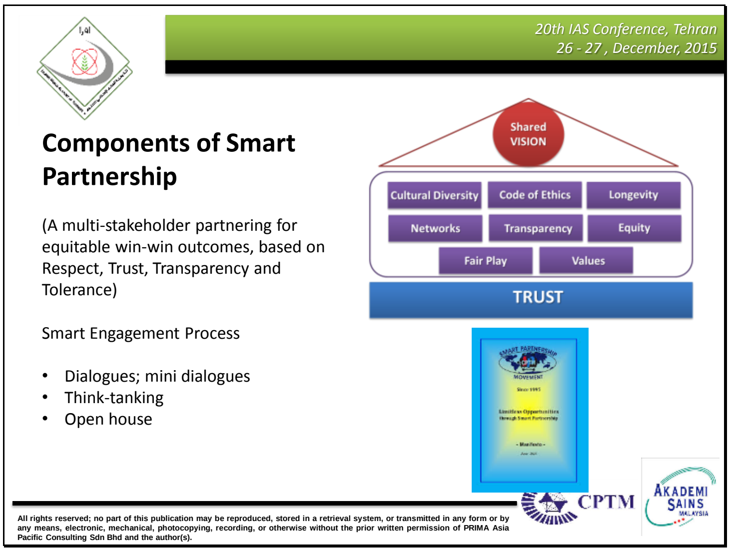


Figure 25. Components of Smart Partnership.

Figure 26. Smart Partnership (SP) in Practice - 1.

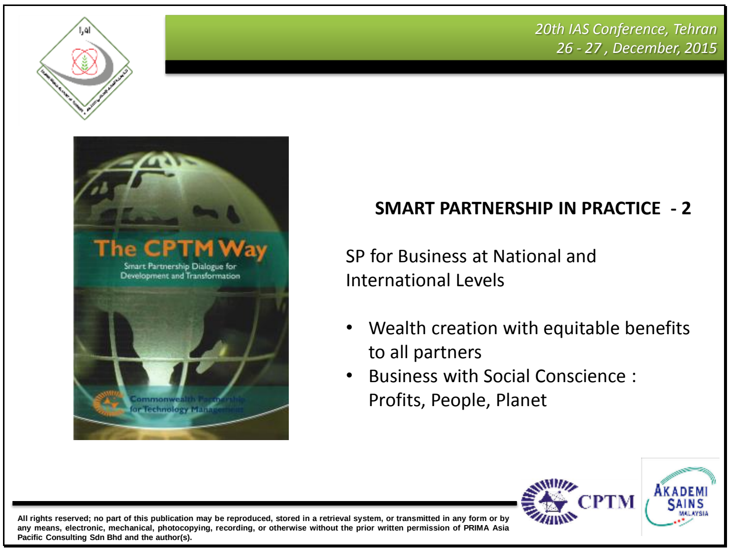


Figure 27. Smart Partnership in Practice - 2.

Figure 28. Smart Partnership in Practice – 3.

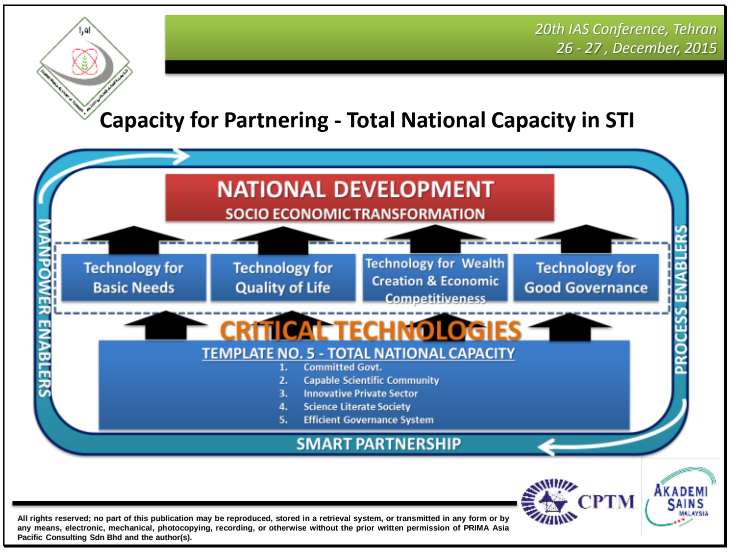


Figure 29. Capacity for Partnering – total National Capacity in STI.

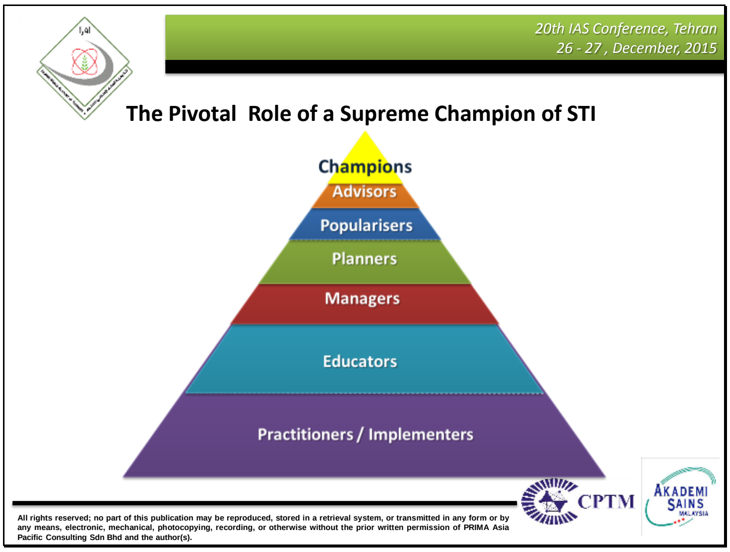


Figure 30. The Pivotal Role of a Supreme Champion of STI.

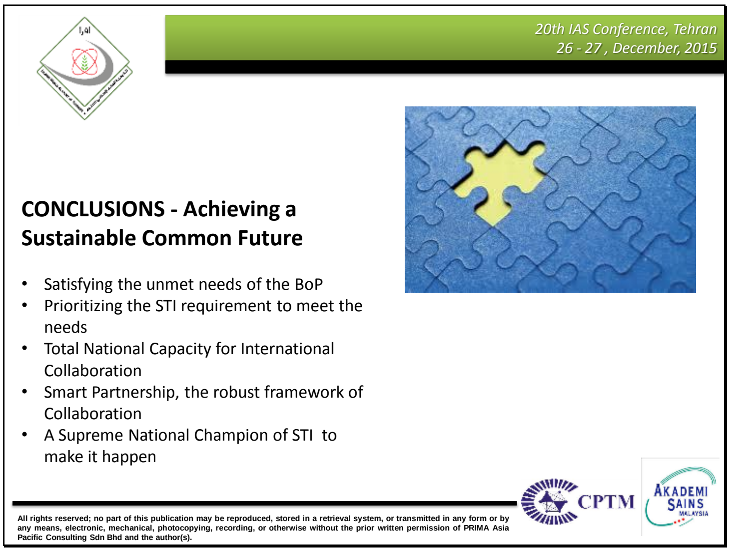


Figure 31. Conclusions – Achieving a Sustainable Common Future.

The Health Landscape of Iran

SEYED ALIREZA MARANDI
President, Iran Academy of Medical Sciences
Tehran, Iran

ABSTRACT

Prior to the Islamic Revolution, there was hardly a health care system in Iran. Preventive health care was very limited, and a fairly decent curative care could only be found in Tehran and to a lesser extent, in a few large cities where a great majority of the 12-14 thousand Iranian physicians where practicing. Those people living in smaller towns and large villages had to seek the advice of expatriate physicians speaking a different language. Poor people in general and residents of over 65/000 villages had virtually no access to medical care. When the Islamic Revolution materialized, people rightfully began to expect social justice and health equity, and the Ministry of Health in response started to establish a primary health care system throughout the country, however the main problem was inadequate health human power. As the Ministry of Higher Education was unable to increase the number of students, in 1985, the Parliament passed a law taking away all health-related schools from the Ministry of Higher Education and integrated them into the Ministry of Health, forming the Ministry of Health and Medical Education. Almost simultaneously at least one university of medical sciences and health services was established in each province. Since then the chancellors of the universities are not only responsible for health-related education and research, but also for the health care of the entire province.

As a result of the integration, not only Iran became self-sufficient in health human power, but research has also become more public health oriented and medical education more community oriented. The integration has also led to an improvement in the health situation throughout the country, particularly in the villages, remote areas and less developed provinces.

Now all villages and towns with less than 20/000 population have access to family practice physicians, through the primary health care system and the plan is to do the same for all cities in order to move closer to the Universal Health Coverage. Effort is also being made to decrease the out of pocket expenses from 52% to 30%. The Ministry of Health reports that currently it is down to 40.4%.

Now everyone’s duty is to implement the Health General Policies endorsed by the Supreme Leader.

PRESENTATION

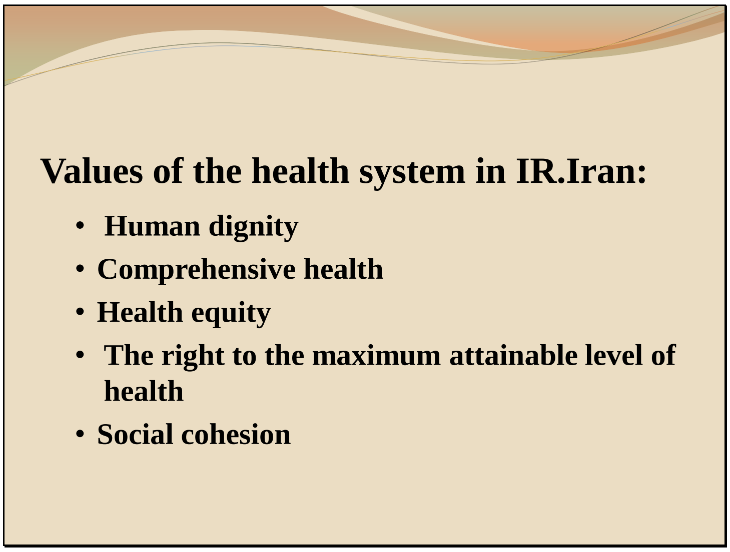


Figure 1. Values of the Health System in Iran.

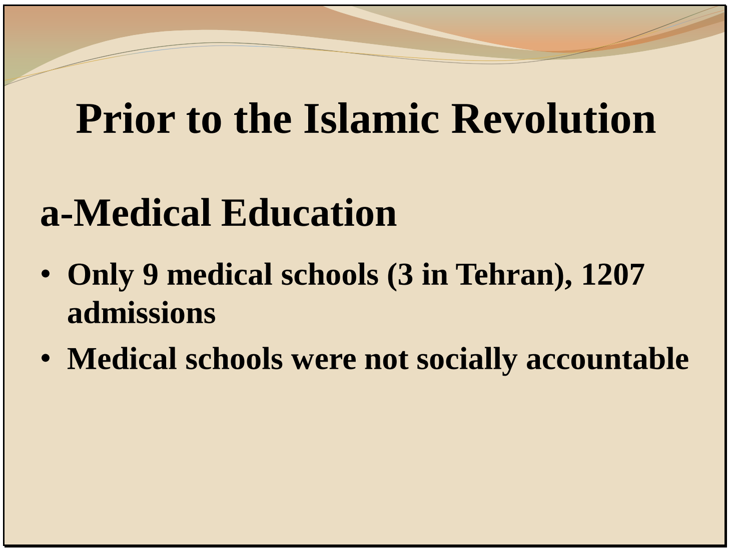


Figure 2. Prior to the Islamic Revolution.

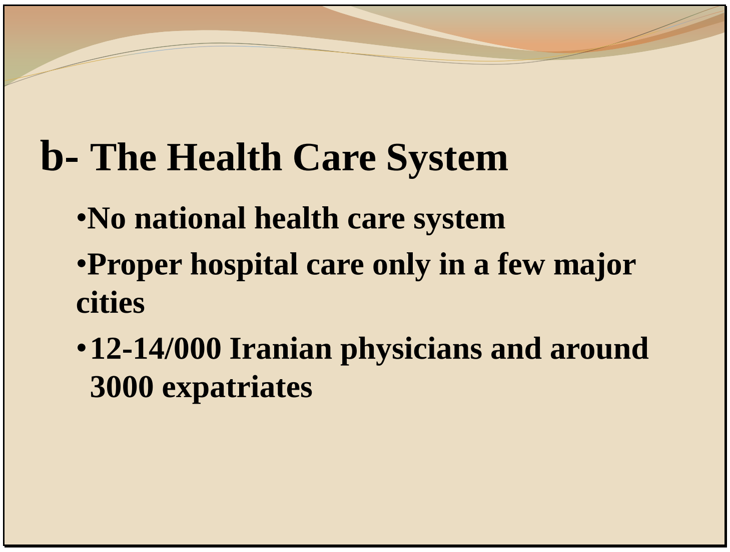


Figure 3.

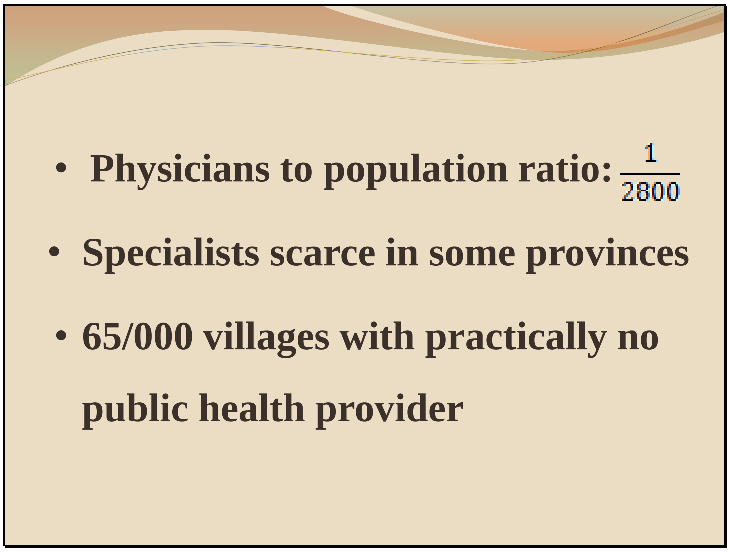


Figure 4.

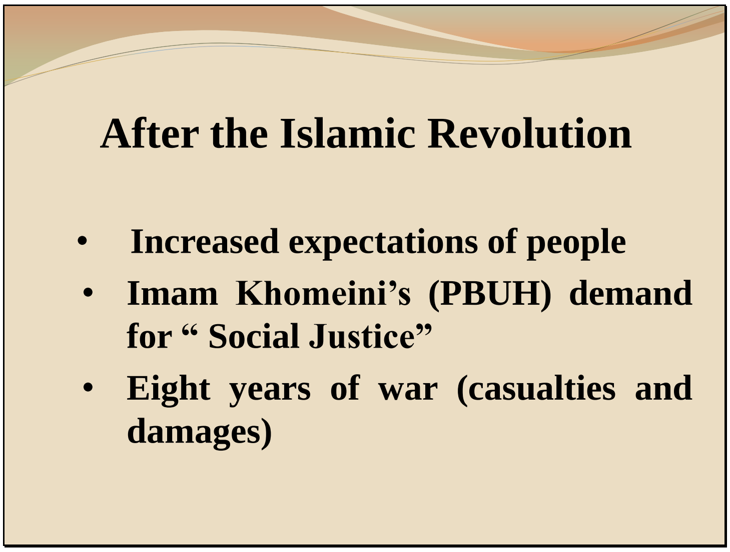


Figure 5. After the Islamic Revolution.

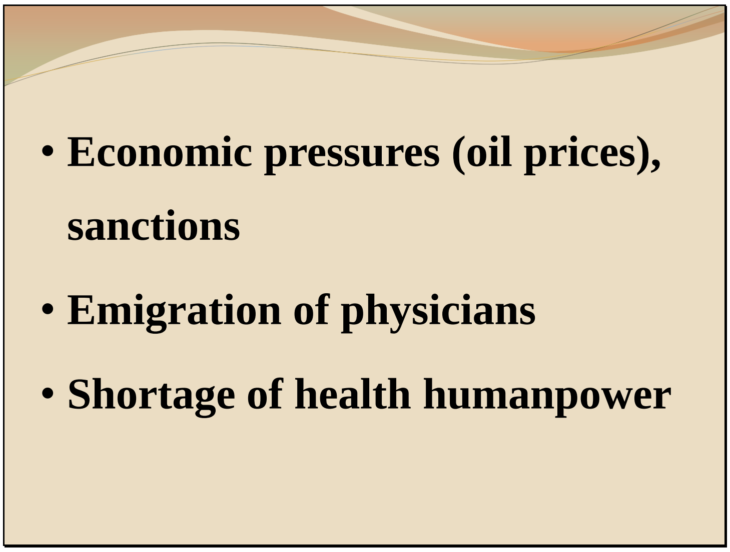


Figure 6.

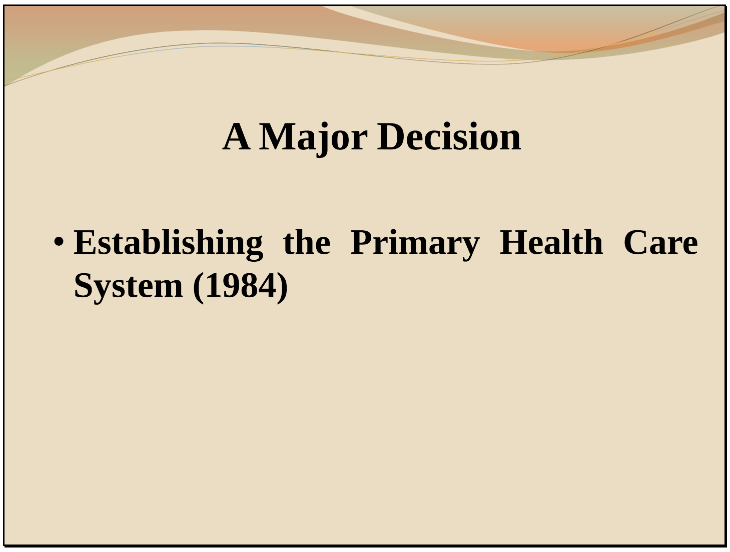


Figure 7. A Major Deciosion.

Figure 8.

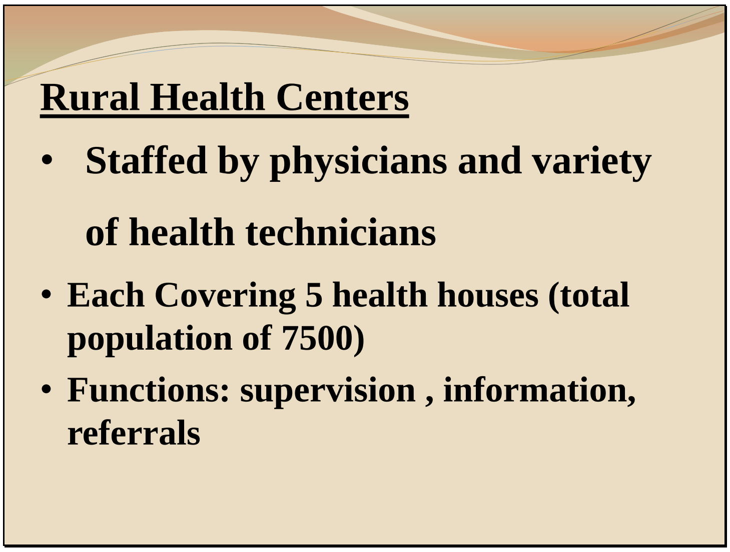


Figure 9. Rural Health Centers.

Figure 10. Urban Health Centers.

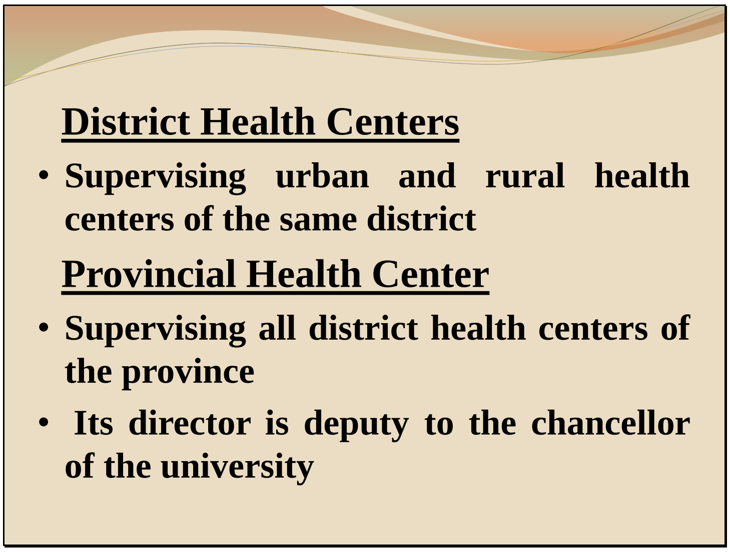


Figure 11.

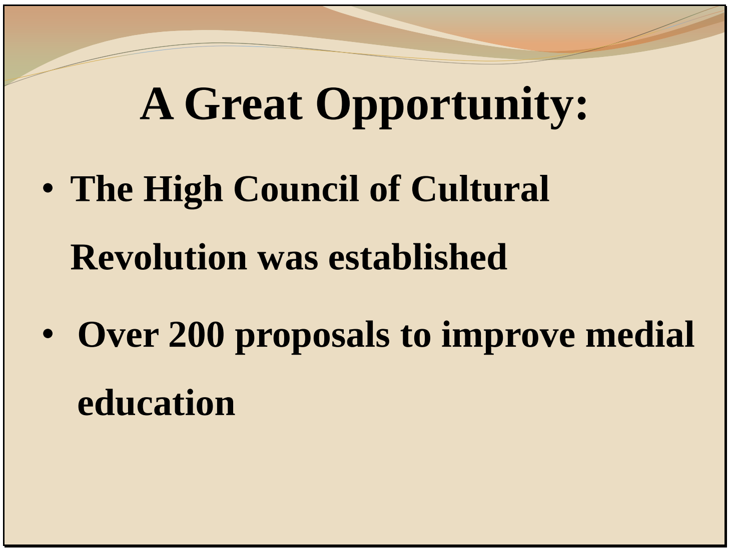


Figure 12. A Great Opportunity.

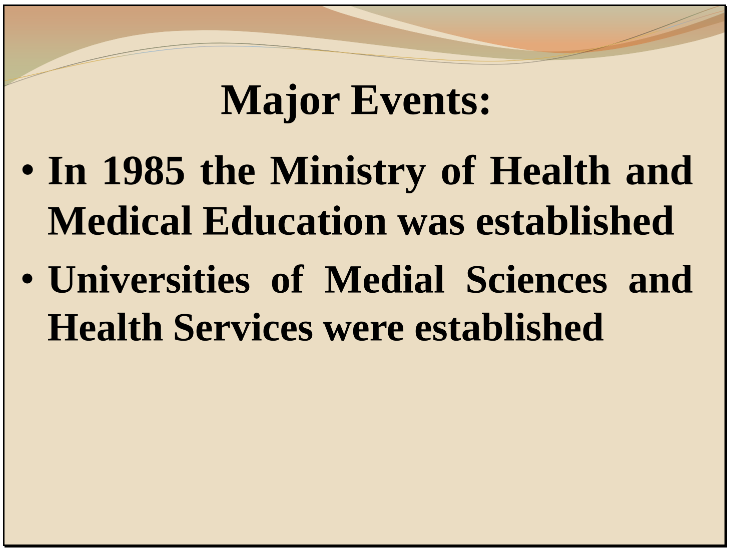


Figure 13. Major Events.

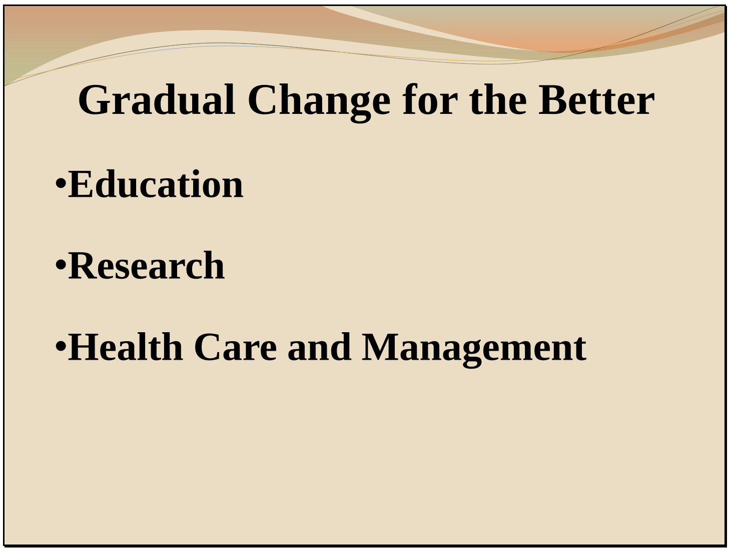
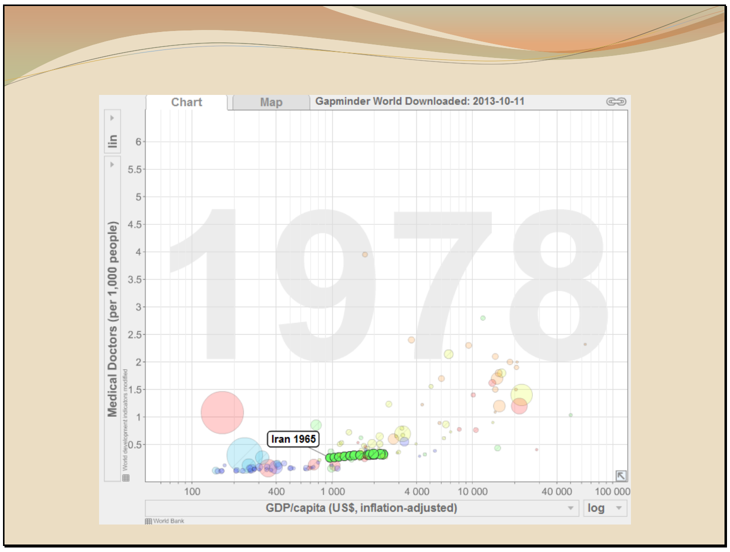


Figure 14. Gradual Change for the Better.

	1979	1985	2000	2008	2015
Schools of Medicine	9	28	35	72	80
Teaching hospital beds	9558	10759	72089		53,902
Academicians	2908	3153	8396	12’500	17,863
Female academicians (%)	26	33	36	41	37.7
Admitted students (annually)	6343	9038	17’036	19’800	40,112
Residency programs graduates (annually)	420	510	1332	1760	2,656
Fellowship programs graduates (annually)	0	2	106	320	543
PhD programs graduates (annually)	2	21	51	250	575
Number of research centers	3	5	100	200	627

Figure 15.



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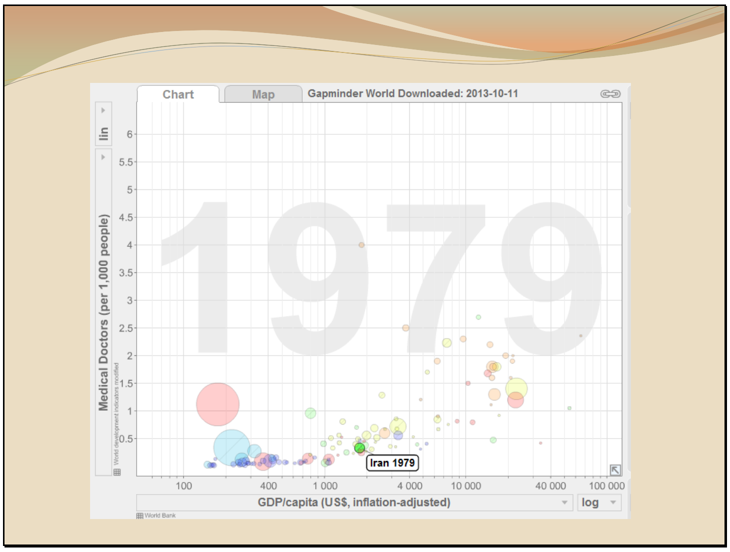

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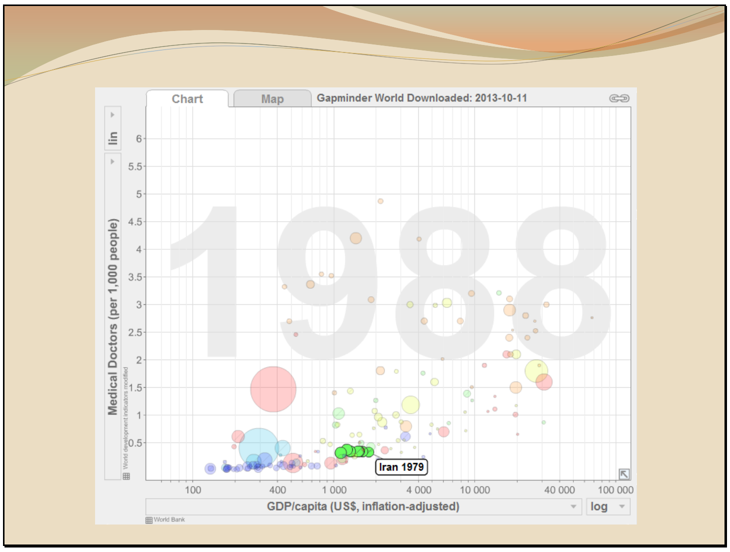

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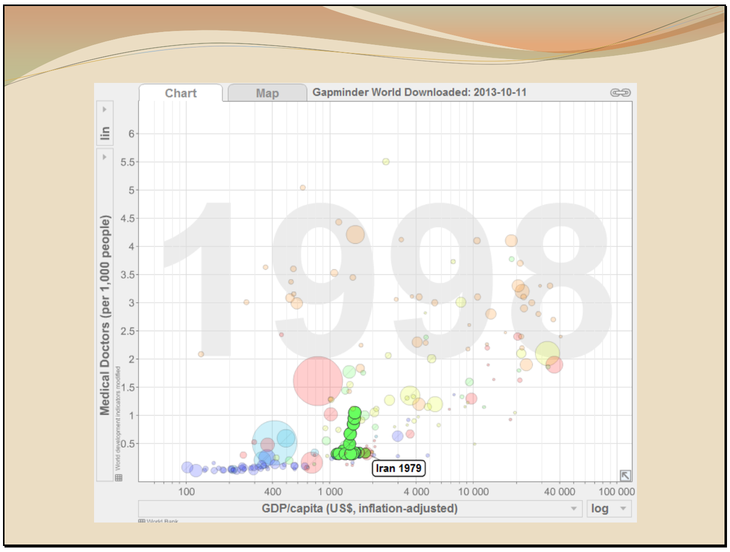
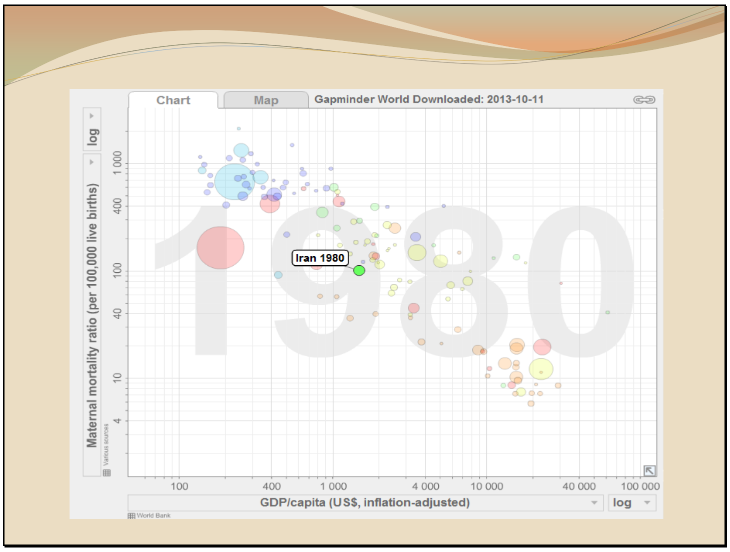


Figure 19.



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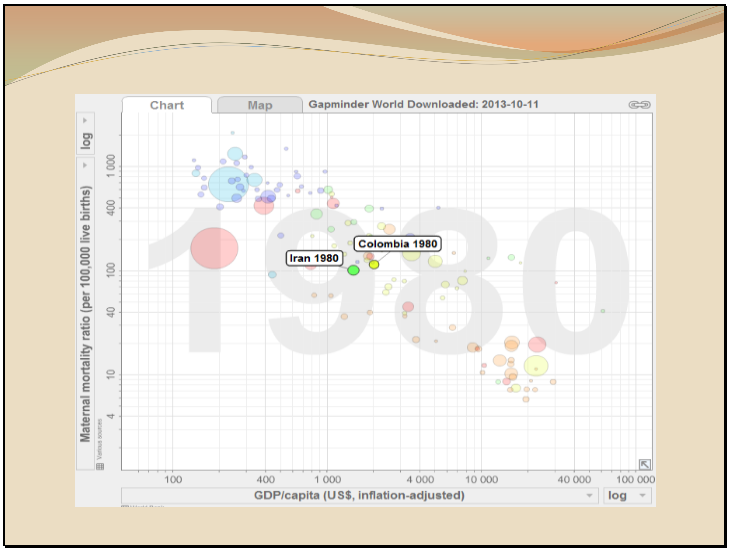

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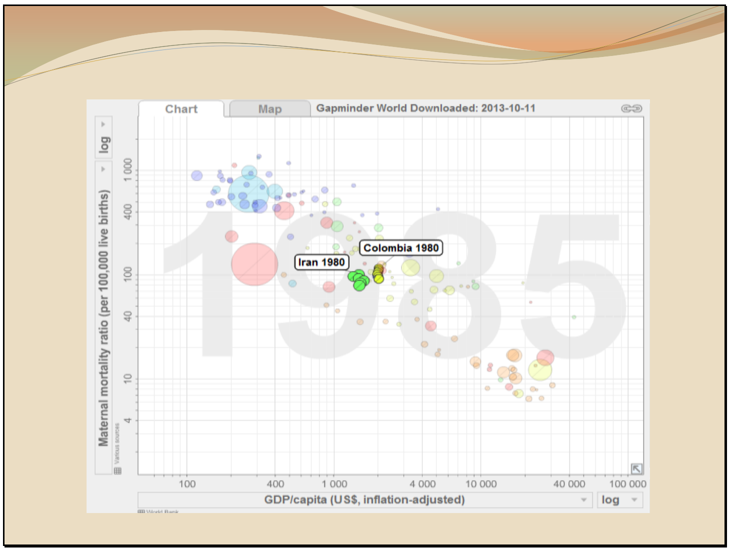

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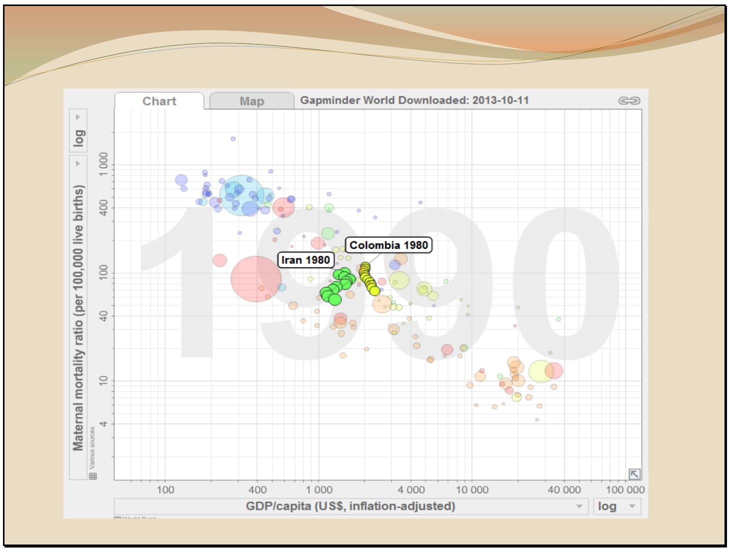

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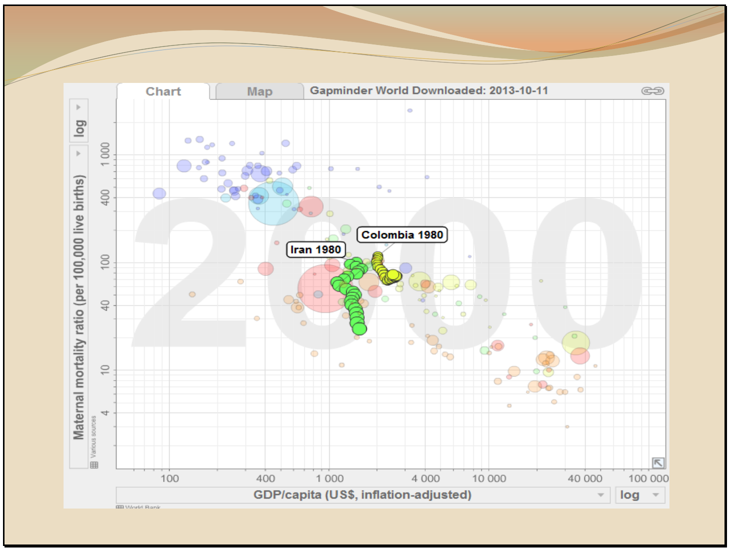

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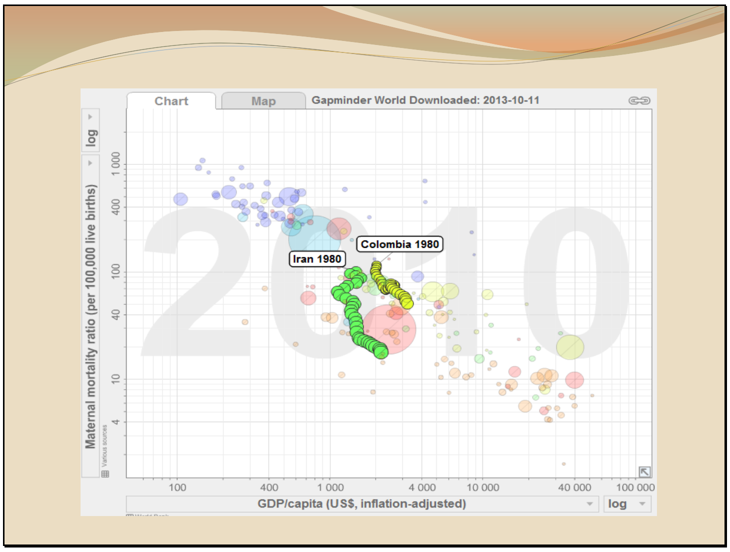

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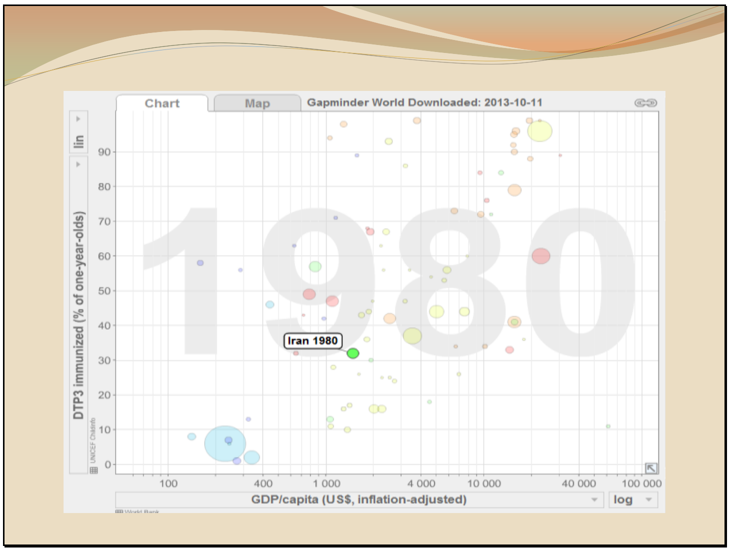


Figure 26.

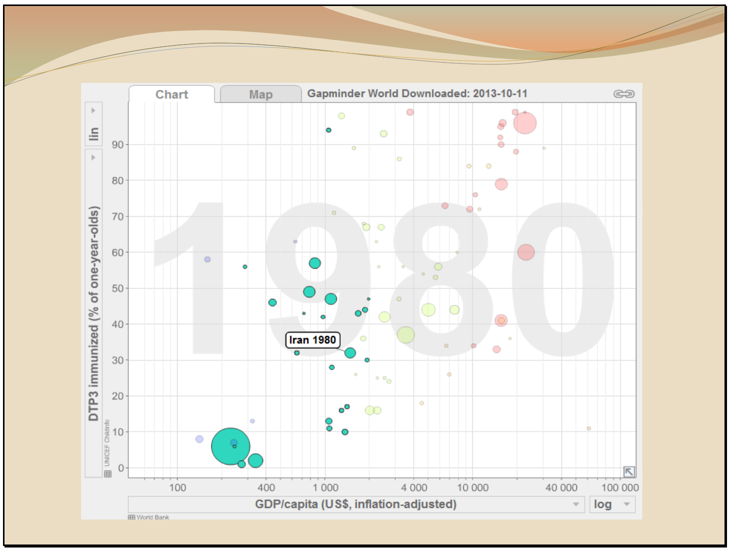
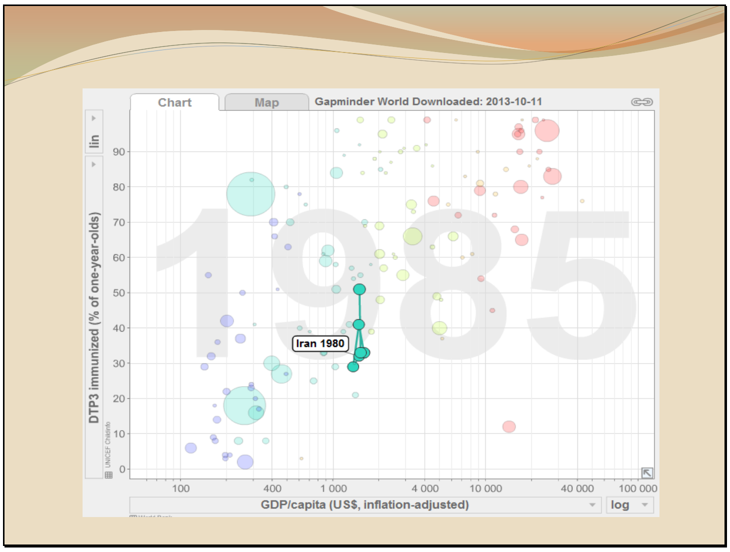


Figure 27.



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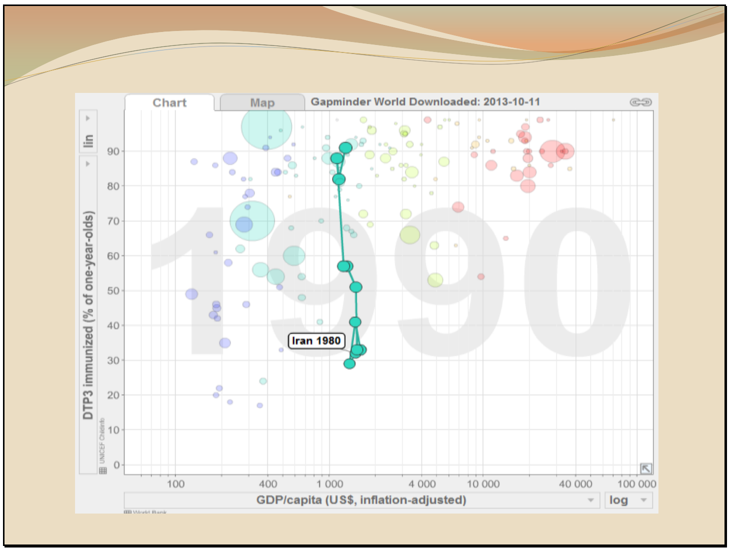

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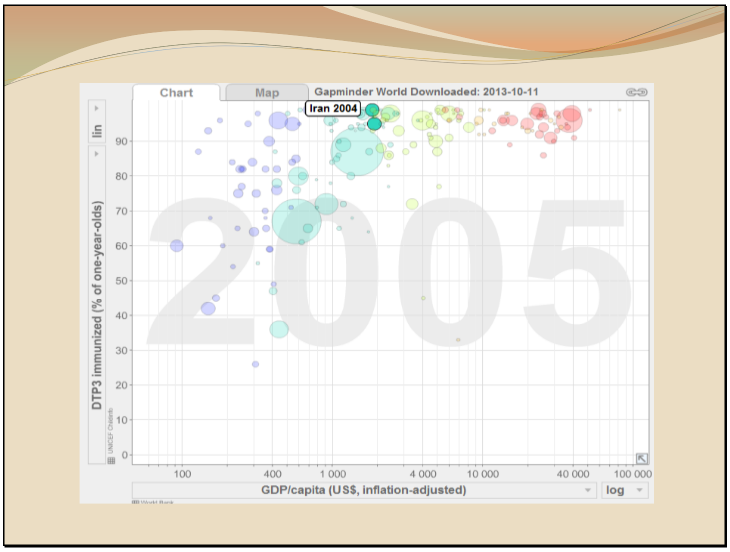

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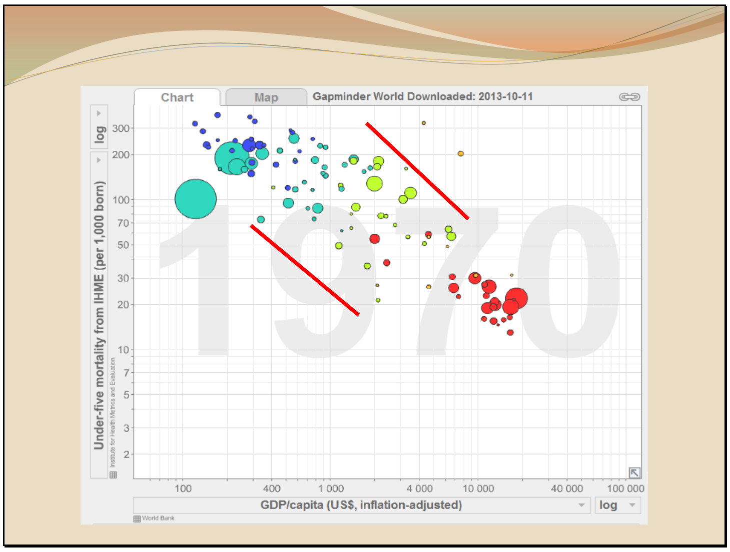

Figure 31.

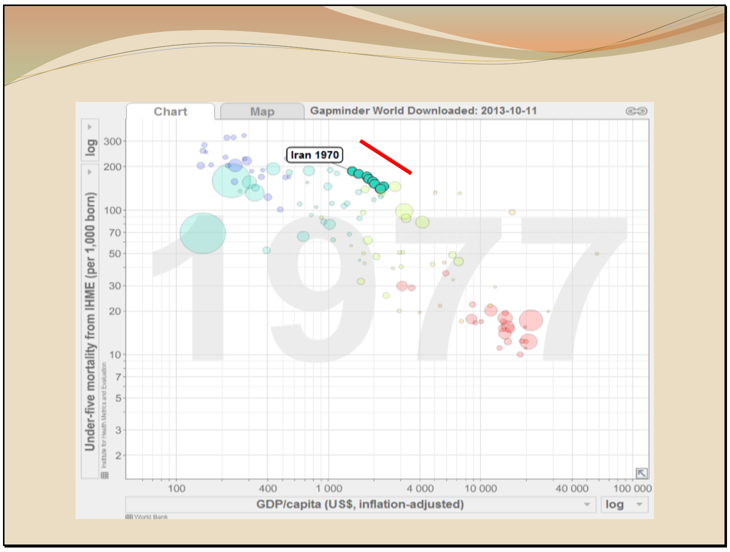

Figure 32.

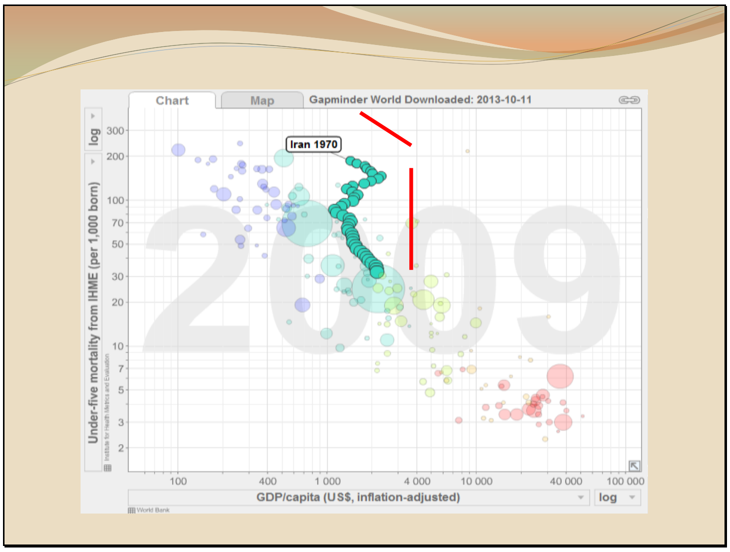

Figure 33.

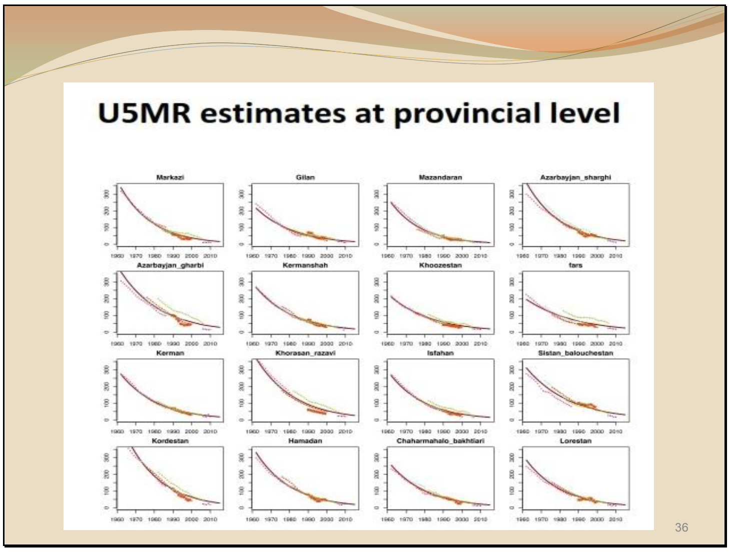

Figure 34. U5MR estimates at provincial level.

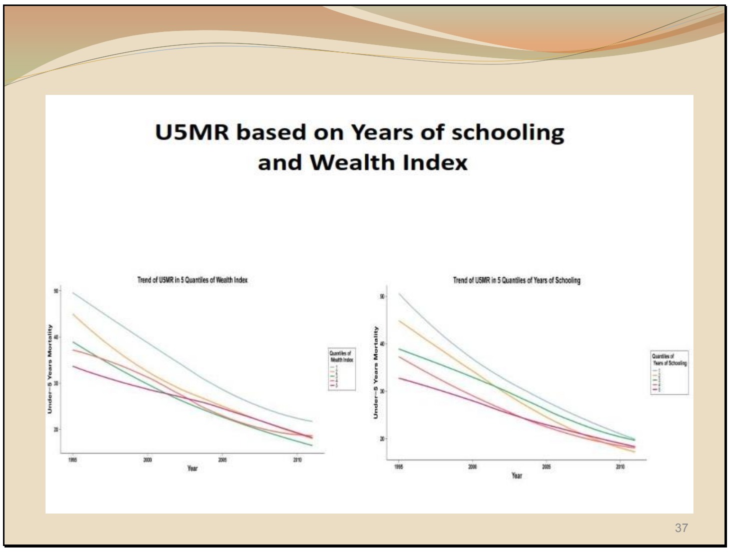

Figure 35. U5MR based on years of schooling and Wealth Index.

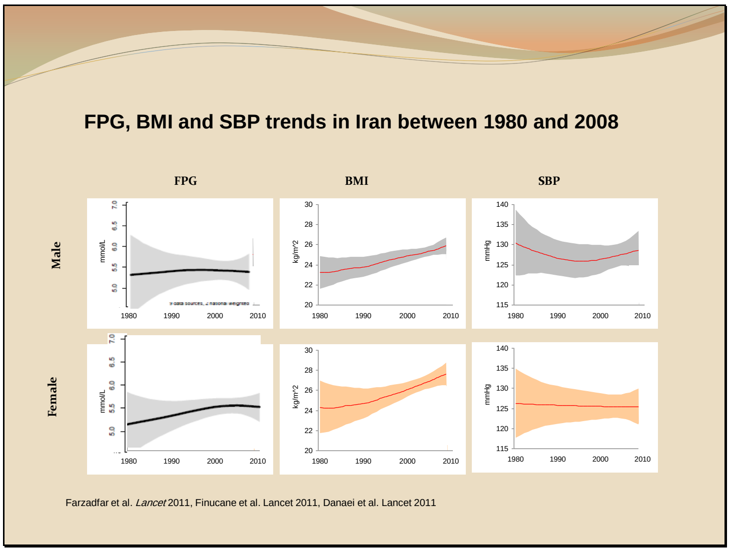

Figure 36. FPG, BMI and SBP trends in Iran between 1980 and 2008.

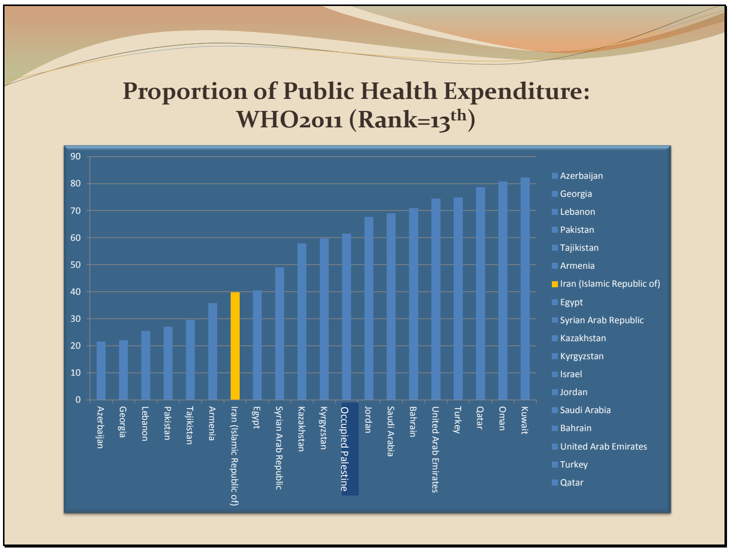

Figure 37. Proportion of Public Health Expenditure.

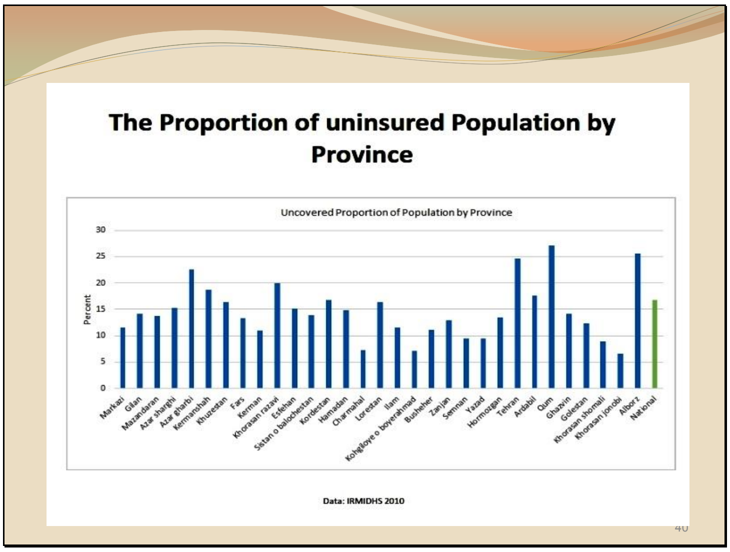

Figure 38. The Proportion of uninsured Population by Province.

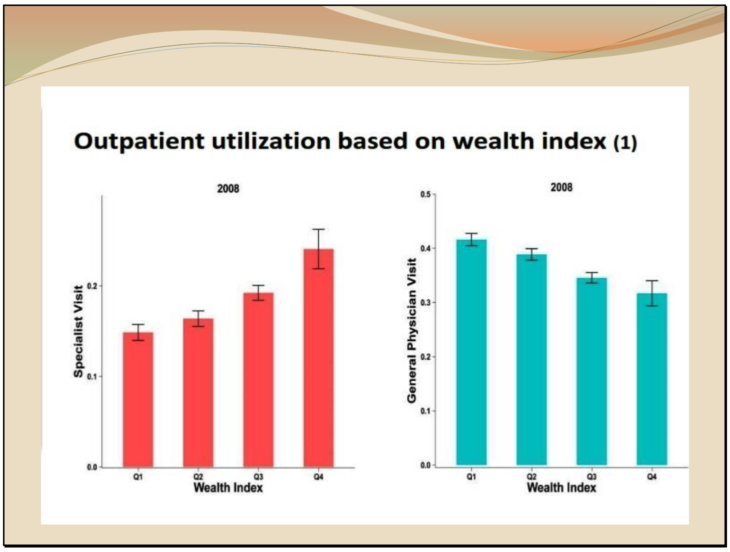

Figure 39. Outpatient utilization based on wealth index.

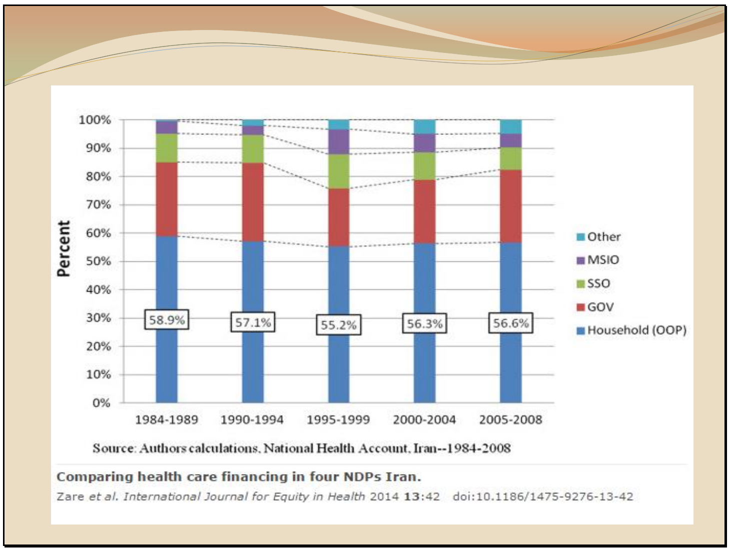

Figure 40.

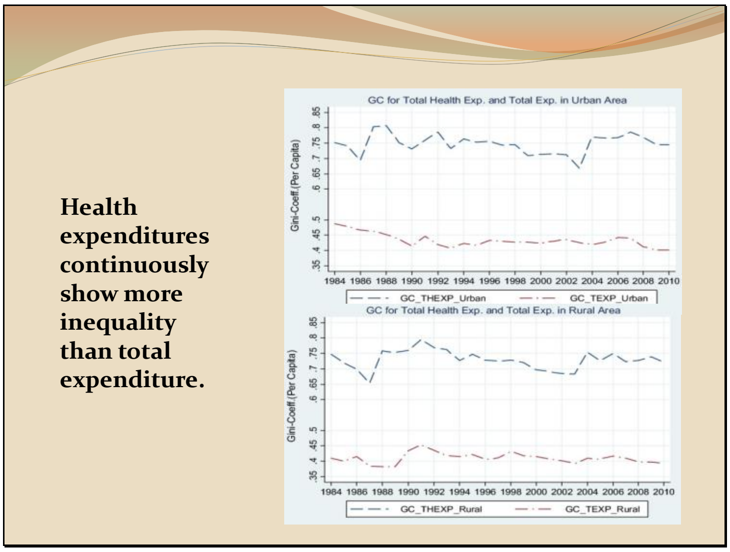

Figure 41. Health expenditures continuously show more inequality than total expenditure.

		1977	1984	2000	2008	2015
Mortality						
	Neonatal		51	29	19	9.5
	Under-five	174	60	36	22	16
	Maternal	255 (1976)	140	37	27	23 (2013)
Life expectancy (Years)						
	Female)	57	71	73.4	74.2	76.5 (2013)
	Male	57	67.7	70.7	71.1	72.17 (2013)
Access to rural PHC (%)			20	90	95	
Access to safe drinking water (%)			71	95	98	96 (2012)
Immunization coverage (%)			20	95	99	99

Figure 42.

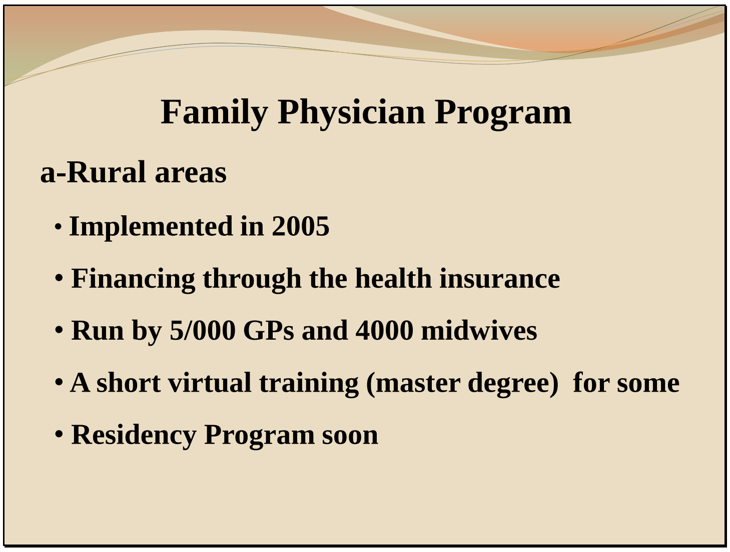

Figure 43. Family Physician Program.

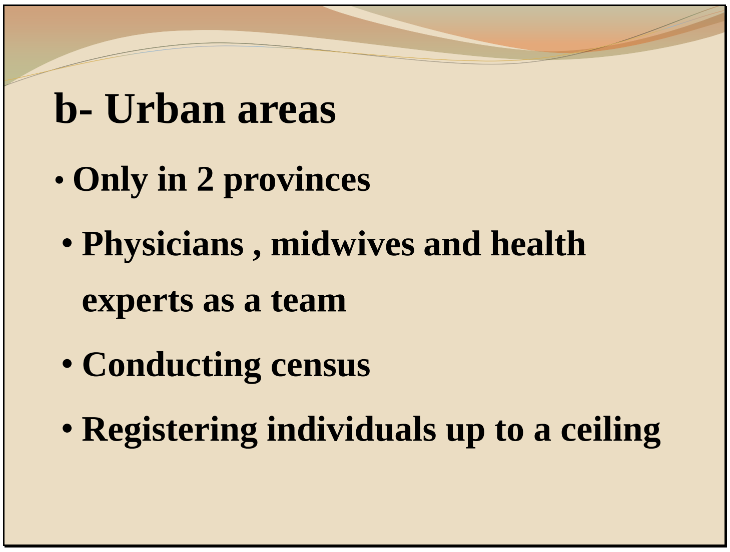

Figure 44.

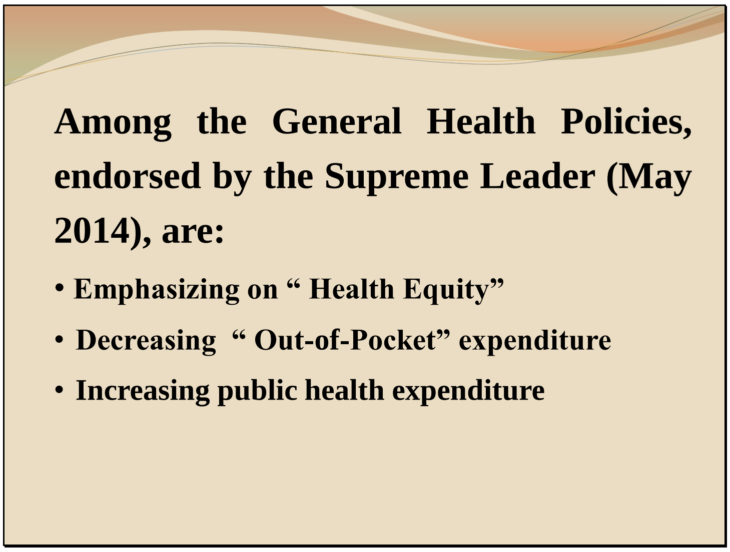

Figure 45. General Health Policies endorsed by the Supreme Leader.

Figure 46. Health Transformation Plan.

Figure 47. Health Transformation Plan (cont.).

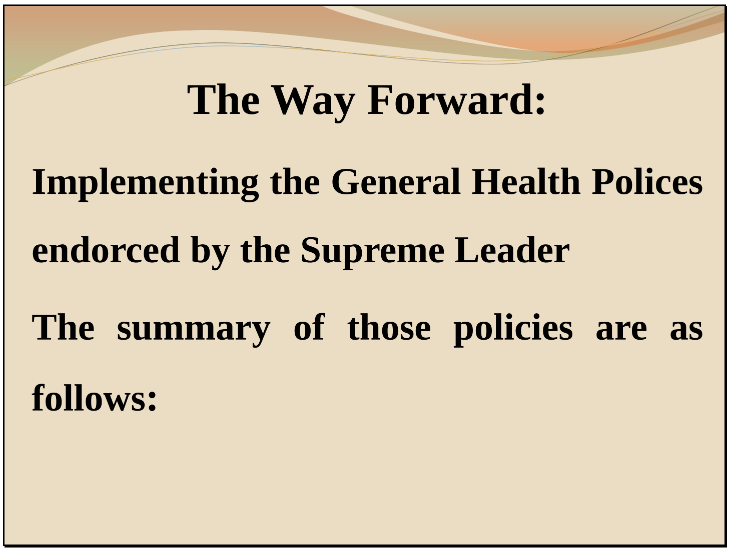

Figure 48. The Way Forward.

- Provision of comprehensive, integrated, preventive, promotive and curative health services based on humanitarian / Islamic principle, and its institutionalization in the country.
- Materialization of a multifaceted approach towards healthy individuals in all policies, rules and regulations.

Figure 49.

- Promotion of mental health and healthy/Islamic lifestyles throughout the country.
- Attainment of self-sufficiency in production of pharmaceuticals, vaccines and biological as well as medical supplies and equipments, according to the international standards and based on Genetic Scheme.

Figure 50.

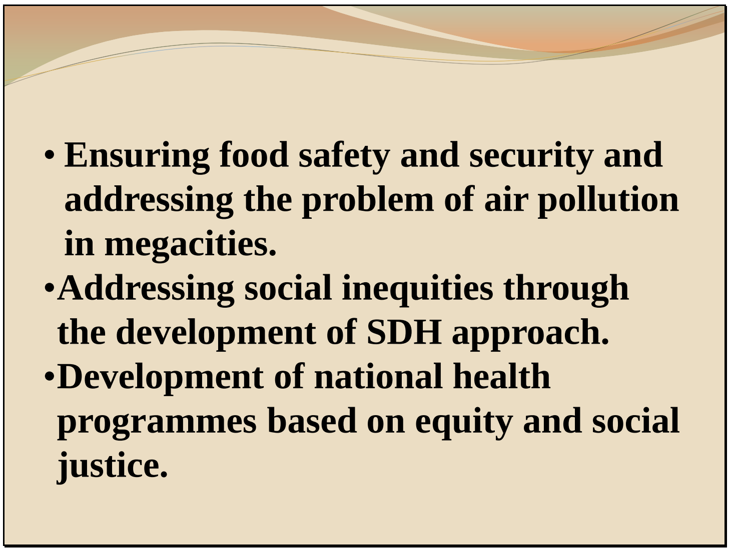

Figure 51.

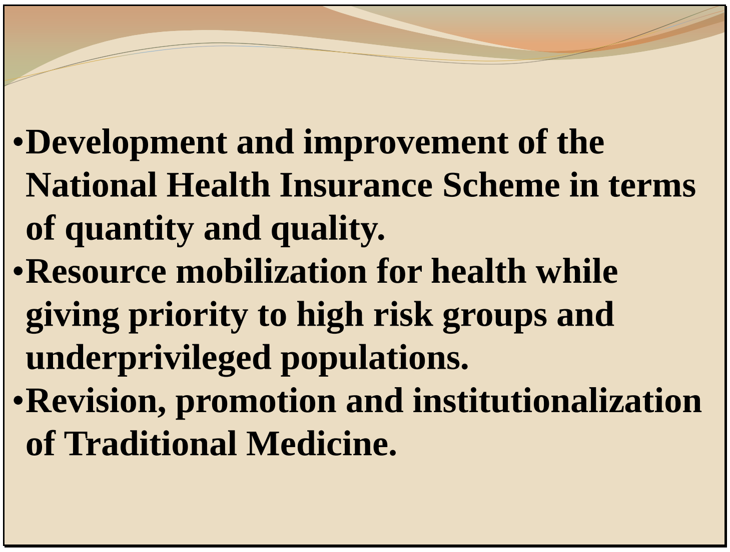

Figure 52.

- Development of Community – oriented / Community – based Medical Education based on the actual needs of the populations.
- Evolution of strategic Medical Education, aimed at attaining scientific authority in science, art and medicine in the Region.

Figure 53.

Pertinent Issues in Global Health

ABDALLAH DAAR FIAS
Professor of Clinical Public Health and of Surgery
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ABSTRACT

The area known as "global health," whose contours have not yet been solidly defined, has become an important part of international discourse. I will start by defining global health, focusing to some extent on those areas that have intersected with my own work directly or indirectly. I will highlight successes and point out the many areas where we have yet to make progress. I will talk about equity, social determinants of health, innovations, research funding, and the challenges and opportunities of improving health systems and health care delivery. I will use Ebola as an example of how we need to think globally, and point out some region-specific threats that cannot be ignored. I will also talk about how to create a "Pandemic of Health" and highlight recent trends in global health education.

PRESENTATION

Inequities in Global Health

- Every second of every day, four women around the world give birth. And every minute, one of those women dies
- In Sweden, the risk of a woman dying during pregnancy and childbirth is 1 in 17, 400; in Afghanistan, it is 1 in 8.
- Addressing such inequities is a big part of global health

Figure 1. Inequities in Global Health.

Worldwide, more than 13 million births each year face serious complications, and every day about 800 women die from preventable causes related to pregnancy and childbirth (about 300,000 annually).

A Few of the Many Global Alliances/Partnerships/Initiatives for Global Health

- Global Fund against HIV, TB and Malaria
- Global Alliance for chronic diseases
- Global Alliance for Clean Cookstoves
- Global Alliance for vaccines and immunizations (GAVI)
- Against cancer in LMICs

Figure 2. A Few of the Many Global Alliances/ Partnerships/Initiatives for Global Health.

Sustainable Development Goals: Agenda 2030

Figure 3. Sustainable Development Goals: Agenda 2030.

Definition of Global Health

Health problems, issues, and concerns that **transcend national boundaries,** may be influenced by circumstances or experiences in other countries, and are best addressed by cooperative actions and solutions

Figure 4. Definition of Global Health.

Figure 5. Another Definition of Global Health.

Global health is the health of populations in a global context. "the area of study, research and practice that places a priority on improving health and achieving equity in health for **all**. Problems that transcend national borders or have a global political and economic impact are often emphasized.

Global health is not to be confused with international health which is defined as the branch of public health focusing on developing nations and foreign aid efforts by industrialized countries.

Figure 6. My Engagements that are Relevant to Global Health.

Figure 7. Three Key Prioritization Studies that Led to Major Funding for Global Health Research and Innovation.

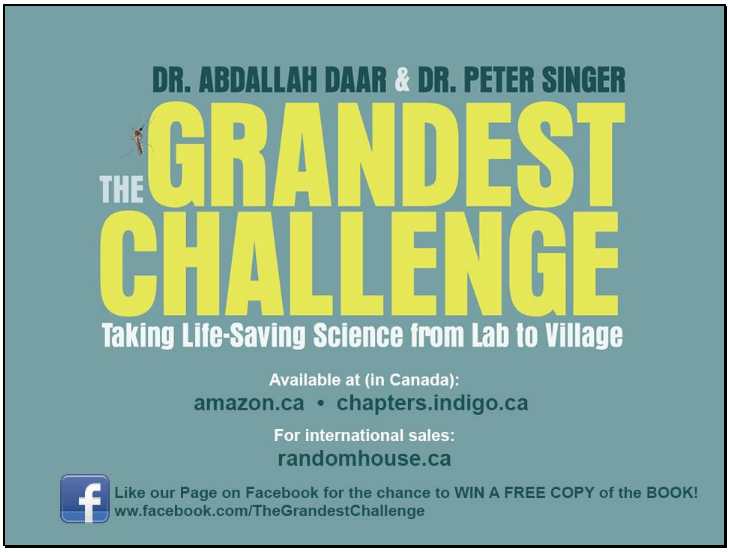


Figure 8. The Grandest Challenge.

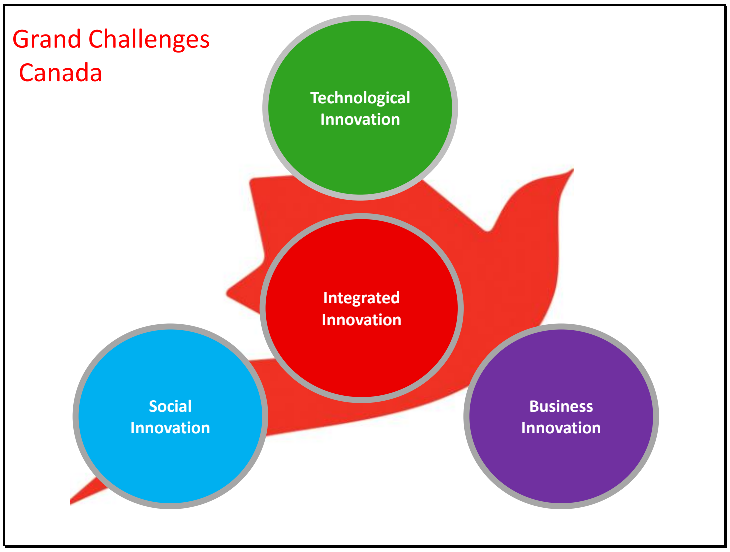


Figure 9. Grand Challenges Canada.

Infectious Diseases

- Meningitis nearly eliminated in Africa due to specific vaccine developed very rapidly and cheaply
- Dengue vaccine coming on stream now
- Malaria, TB, HIV: progress
- (Neglected Tropical Diseases)
- Measles mortality decreased by 60% from 1999–2005.

Figure 10. Infectious Diseases.

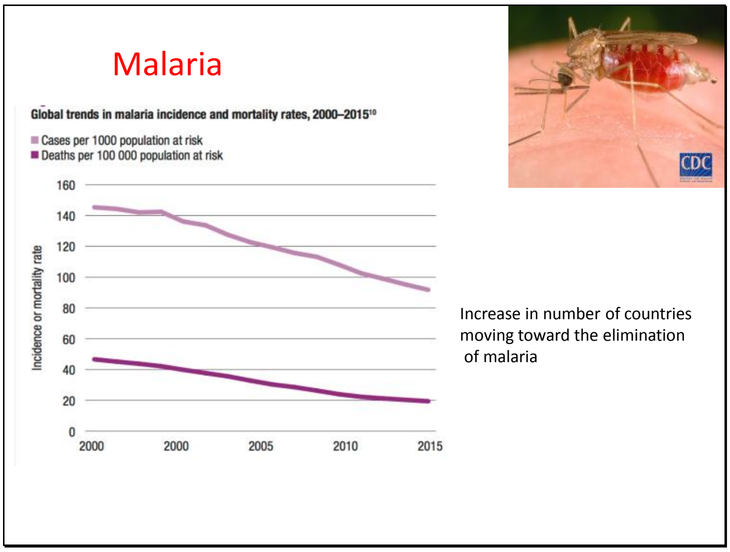


Figure 11. Malaria.

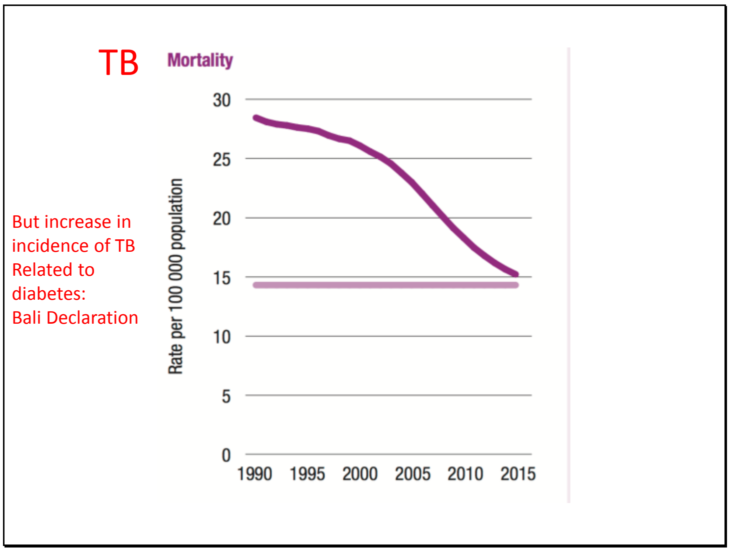


Figure 12. TB.

Bali Declaration http://www.worlddiabetesfoundation.org/news/bali-declaration-calls-action-against-tb-diabetes-co-epidemic

Flat line is target to be achieved.

http://www.who.int/gho/publications/mdgs-sdgs/MDGs-SDGs2015_chapter5.pdf

SDG Target 3.3 is focused on the major infectious diseases and includes HIV/AIDS (1.2 million deaths), TB (1.1 million deaths) and malaria (438 000 deaths). Encouraged by the major achievements of the MDG era, ambitious new global targets have been set for HIV, TB and malaria in the World Health Assembly and by the Joint United Nations Programme on HIV/AIDS (UNAIDS) Programme Coordination Board. The SDG target also goes beyond the MDGs in broadening the scope of attention to specifically include ending neglected tropical diseases (NTDs), and combating waterborne diseases, viral hepatitis and other communicable diseases.

Globally, the number of deaths due to infectious diseases, including parasitic diseases and respiratory infections, fell from 12.1 million in 2000 to 9.5 million in 2012. The percentage of all deaths due to infectious diseases decreased from 23% to 17%. In the African Region, and to a lesser extent the South-East Asia Region and the Eastern Mediterranean Region, infectious diseases are still a leading cause of death. The three regions account for 81% of all deaths and 89% of all YLL due to infectious and parasitic diseases in the world.

MDG Target 6 has been met for the major infectious diseases. Incidence (new HIV infections and new cases of malaria and TB) has declined: compared to 2000, the number of people newly infected with HIV was 35% lower; the malaria incidence rate among the population at risk was 37% lower and the TB incidence rate was 18% lower.

Major increases in the coverage of key interventions have been recorded for all three diseases. In 2014, 14.9 million people living with HIV were receiving ART, up from 690 000 in 2000. Coverage of (new) malaria interventions also increased rapidly. For instance, in sub-Saharan Africa an estimated 68% of children under five were sleeping under an ITN in 2015, compared to less than 2% in 2000. TB case detection rates increased from 38% to 63%, while maintaining high levels of treatment success (85% or higher) since 2007.

MDG progress has been made because of increased political commitment, strong global partnerships, drastic increases in funding, scaling up of new and existing interventions and better monitoring and use of data.

Infectious disease outbreaks remain a concern to all countries, imposing a significant burden on economies and public health. Several respiratory infectious disease outbreaks have occurred since 2000, including the 2003 severe acute respiratory syndrome (SARS) epidemic and the 2009 A (H1N1) influenza virus epidemic. Cholera is endemic in many countries and the Haiti outbreak of 2010–2011 provided a vivid reminder of its potential to spread. Most recently, the outbreak of Ebola virus disease in West Africa resulted in over 28 000 cases and more than 11 295 deaths (as of 23 September 2015), causing considerable concern across the globe.

The spread of infectious diseases is affected by multiple socioeconomic, environmental and ecological factors as well as rapidly increasing antimicrobial resistance. The SDGs provide a new platform for an integrated approach across the economic, social and environmental pillars of development, which should be used to address all infectious diseases.

http://www.who.int/gho/publications/mdgs-sdgs/MDGs-SDGs2015_chapter5_snapshot_tuberculosis.pdf

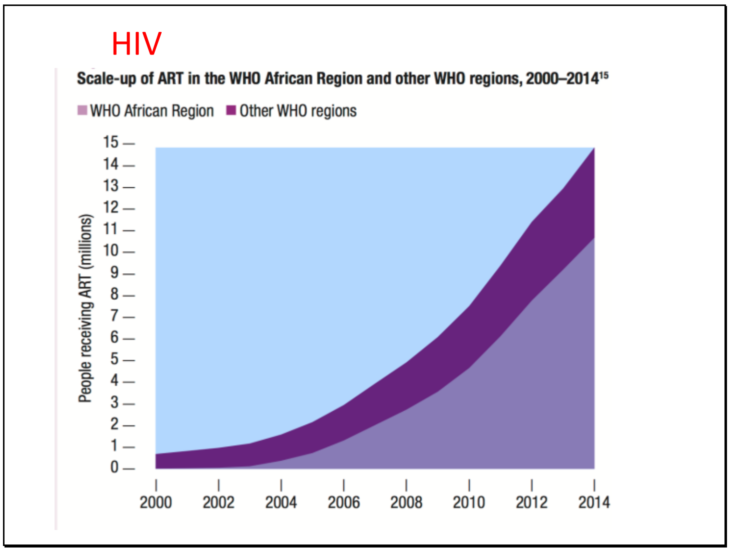


Figure 13. HIV.

Ebola and Other Potential Pandemics

- Lessons from West Africa: we are not prepared; disaster preparadeness. What would happen if Ebola hit Karachi or Cairo??
- Need rapid response mechanisms
- Better governance
- Resources

Figure 14. Ebola and Other Potential Pandemics.

Bill Gates warns over risk of pandemic precipice "Bill Gates says there could be one benefit from the Ebola epidemic that has killed more than 11,000 people in West Africa since 2014. 'It may serve as a wake-up call,' says the Microsoft founder. 'We must prepare for future epidemics of diseases that may spread more effectively than Ebola'..." (Ward, 11/8).

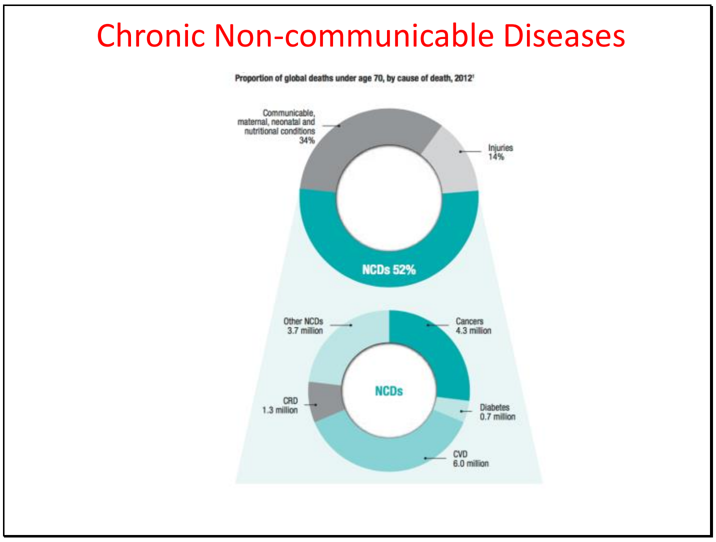


Figure 15. Chronic Non-communicable Diseases.

http://www.who.int/gho/publications/mdgs-sdgs/MDGs-SDGs2015_chapter6.pdf

NCDs are included as a speci c SDG target (reducing premature mortality from NCDs by one third) and are part of several other health targets.

In 2012, an estimated 52% of all deaths under age 70 was due to NCDs, and two thirds of those deaths were caused by cardiovascular diseases (CVD), cancer, diabetes and chronic respiratory disease (CRD).

Premature mortality rates due to NCDs declined globally by 15% between 2000 and 2012. A major factor is the decrease in CVD mortality, driven by population-level blood pressure improvements, declines in tobacco use and advances in medical treatment. Declines have been greater in high-income countries than in the low- and middle-income countries.

Achieving the SDG target for NCDs will require major interventions to deal with a context characterized by ageing populations, rapid unplanned urbanization and globalization of markets that promote inactivity and unhealthy diets, and will focus on the development and implementation of strong national plans that emphasize prevention and treatment access for all (half of all countries had neither a national plan nor budget in 2013).

The UN Political Declaration on NCDs adopted at the UN General Assembly in 2011 and the UN Outcome Document on NCDs adopted at the UN General Assembly in 2014 include a roadmap of commitments made by governments. The WHO Global Action Plan for the Prevention and Control of NCDs 2013–2020 endorsed by the World Health Assembly in May 2013 sets priorities and provides strategic guidance on how countries can implement the roadmap of commitments. The Global Action Plan includes voluntary targets that focus on risk factors such as tobacco use, high blood pressure, high salt intake, obesity and physical inactivity, as well as targets on access to essential NCD medicines and technologies, and drug therapy and counselling.

The WHO Framework Convention on Tobacco Control (WHO FCTC), ratified by 180 Parties – representing 90% of the global population – is the first public health treaty negotiated under the auspices of WHO. SDG target 3.a commits governments to strengthen the implementation of the WHO FCTC in all countries. The prevalence of tobacco smoking among people age 15 years and older has declined globally from 27% in 2000 to 21% in 2013, though not in all regions. Effective country implementation of multisectoral control measures such as raising taxes on tobacco and banning smoking in public places are major success factors.

SDG Target 3.9 aims to reduce deaths and illnesses related to hazardous chemicals, as well as air, water and soil pollution and contamination. About 7 million NCD deaths are attributed to indoor and outdoor air pollution. Global awareness of the need for multisectoral action is exemplified by the inclusion of air quality in three other goals and a recent World Health Assembly resolution on addressing the health impacts of air pollution.

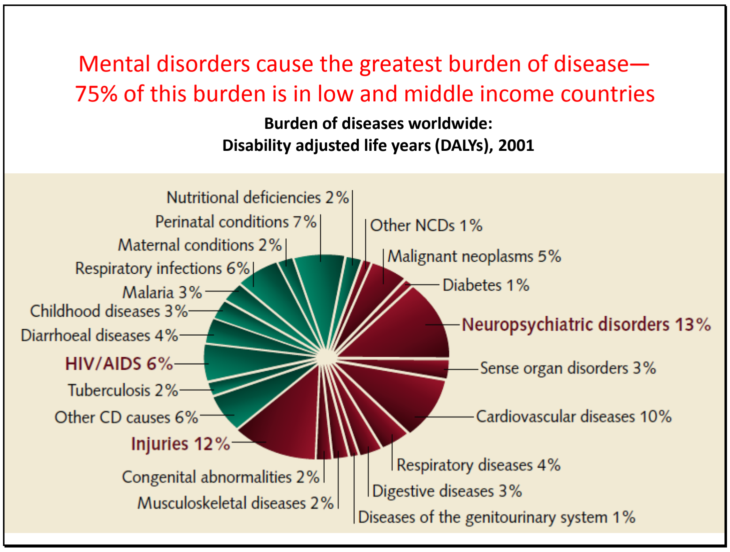


Figure 16. Mental disorders cause the greatest burden of disease.

http://www.who.int/gho/publications/mdgs-sdgs/MDGs-SDGs2015_chapter7.pdf

Unlike the MDGs, the SDGs include mental health and substance use disorders that, together with neurological and developmental disorders, are responsible for over 10% of the global disease burden.

SDG Target 3.4 calls for the promotion of mental health and well-being. Depression and suicide take a major toll on the health of the population. Nearly one in 10 people in the world suffer from a mental disorder. An estimated 804 000 deaths due to suicide occurred worldwide in 2012. Treatment coverage for mental disorders is very poor in many countries and significant scale-up will be required. Evidence-based guidelines for the management of depression and suicide are available, and the WHO Mental Health Action Plan 2013–2020 calls for a 20% increase in service coverage for severe mental disorders.

Dementia has become a major global health issue because it affects many people and their families (it is estimated that over 46 million people are living with dementia in 2015, a number expected to reach almost 75 million by 2030) and imposes major financial costs on societies (globally US$ 604 billion in 2010). Momentum is gathering with regard to the need to understand the causes of dementia and to develop appropriate prevention strategies and treatments. A broad public health approach is needed to improve the care and quality of life of people with dementia and family caregivers, articulated in a stand-alone dementia policy or plan, or integrated into existing health, mental health or old-age policies and plans.

SDG Target 3.5 calls for strengthening the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol. Almost 2% of the global burden of disease is estimated to be associated with alcohol and other substance use disorders. Alcohol use is one of the major risks for NCDs and a target of reducing harmful use by 10% over the next 15 years has been set. The WHO global strategy on reducing the harmful use of alcohol calls for national policies to strengthen the public health response to harmful use and build capacity for prevention and treatment of substance use disorders and associated health conditions.

In 2013, some 27 million people worldwide suffered from drug use disorders; almost 50% injected drugs, and an estimated 1.65 million were living with HIV. Since 2006, the number of people using illicit drugs has increased by 38 million, reaching 246 million in 2013. The number of problem users has remained fairly constant at 27 million since 2008. Treatment coverage for drug use disorders continues to be low. A special session of the UN General Assembly will be held in 2016 to address the world drug problem.

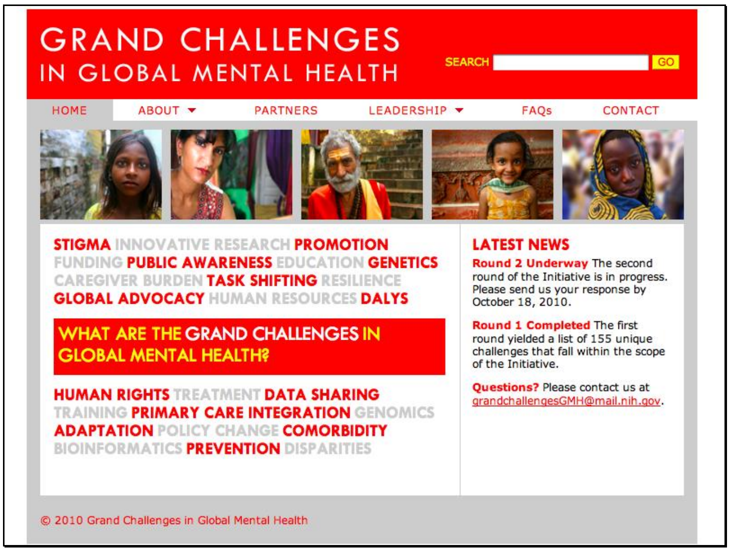


Figure 17. Grand Challenges.

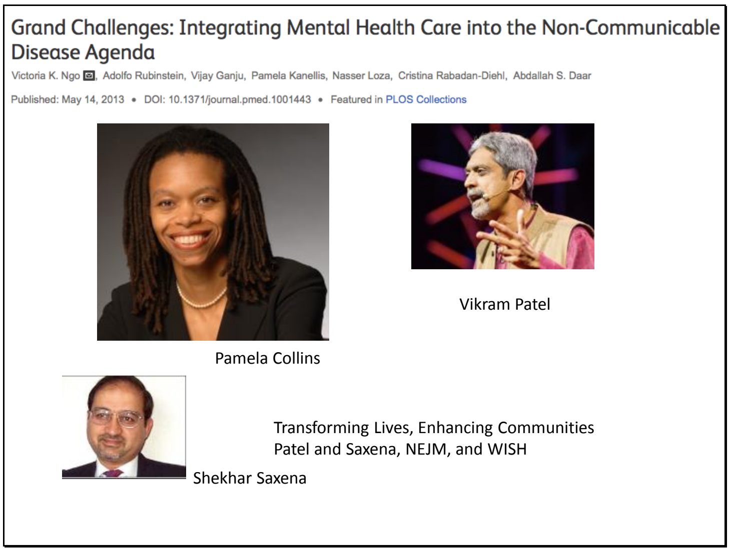


Figure 18. Grand Challenges: Integrating Mental Health Care into the Non-Communicable Disease Agenda.

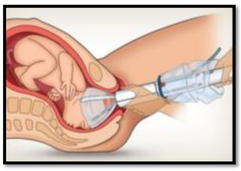
Declaration On Mental Health In Africa: Moving To Implementation (Daar et al 2014, *Global Health Action)*

Includes:

- Develop a National Mental Health Strategy and Plan
- Financing parity between mental and physical health alike
- Integrate into health system; focus on primary health care
- Resources for task-sharing
- Care that is evidence-based and culturally appropriate
- Be person-centred and holistic, providing psychological and social care as well as improving access to biomedical services
- MH & violence, especially against women and children
- Links between mental health and other health and development priorities like HIV/AIDS and MNCH

Figure 19. Declaration on Mental Health in Africa: Moving to Implementation.

MNCH: Two Examples of Saving Lives at Birth Projects
(Grand Challenges Canada)



The ODON Device: Low cost instrument for assisted delivery; Developed by a car mechanic in Argentina; clinical trials ongoing; being manufactured by Becton Dickinson

Imams as MNCH Champions

dRPC, Nigeria

Figure 20. MNCH: Two Examples of Saving Lives at Birth Projects.

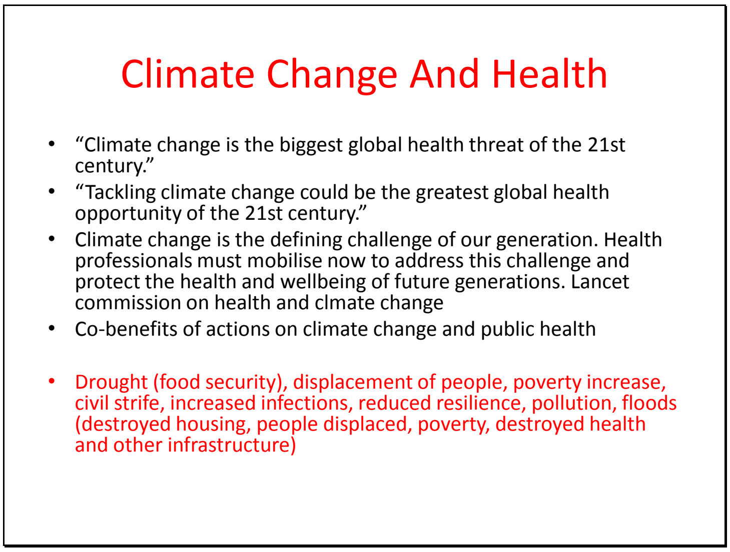


Figure 21. Climate Change and Health.

Costello A, Abbas M, Allen A, et al. Managing the health effects of climate change: *Lancet* and University College London Institute for Global Health Commission. *Lancet* 2009; **373:** 1693–733.

Watts N, Adger WN, Agnolucci P, et al. Health and climate change: policy responses to protect public health. *Lancet* 2015; published online June 23. http://dx.doi.org/10.1016/S0140-6736(15)60854-62.

http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(15)60931-X.pdf

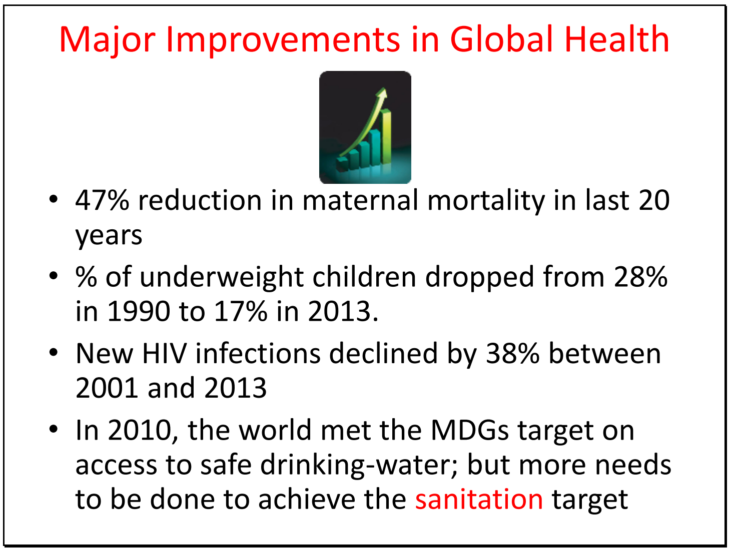


Figure 22.

http://www.who.int/mediacentre/factsheets/fs290/en/

http://www.who.int/workforcealliance/media/news/2015/path-towards-SDGs/en/

Figure 23. Trends in Global Health.

Universal health coverage (UHC) is defined as ensuring that all people can use the promotive, preventive, curative, rehabilitative and palliative health services they need, of sufficient quality to be effective, while also ensuring that the use of these services does not expose the user to financial hardship. UHC is prominent in the SDG declaration and has a specific target under the health goal. It is the only target that underpins, and is key to the achievement of, all the others.

During the MDG era, much progress was made in the coverage of key interventions for maternal and child health and against infectious diseases. Coverage gaps between the rich and the poor for these interventions were reduced in many countries. Per capita government expenditure on health went up by about 40% in real terms between 2000 and 2013, and out-of-pocket spending decreased slightly from 35% to 31% of total health spending.

UHC http://www.who.int/gho/publications/mdgs-sdgs/MDGs-SDGs2015_chapter3.pdf

Country actions supported by global agencies and partnerships and the scaling-up of innovative interventions for diagnosis (e.g. rapid tests for malaria and HIV), prevention (e.g. vaccines) and treatment (e.g. ART and ACTs) have contributed to improved service provision and performance.

Major health system weaknesses remain. Many countries lack sound health financing, leading to high out-of-pocket payments and financial catastrophe or impoverishment for families, and have major inadequacies in health workforce and infrastructure (especially in the rural areas), medical products (poor access, inappropriate use and reports on substandard, spurious, falsified, falsely labelled and counterfeit (SSFFC) medicines entering the supply chain), service quality and information and accountability. Weak health systems also leave major gaps in the national, regional and global defences against outbreaks of infectious diseases, such as Ebola virus disease and influenza epidemics.

While the MDG focus on specific diseases and health issues encouraged a tendency to reinforce programme silos set up to deliver selected interventions, all countries now face a much broader spectrum of health challenges, including the rapid rise of NCDs, the challenges of injuries and health security. Strong health systems are required to sustain and expand the ufinished MDG agenda, make major progress toward UHC and ensure resilience against epidemic diseases and disasters.

The SDG targets include a comprehensive set of health targets that address the unfinished and expanded MDG agenda, as well as major challenges related to NCDs, injuries and environmental issues. The target on UHC underpins all other targets and provides an opportunity to refocus efforts on a more sustainable approach through system-wide reform, based on the principles of efficiency and health service integration and people-centred care. The SDGs also fundamentally call for intersectoral action, acknowledging that attainment of health goals is dependent not only on actions within the health sector, but also on economic, social, cultural and environmental factors. Making progress towards UHC depends to a considerable extent on the broader policy context within which health systems operate and on levels and differentials in socioeconomic development.

Some Major Challenges

- Climate Change: 100 million people will be pushed into poverty by 2030; will increase strife
- Reduce neonatal deaths
- Antibiotic resistance
- Diabetes epidemic
- Aging populations
- Dementia
- Refugees e.g. Syrians displaced, health in camps
- Injuries and violence
- Water and sanitation
- Urban Health

Figure 24. Some Major Challenges.

Some Major Opportunities

- Eradicate polio
- UNAIDS plans to end AIDS by 2030
- Eradicate measles
- Eradicate malaria? via Gene editing e.g. of malaria carrying mosquitoes plus gene drive; new vaccines
- Proper use of big data

Figure 25. Some Major Opportunities.

What diminishes you
diminishes me.

The life of every child,
every human, has equal value

Figure 26.

Emerging Infectious Diseases: The Researcher's Guide

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1 ABSTRACT

A clinical researcher trained in a developed resource rich country returning to a developing resource strapped country to establish a meaningful research program relevant to the needs of the country has to face major challenges in order to compete in science with the developed world for international publications and research grants. The lack of political will and competing priorities for funding are some of the major challenges for development of Science and Technology as seen by budgetary allocations for research, health and education in the developing worlds. This transplantation therefore often fails to succeed and is the main reason for a lack of development of a critical core of scientist in the developing world.

In this presentation I will discuss some of the key elements that led to the development of a successful research program in Immunology of infectious diseases with a focus on leprosy and tuberculosis. This program developed a State-of-Art Immunology Laboratory. National and International collaborations were developed with The Marie Adelaide Leprosy Control Program in Pakistan, The London School of Hygiene and Tropical Medicine, Case Western Reserve University and Stanford University to mention a few. The funding support was provided by The Aga Khan University in the form of Seed Grant, World Health organization which provided Institutional grant to the Principal Investigator, Rockefeller Foundation, Welcome Trust and many others. In addition to publishing > 200 papers, training was provided for PhD students, FCPS students, Postdoctoral Fellows and mentored junior faculty at The Aga Khan University. Several are now holding key academic position which is really the hallmark of this research program as success of any program lies in its continuity. I will highlight some of key research findings in this presentation.

2 INTRODUCTION

I would like to thank The Islamic World Academy of Sciences and the organizers of symposium and in particular Dr Zoubi for inviting me to give this presentation at the Symposium held in Tehran, Iran in December 2015. Although the topic given to me was a researcher's guide for emerging infectious disease my research program deals with neglected and reemerging infectious diseases which include parasitic and mycobacterial infections. I pondered over the title and decided that challenges for becoming an infectious disease group leader in a developing country may provide some guidance to budding scientist aspiring to become research leaders in their own countries. The characteristic brain drain from East to West has several reasons of which the biggest challenge is a lack of understanding as to what research contributions will add to the country's needs and this is particularly for fundamental sciences. This has resulted in absence of scientific nurseries for developing a critical core of scientist. Furthermore, the political turmoil and violence in several developing countries can make even a brave heart tremble. As one of my Egyptian friend once commented when he heard that I was returning to Pakistan from National Institutes of Health in US, after spending 18 years abroad, that he had also contemplated returning to Egypt but discovered that for every successful model there were a hundred failed models and he was not willing to take that risk. It was only when I came back I realized what he was talking about. So an additional purpose for this presentation is to bring awareness for developing countries aspiring to advance in Science and Technology as to the support required for promoting research program leaders and research programs. I would like to share with you the key elements which allow a group leader to develop a successful infectious diseases research program in a developing country. I have divided the requirements and challenges into 3 phases; 1) Prerequisite Training 2) Becoming an independent investigator 3) Indigenous support in a developing country Institute to develop a research Program.

3 REQUIREMENTS AND CHALLENGES

3.1 Pre-requisite Training

Initial training is a key element in motivating a budding scientist to aspire towards a research career. University Professors usually provide role models who inspire students to pursue science. My graduate training started in Karachi University with a Master's thesis in Immunology. At that time due the vision of Professor Anwar, Head of Department of Microbiology, several Faculty members holding a Master's Degree, were sent abroad for postgraduate training who returned from the west bringing with them the excitement of new frontiers opening up in biology. This excitement was catching and provided the motivation to follow in their footsteps for no other reason than to become part of this new frontier. The current situation with respect to the government universities in Pakistan in general, although there are exceptions, are wrought with political influences and the process of recruitment of faculty and promotion is no exception. Length of stay rather than merit is more important for promotion. Teaching has greater priority than research with no clear-cut balance between teaching, research and administrative activities. This is, in addition to poor compensation and working conditions because of meager fund allocations that lead to the best brains opting for better prospects in the West. Private Universities are filling in this niche but the expenses are prohibitive and not within reach of the common man. So unless there is enabling environment in the government universities development of Science and Technology will remain a dream in these countries.

From Karachi University, I went to The University of Western Ontario, Canada, for a PhD in Immunology of parasitic diseases and then to Naval Medical Center as a Research Associate on a National Research Council Grant. I was recruited to The Clinical Allergy Section at Johns Hopkins University (JHU) as junior faculty. At all these institutes I was humbled by the breadth and dimension of research and it was the environment that nurtured the passion for science and research. The culture of research and thinking in these environments was the single most important element in my training and development as a research investigator. I call these Institutions my science nurseries. In these research nurseries I learnt about critical thinking, the power of new tools and methodology and more important how to use these tools to address cutting edge research questions. My focus of research was on regulation and modulation of allergic responses and it first centered around purification and properties of parasite allergens (Ascaris lumbricoides, Shistosoma mansoni) and assessing potency of parasite allergens in experimental model (1, 2, 3) which then extended into clinical setting to study pollen allergens and their potency (4,5). At this point in time it became obvious to me that parasites are much more potent inducers of IgE antibodies than the common allergens from plants and insects, but surprisingly parasites infections do not result in the harmful effects that you see in atopic allergy.

3.2. The evolution of an independent Investigator

Unraveling mechanisms, which govern induction, modulation and regulation of IgE antibody is of utmost importance to clinical allergists. Parasites are the most inducers of IgE antibodies which when cross-linked by specific antigens on the mast cells, results in release of both preformed and newly synthesized allergic mediators . In parasite infections there dis ample dparasite specific IgE antibodies, circulating antigen which should result in anaphylactic shock but most patients show little or no allergic reactivity. It would therefore seem that parasites must have evolved a natural mechanism to block anaphylactic responses for their own survival as parasite usually live within the host for several months to years. We therefore, felt that parasites were probably the best model to study modulation of allergic responses. With these questions I moved to National Institutes of Allergy and Infectious Diseases, NIH, in Bethesda, to start my next phase in research career as an independent investigator. I joined Dr Eric Ottesen's program in Clinical Parasitology Section (NIH). Dr Ottesen's laboratory was interested in analyzing the relationship of the immune response across the clinical spectrum of filariasis. Filariasis is endemic in South India. Dr Ottesen had established collaborations with a team at Tuberculosis Research Centre (TRC) Madras (now Chinnai) India. All our studies were conducted on clinical samples collected from this site. This was my first experience of the importance of international collaborations and usefulness of development of specimen banks for both prospective and retrospective studies which later became the backbone for my future studies. My role was to establish was to develop new tools to assess parasite specific responses in a quantitative way, in order to address the issue of regulation and modulation of immune responses in filariasis with a focus on IgE responses across the filariasis disease spectrum.

Clinical Spectrum of Filariasis

Clinical presentation in filariasis ranges from severe lymphatic obstruction leading to the characteristic elephantiaisis syndrome (Figure 1A) or completely asymptomatic individuals with circulating microfilaria (Figure1 B). Only a small percentage (<1%) of individuals develop pulmonary eosinophilia with nocturnal asthma and mild allergic symptomatology.

Although biological assays such as histamine release assay had shown the presence of filarial specific IgE, there were no quantitative assays to address the percentage of antigen specific IgE antibodies in filariasis patients across the disease spectrum. Most assays to determine antigen specific IgE antibodies were either in vivo assays such as skin tests which needed to be carried out in a clinical allergy setting or biological assays such as histamine release in vitro from basophils which require that they be done on fresh samples. Neither assay was amenable for large field studies. So we set about developing a highly sensitive in vitro assay for determining the concentration of filarial-specific IgE antibodies in sera of filariasis patients. We successfully developed a radioimmunoassay which could quantitatively determine picogram levels of filarial specific IgE. The development of this assay won the Berson-Yallow Award by The American Society of Nuclear Medicine in 1980 (6, 7).

This assay allowed quantitative determination of fllaria specific IgE across the disease spectrum. (8). Both polyclonal and filarial specific IgE concentrations were compared in filariasis with those found in allergic diseases such as hay fever (Table 1). With these kinds of antigen specific IgE antibodies in the presence of circulating filarial antigens, most filariasis patients should have been undergoing fatal anaphylactic shock Allergist had identified allergen specific IgG antibodies at high concentration (1:100) was known to block IgE mediated histamine release from basophils in vitro. There are four subsets of IgG (IgG1-IgG4) with different concentrations and biological activity. We demonstrated that IgG4 subclass which comprises of only a minor fraction (<4%) of the circulating pool of IgG antibodies, had >70% of IgE blocking activity (8). The reason for this efficacy was that IgG4 subclass recognized the same allergens as IgE antibodies (9). These studies provided a specific role for IgG4 antibodies in allergies. The significance of this work was apparent by this paper achieving the distinction of becoming ICMR's most cited research paper (1950-2010).

To summarize the lessons learnt in in this phase of my career was the importance of viable International collaborations, development of specimen banks, effective utility of tools and importance of cross fertilization. The lessons learnt at JHU in a Clinical Allergy setting were effectively applied to Clinical Parasitology to address an issue relevant for both fields. I cannot move onto my next phase in my career without acknowledging my mentors and key collaborators which include Drs Marsh, Adkinson, Hamilton (JHU), Dr Ottesen (NIH) and Drs Tripathy and Kumarswamy (TRC, India).

3.3 Evolution of a Research Program Leader

At this point in time I was recruited by the newly established The Aga Khan University (AKU) in Karachi, Pakistan to establish a State-Of-The Art Immunology research laboratory. The Aga Khan University's main mission was to develop a Hospital and Medical University which would meet international standards. The new University and its mission were alluring. I had always wanted to return to my native country for a lot of reason, including emotional ones but the comment of my Egyptian friend lingered and I felt if I needed to succeed I had to burn my boats to do so. I resigned from NIH instead of taking leave and returned to Karachi with a single commitment to develop a Research Immunology Laboratory which would be broad based to support research in infectious diseases. AKU in 1986 was in its infancy and had as yet not graduated its first batch of MBBS students (Figure 2).

At the time I joined AKU, There were 50 odd highly motivated faculty members with a desire to set up a medical college of International caliber and the first of its kind in Pakistan. AKU was the first University to put in place a professional administrative structure and policies for recruitment and promotion in line with the International norms. As all universities do, AKU had also defined its objectives for academic activities no different than other universities such as to have teacher's current in the area in which they are imparting knowledge and provide critical scientific thinking at the undergraduate and graduate level. It also decided on its research priorities based on both the countries need as well available expertise. Infectious disease was on top of the list of priorities due to the magnitude of the problem. So I was in the right place at the right time. The objectives I defined for our research program are listed in Table 2.

I needed to identify a disease model which would allow me to set up a State-of Art Immunology Laboratory and could address issues in a broad spectrum of biology (Figure 3) as defined in the model by Comas et al (10).

I chose Immunology of Leprosy as the first program, although the incidence and prevalence of leprosy is much lower than tuberculosis, globally as well as in Pakistan. There were several reasons for choosing this model. The most important reason was that leprosy was the first disease described, where the disease severity spectrum is directly related to the type of immune response activated in the host (Figure 4). In leprosy, increasing disease severity is associated with increasing antibody responses in parallel with increasing bacterial load while strong cell-mediated immunity results in less severe disease (11). So this was an ideal disease for setting up an Immunology laboratory. Both leprosy and tuberculosis bacteria reside and multiply in the macrophages. The interplay between antibodies and macrophages determine the final outcome of disease severity. However, the most compelling reason for choosing leprosy was that there was a well-developed Leprosy Control Program in Pakistan (Figure 5). There were 250+ Leprosy Field units throughout Pakistan including Azad Kashmir. There was also a wealth of clinical material from well characterized leprosy patients. The number of patients registered year-wise is shown in Figure 6. The National Reference Center (Figure 7), an 80 bedded hospital was only 5 KM from AKU. We contacted Dr Pfau, a German nun who had established the program in 1965, and turned it into the most successful Control Program in the history of Pakistan (12). Dr Pfau was not much interested in bench research and her main priority was how our research would support her patients (Figure 8) and control activities Dr Pfau was referring to Translational Research. This concept of systemic flow of information from bench to the field (Figure 9) was conceptualized in 2007 by Nadler et al (13). We discussed our objectives (Table 2) with Dr Pfau who then gave us acceptance for collaboration with MALC. Again, a very important lesson was learnt in developing viable collaborations. The objectives should be in line with both collaborators expectations.

Conceptualization of a research program is important as it provides a framework within which we can plan our activities, but implementation is a far more difficult task. The beautiful setting of AKU was like an oasis in the desert (Figure 2) but the research path was studded with challenges. Where can I get the team of scientist and technologists to do the clinic and lab based work? There was no electronic access to information and therefore it was difficult to keep current with information. We developed our library by requesting articles directly from authors and I must say the response was amazing. We were away from source of 7 consumables and reagents and perishables with a lag time of at least 6 months. Granting agencies require annual reporting. International grants do not offset salaries and indirect administrative overheads and with little expertise in financial management of research grants at AKU, it was a constant uphill battle but we learnt from each other. In addition, power outages, strikes, curfews and street gunfights were common occurrences in Karachi in the late 80' and early 90's. This is where Institutional support became critical. I was facilitated in overcoming most of these challenges by the tremendous initial support provided by AKU in the form of Seed Money Grant, laboratory space with the basic infrastructure, and the support of The President (Dr Shams Kassim Lakha) , Rector (Dr Qamar Vellani) several successive Deans (Dr Cheves Smythe, Dr David Ulmer, Dr John Dirks, Dr Roger Sutton) who appreciated the importance of this kind of a research program at AKU. But there were critical gaps in terms of trained manpower and expertise and a graduate program had yet to start. Therefore, we had to look at additional resources to fill in the gaps. We needed to develop meaningful and sustainable International collaborations as well. The experience at NIH stood me in good stead. Each collaborating Institute was picked carefully to complement mutual needs (Figure 10). Our main collaborators at each of these institutions and the expertise they provided are listed in Table 3.

Initially we were able to obtain funds from Rockefeller Foundation (Table 4) in collaboration with LSHTM which provided us with funds to develop basic research infrastructure. The first major milestone was successfully competing for a Program-Based Institutional Strengthening Grant from the World Health Organization (WHO) (Table 4). This allowed us to recruit and train teams of technicians and research officers and expand our research for both clinical and bench based studies. The research teams developed are listed in (Table 5).

This grant provided funds for development of additional space which were shared between WHO and AKU, again showing commitment of the Institute for this program. Since this grant was given within the framework of a research program directly to the Principal investigator, it allowed development of research infrastructure within the framework of a research program. With systems and tools in place we also obtained funding for TB Research (Table 4). The backbone of this program was the development of specimen bank (tissues, cells, sera) on >3000 patients, which were appropriately collected and documented and stored. The importance of rigorous documentation cannot be overemphasized and provided a firm basis for retrospective studies. The progress was carefully monitored by WHO with field visits and annual reports. This probably was a key determinant in keeping the program on the right track. Research project evolved from immuno-diagnosis to immuno-pathogenesis and immuno-regulation in leprosy disease (14-23). With a track record we were able to obtain further funding support from several other agencies, and we were able to quickly move into other infectious disease such as tuberculosis in collaboration with CWRU and Masoomeen Chest Diseases Hospital in Karachi (24-28). We also carried out inter-disciplinary projects in protozoal disease such as Blastocystis (29) malaria (30) and amoebiasis (31). Our studies provided major insight into regulation and modulation of antibodies in infectious diseases. Although this list is not comprehensive I would like to end with acknowledging my wonderful team of collaborators (Table 5) at the National Level, and the AKU team of co-investigators, collaborators, managers, technical staff and financial administrators for their excellent support in putting together a successful program.

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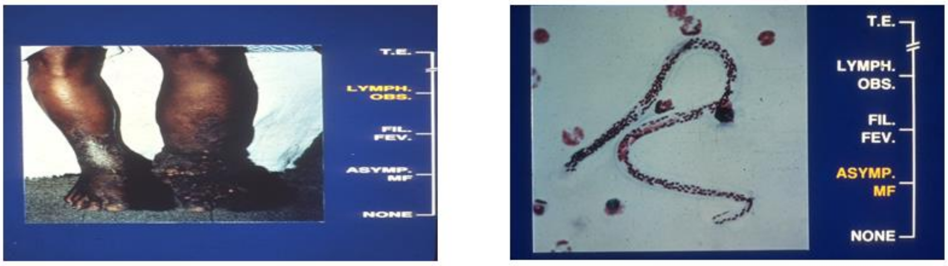
FIGURES

A. B.



Chronic pathology (CP) circulating microfilaria (MF)

Figure 1. Clinical Spectrum of Filariasis.

A. Patient with chronic lymphatic obstruction resulting in Elephant foot syndrome.
B. Asymtomatic patients with circulating microfilaria.
This is the infective stage where microfilaria is taken up by the mosquitoes for further development.

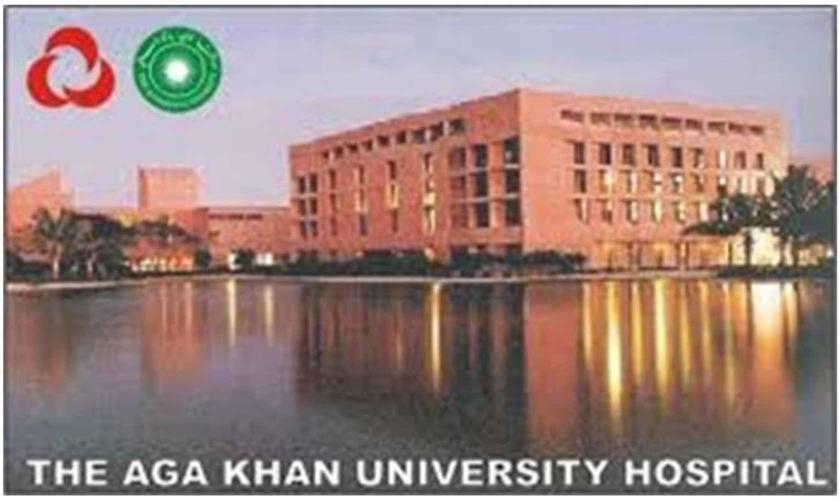
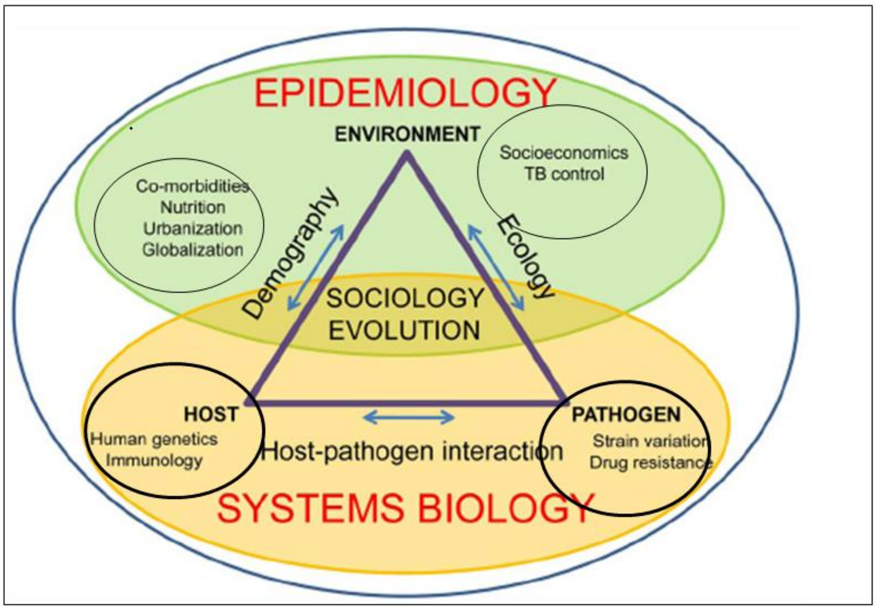


Figure 2. The Aga Khan University Hospital in Karachi, Pakistan.



DOI: http://dx.doi.org/10.1016/j.tim.2011.07.002

Figure 3. A Systems Biology Approach to Infectious Disease Research.

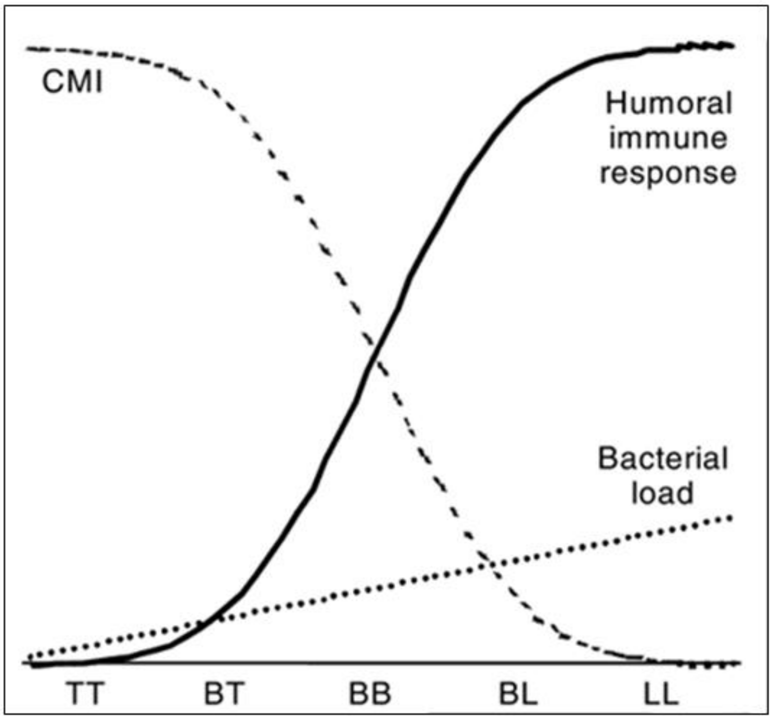


Figure 4. Leprosy disease spectrum.

Disease severity ranges from localized tuberculoid form (TT, BT) with strong cell mediated immunity (CMI) and low to absent bacteria in skin or biopsy samples. The more severe disseminated form of the disease is the Lepromatous form (BB, BL, LL) with high bacterial load, and strong Humoral (antibody mediated response) responses.

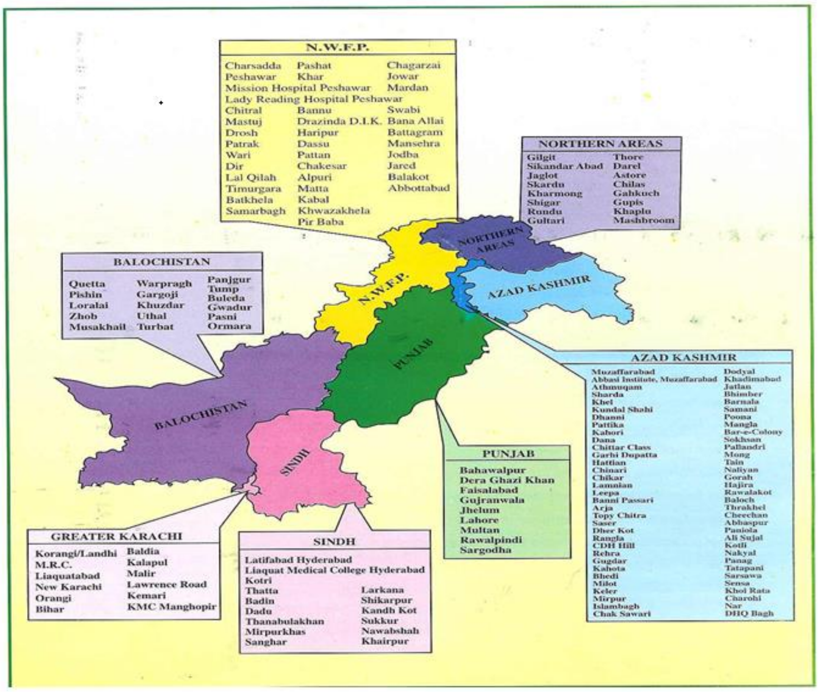


Figure 5. Leprosy Control Program in Pakistan.*

There are 250+ Leprosy field units throughout Pakistan including Azad Kashmir.

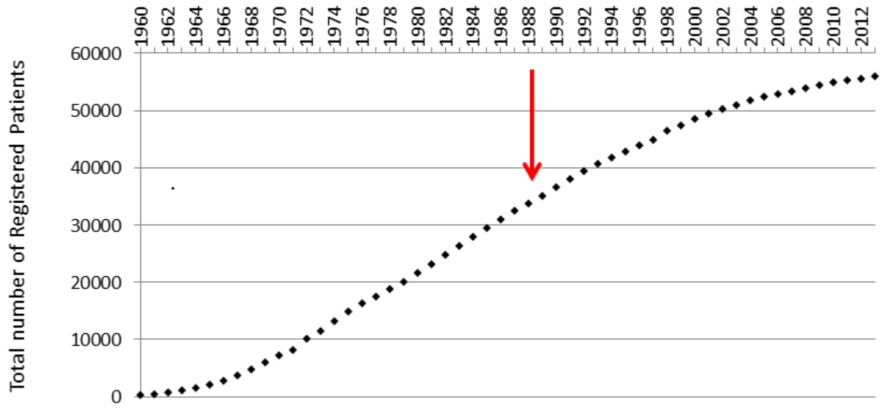


Figure 6. Registered Leprosy patients during 1963-2012.**

These patients had well documented clinical history according to WHO guidelines. There was regular annual household contacts check up by field teams who also followed up patients defaulting on chemotherapy. The red arrow indicates the initiation of our collaboration with MALC.

* Reproduced with permission from MALC.
** MALC Statistics Department.

Figure 7. Marie Adelaide National Reference Center.

The main referral center is located in the heart of Karachi. It is a 50 bedded hospital where patients with complications or deformities requiring hospital care are admitted from the entire country.

Figure 8. Dr Pfau examining a leprosy patient in a field clinic in Northern Areas.

Figure 9. The gap between the bench, the bedside and field

Figure 10. Collaborating Institutes

A. London School of Hygiene and Tropical Medicine UK;
B. St Thomas' Hospital UK; C. University of Colorado UK; D. Case Western Reserve University

TABLES

Table 1. Comparison of IgE responses in allergy and parasitic infection

IgE synthesis	Allergy (Hay fever)	Parasite infection (Filariasis)
Polyclonal IgE (ng/ml)	10-1000	100-200,000
Antigen specific IgE (ng/ml)	5-2000	5-40000
Specific IgE (% of Total IgE)	17-55	1-30
# of antigens recognized	5-30	30-50

Table 2. Objectives of the Research Program on Infectious Diseases

1.	Multidisciplinary: Cross cutting themes (basic, clinical and population-based.
2.	Relevance to Pakistan and developing world: This should be assessed in terms of disease burden (morbidity and mortality figures.
3.	Impact on country: Amenable to control with improved diagnosis, new candidate vaccines for field testing and improved patient management.

Table 3. International Collaborators and their Expertise

• Dr Hazel Dockrell LSHTM UK (Leprosy Immunology).
• Dr Sebastian Lucas St Thomas Hospital, UK (histopathologist).
• Dr Keith McAdam LSHTM UK (clinical leprosy).
• Dr Neil Stoker, LSHTM (molecular biologist).
• Dr Patrick Brennan (leprosy reagents).
• Dr Jerrold Ellner CWRU (TB Immunology).

Table 4. International Grants for Initiating the Research Program

1.	Molecular markers for prediction of reactions in leprosy. Collaborating Units: London School of Hygiene and Tropical Medicine (LSHTM) and Marie Adelaide Leprosy Centre (MALC). Funding agency, Rockefeller Foundation PI: Dr Rabia Hussain (1987-1989) $ 120,000.
2.	Immunological evaluation of purified recombinant and synthetic M. leprae antigens UNDP/World Bank/WHO/TDR. Institutional Strengthening Grant: Investigator Initiated Program Based Grant PI: Dr Rabia Hussain Co PI: Dr Rumina Hasan (AKU) and Dr. Hazel Dockrell (LSHTM)(1989-1993) $ 250,426.
3.	Immuno-regulation of tuberculosis UNDP/World Bank/WHO/TDR/ IMMTUB: Programme for vaccine development. PI: Dr Rabia Hussain (1991-1993) $60,000.

Table 5. National Collaborators for Leprosy and TB Research Program (MALC)

•	Dr Ruth Pfau, (Control Program Chief).
•	Dr Thomas Chiang (Medical Director).
•	Dr Ashfaq Ali (Leprosy Training).
•	Dr Mutahir Zia MALC (Clinical Leprosy).
•	Drs Fatima Firdausi,Qadeer Ehsan, Zeenat Uquaili Shahid Zafar, MALC/AKU (Research Medical officers), Masoomeen Trust Hospital.
•	Dr Ghaffar Dawood (Pulmonologist). Ms Farida Talat (Research Officer), AKU.
•	Dr Willem Sturm (Co-investigator), Dr Rumina Hasan (PhD; Co-Investigator) Zahra Hasan,(Post-Doctoral) Dr Bushra Jamil (Research Officer), Dr Erum Khan (FCPS), Dr Arnawaz Kifayet (PhD) Dr Najeeha Talat (PhD), Dr Ambreen Ansari (PhD).

PRESENTATION

Evolution of a research program leader

Phase 1: Research Training 1970-1973

Phase 2: Becoming an independent investigator 1973-1980

Phase 3: Research Program group leader 1981-2012

Figure 1. Evolution of a research program leader.

Phase 1: Research Training

- PhD (Ascariasis)
- Fellowship (Schistosomiasis)
- Instructor (Atopy and allergy)

Figure 2. Phase 1: Research Training.

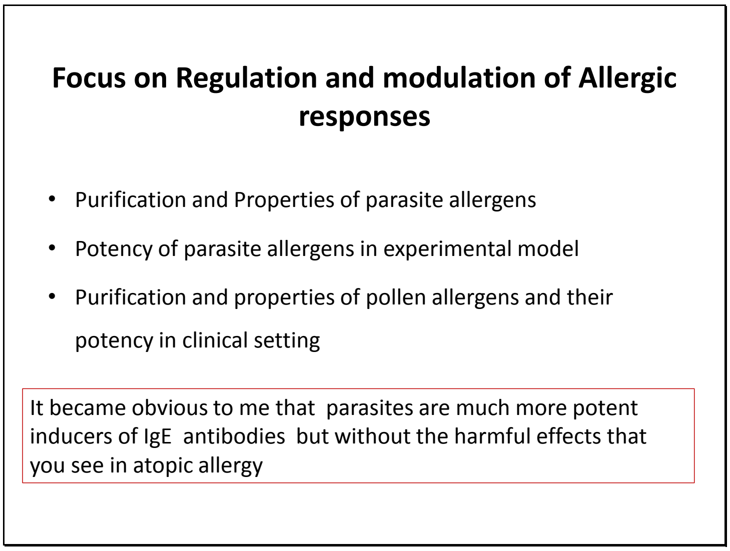


Figure 3. Focus on regulation and modulation of allergic responses.

Figure 4. Phase 2: Research as an independent investigator.

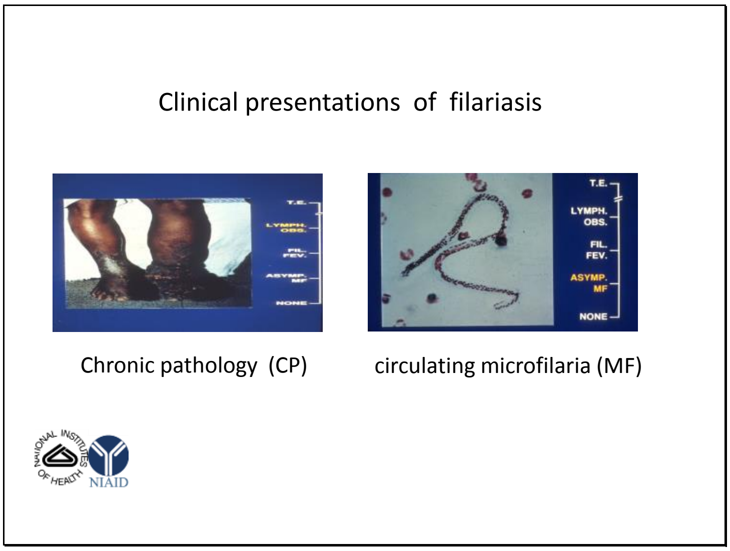


Figure 5. Clinical presentations of filariasis.

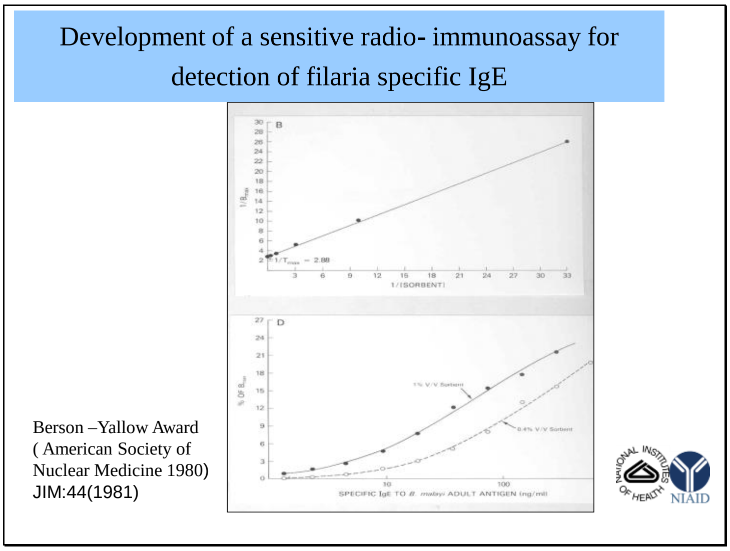


Figure 6. Development of a sensitive radio-immuno assay for detection of filarial specific IgE.

IgE responses in allergy and parasitic infection

IgE synthesis	Allergy (Hay fever)	Parasite infection (Filariasis)
Polyclonal IgE (ng/ml)	10-1000	100-200,000
Antigen specific IgE (ng/ml)	5-2000	5-40000
Specific IgE (% of Total IgE)	17-55	1-30
# of antigens recognized	5-30	30-50

NATIONAL INSTITUTES OF HEALTH NIAID

Figure 7. IgE responses in allergy and parasitic infection.

Hypothesis

Parasites must have evolved a natural mechanism whereby they could survive without Inducing death in the host as a survival strategy

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Figure 8. Hypothesis.

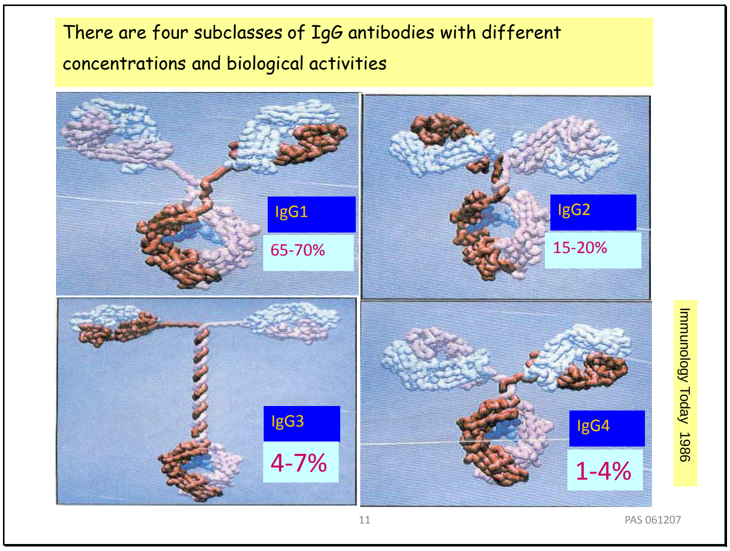
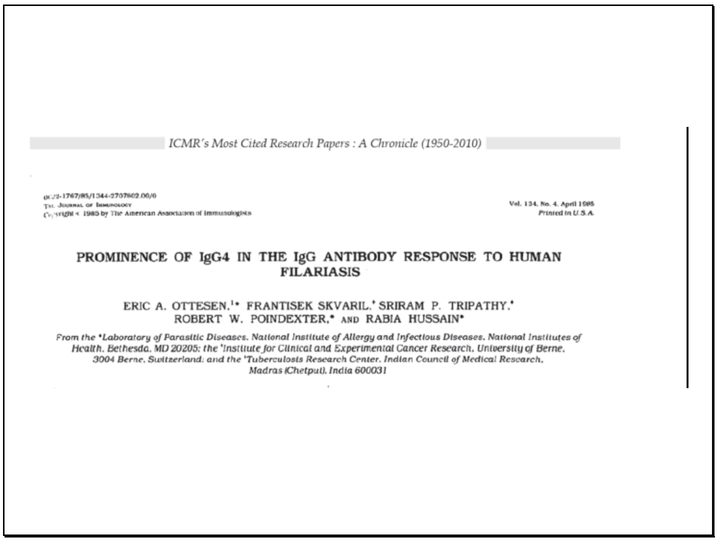


Figure 9. There are four subclasses of IgG antibodies with different concentrations and biological activities.



ICMR's Most Cited Research Papers : A Chronicle (1950-2010)

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PROMINENCE OF IgG4 IN THE IgG ANTIBODY RESPONSE TO HUMAN FILARIASIS

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From the [*]Laboratory of Parasitic Diseases, National Institute of Allergy and Infectious Diseases, National Institutes of Health, Bethesda, MD 20205; the [†]Institute for Clinical and Experimental Cancer Research, University of Berne, 3004 Berne, Switzerland; and the [‡]Tuberculosis Research Center, Indian Council of Medical Research, Madras (Chetput), India 600031

Figure 10.

Collaborators

Mentor

- Dr Eric Ottesen, NIH, USA
- Dr Nuzhat Kaushal NIH, USA
- Dr Robert Hamilton; Dr Frank Adkinson, JHU USA
- Dr Tripathy, Dr Kumaraswami, Dr Ramesh Paranjape, Chinnai, India

Figure 11.Collaborators.

Phase 3: Research Group Leader

1986-2012

14

Figure 12. Phase 3: Research Group Leader.

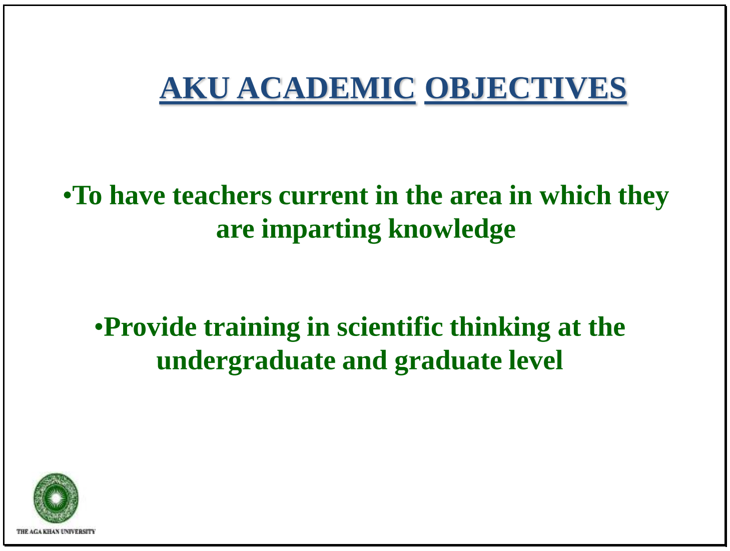

Figure 13. AKU Academic Objectives.

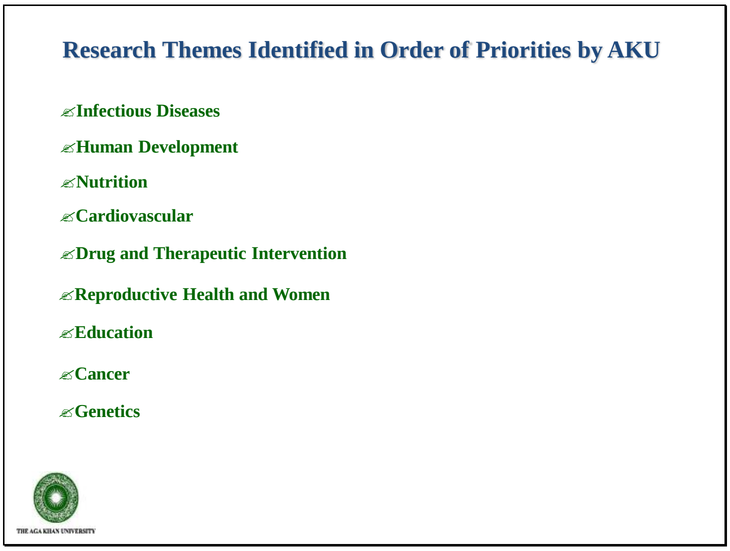

Figure 14. Research Themes Identified in Order of Priorities by AKU.

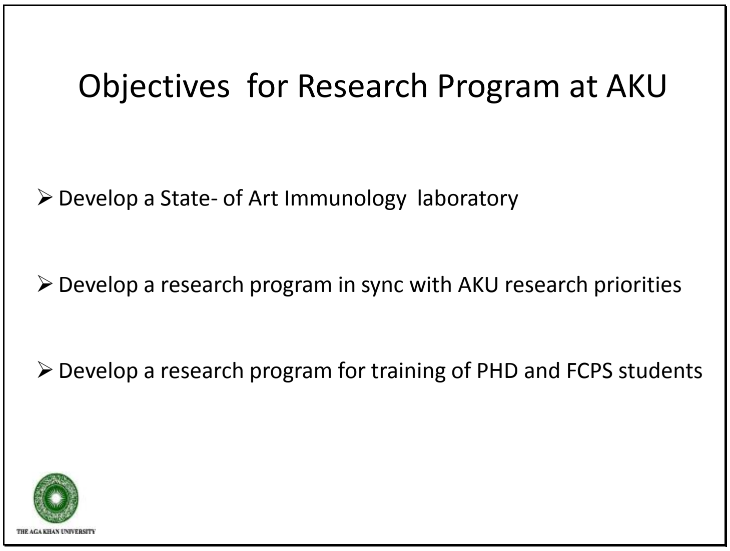

Figure 15. Objectives for Research Program at AKU.

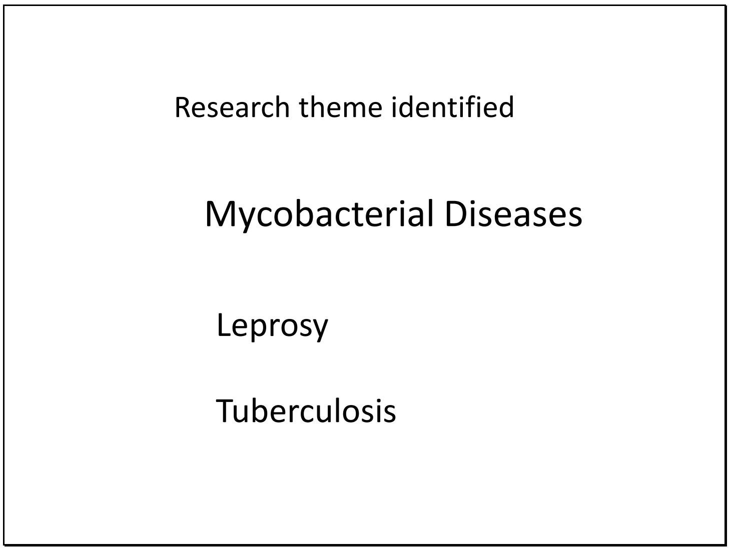

Figure 16. Research theme identified.

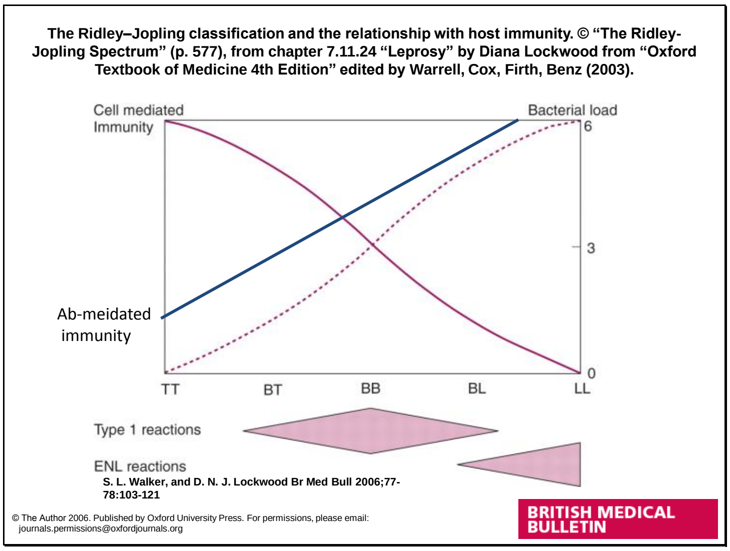

Figure 17.

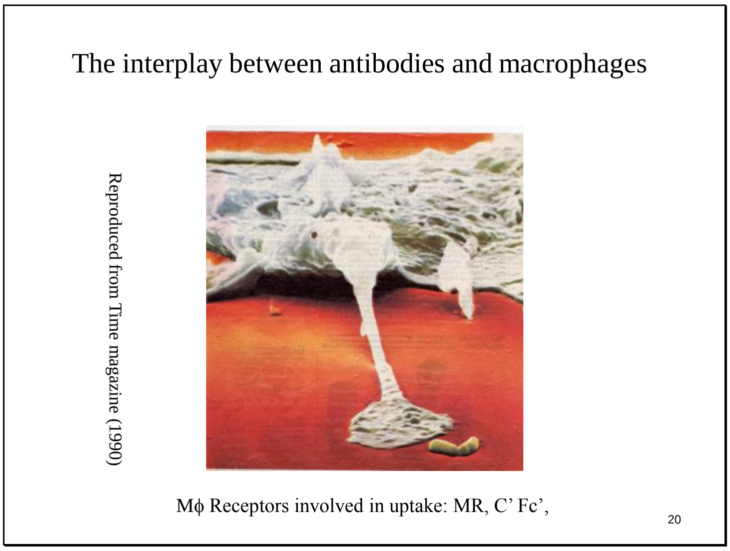

Figure 18. The interplay between antibodies and macrophages.

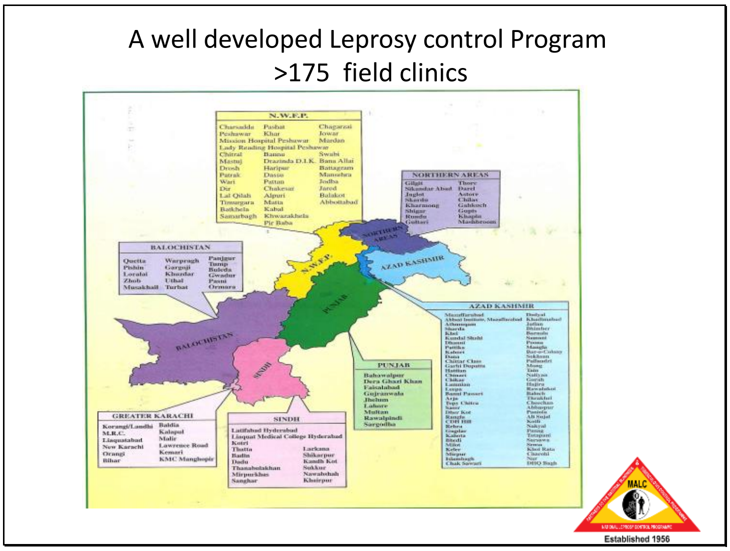

Figure 19. A well-developed Leprosy control Program.

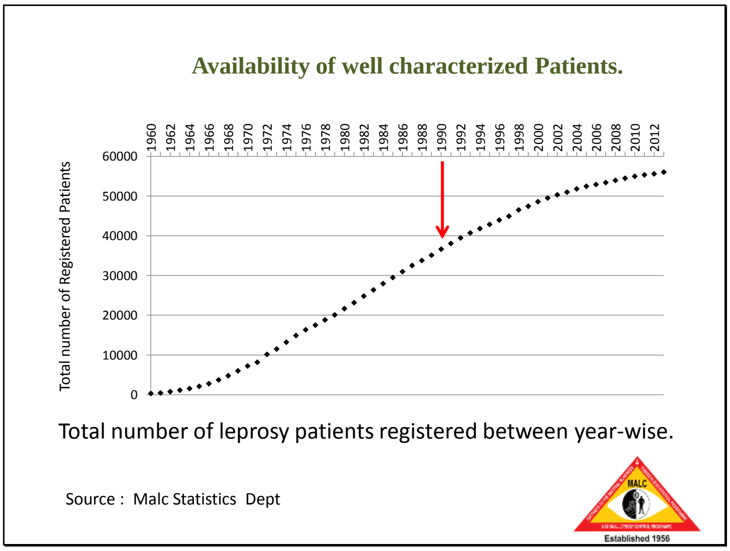

Figure 20. Availability of well characterized patients.

The National Reference Center (MALC) 5 KM from AKU

Figure 21. The National Reference Center (MALC).

How will research help my patients?

Figure 22. How will research help my patients?

Objectives needed to be redefined as follows

1. Multidisciplinary: Cross cutting themes (basic, clinical and population-based)

2. Relevance to Pakistan and developing world: This should be assessed in terms of disease burden (morbidity and mortality figures)

3. Impact on country: Amenable to control with improved diagnosis, new candidate vaccines for field testing and improved patient management.

Figure 23. Objectives needed to be redefined as follows.

Administrative Challenges -1985-1990

- **Critical pool of scientists and technologist missing**
- **Infrastructure for research lacking (proper radioactive room, cold room, hot room, animal facilities lacking)**
- **Access to current information lacking (Journals available 4-6 months lag).**
- **Away from source (perishable reagents, spares, consumable, lag of 6-8 months)**
- **Foreign agencies do not offset salaries and administrative overheads**
- Finally there was little experience in finance department for managing Research Grants

Figure 24. Administrative Challenges (1985-1990).

Figure 25.

Figure 26. Collaborating Institutes for Lab-Based Leprosy Research.

International Collaborators with most significant contribution

- Dr Hazel Dockrell LSHTM UK (lab based)
- Dr Sebastian Lucas St Thomas Hospital, UK (histopathologist)
- Dr Keith McAdam LSHTM UK (clinical leprosy)
- Dr Neil Stoker, LSHTM (molecular biologist)
- Dr Patrick Brennan (leprosy reagents)

Figure 27. International Collaborators with most significant Contributions.

Research Funding

1. Molecular markers for prediction of reactions in leprosy. Collaborating Units: London School of Hygiene and Tropical Medicine (LSHTM) and Marie Adelaide Leprosy Centre (MALC). Funding agency, **Rockefeller Foundation** PI: Dr. Rabia Hussain (1987-1989) **$ 120,000.**

2. Immunological evaluation of purified recombinant and synthetic *M. leprae* antigens **UNDP/World Bank/WHO/TDR. Institutional Strengthening Grant:** Investigator Initiated Program Based Grant PI: Dr. Rabia Hussain Co PI: Dr. Rumina Hasan (AKU)and Dr. Hazel Dockrell (LSHTM)(1989-1993) **$ 250,426.**

30

Figure 28. Research Funding.

Serum, cells and biopsy tissue banks

> 3000 well characterized leprosy patients

Figure 29. Serum, cells and biopsy tissue banks.

National Research Team

- Dr Ruth Pfau, MALC (control program chief)
- Dr Thomas Chiang, MALC (medical Director)
- Dr Ashfaq Ali, MALC (training)
- Dr Mutahir Zia (Senior Leprologist)
- Drs Fatima Firdausi,Qadeer Ehsan, Zeenat Uquaili Shahid Zafar, MALC (Research Medical officers)

32 PAS 061207

Figure 30. National Research Team.

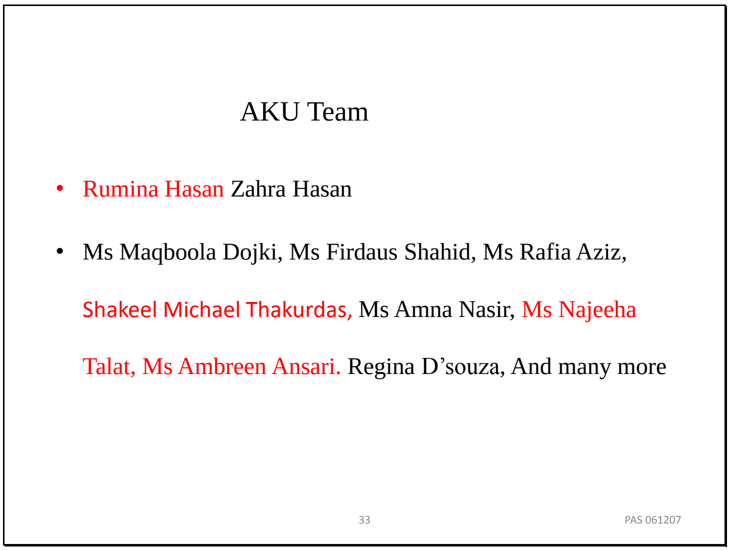

Figure 31. AKU Team.

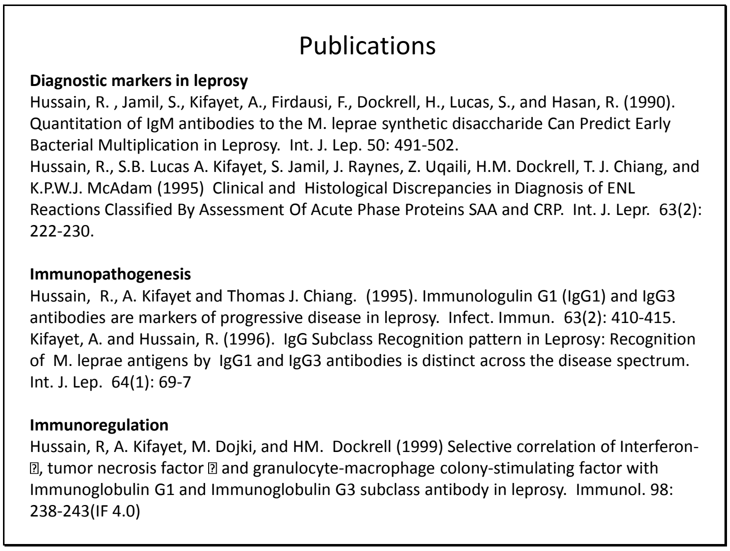

Figure 32. Publications.

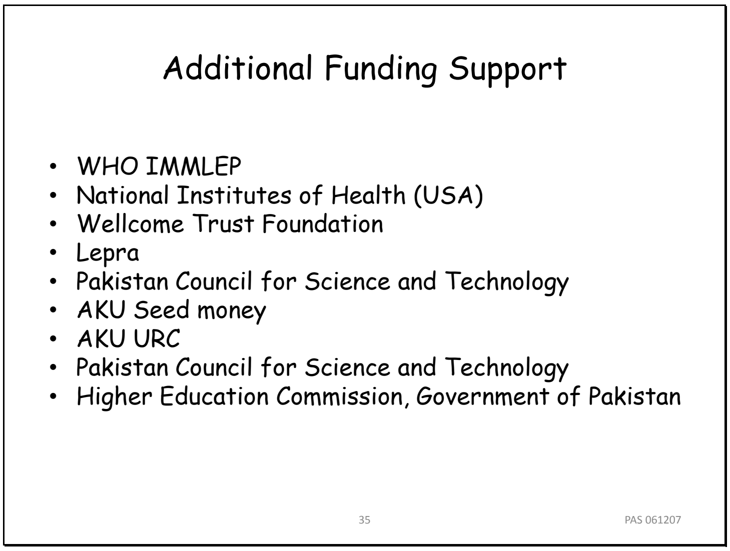

Figure 33. Additional Funding Support.

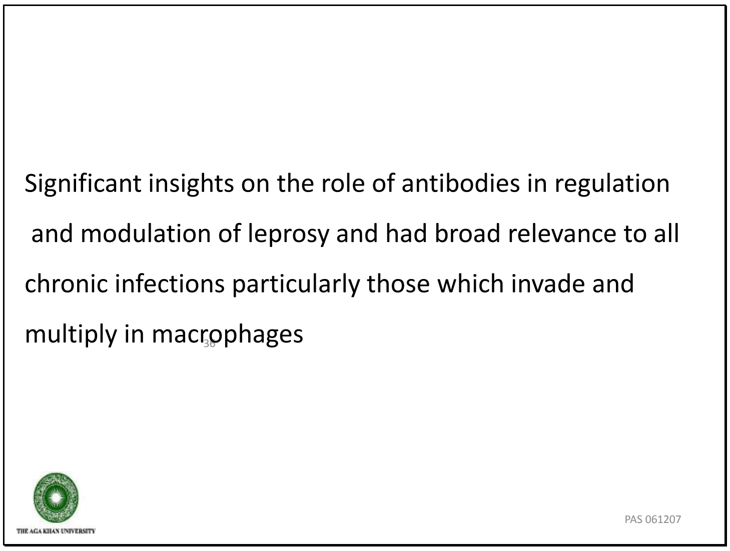

Figure 34.

Intracellular parasites of Macrophage/ monocyte system

- **Viruses**: *adenoviruses, **herpesviruses** (herpes simplex virus, cytomegalovirus), poxviruses (**vaccinia**), retroviruses (human immunodeficiency virus), togaviruses (**Dengue virus**), bunyaviruses, paramyxoviruses*

- **Bacteria**: *Brucella abortus, chlamydia spp. (C. trachomatis, C. psittaci) **Corynebacterium spp.,** Franciscella tularensis, Legionella pneumophila, Listeria monocytogenes, **Mycobacteria spp. (M. tuberculosis, M. leprae**, M. intracellulare), Rickettsia spp. (R. akari, R. prowazekii, R. tsutsugamushi), **Salmonella spp.** (S. typhimurium)*

- **Viruses**: *adenoviruses, **herpesviruses** (herpes simplex virus, cytomegalovirus), poxviruses (**vaccinia**), retroviruses (human immunodeficiency virus), togaviruses (**Dengue virus**), bunyaviruses, paramyxoviruses*

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Figure 35. Intracellular Parasites of Macrophage/ Monocyte System.

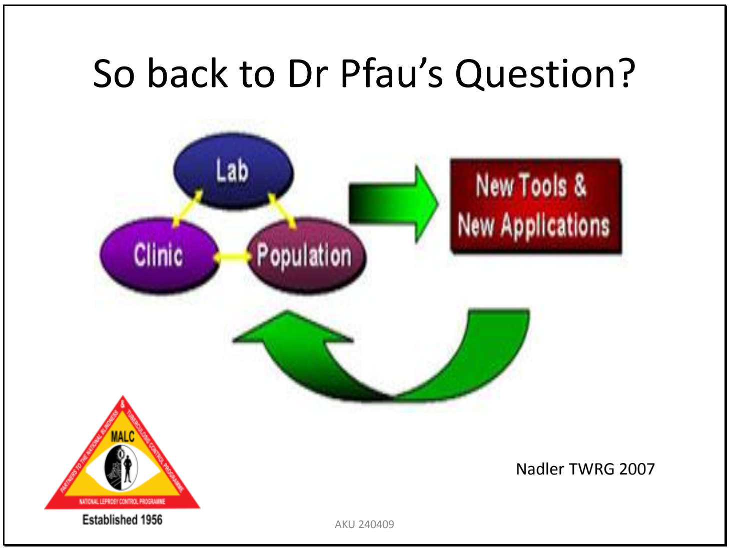

Figure 36. So back to Dr Pfau's Question?

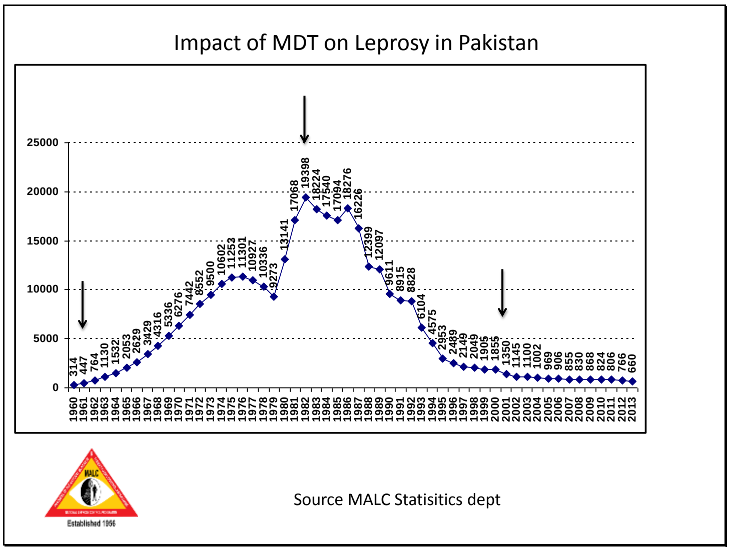

Figure 37. Impact of MDT on Leprosy in Pakistan.

IDEAL Consortium
Initiative for Diagnosis and Epidemiological Assays for Leprosy

Funded by Heiser Foundation. $600000 (Starting 2006)

Components

- Steering Committee
- Six Group Leaders, 25 investigators and 5-10 affiliated research assistants at each site
- 5 field sites (Brazil, Bangladesh, Ethiopia, Nepal and **Pakistan**)
- Annual Workshop at one of the field sites

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Figure 38. IDEAL Consortium initiative for Diagnosis and Epidemiological Assays for Leprosy.

Rationale for IDEAL

- **To identify subclinical infections and treat those harboring the infection to eliminate the disease.**
- In 2001 M leprae genome was deciphered
- *M. leprae* specific open reading frames were identified
- A consortium was developed to synthesize these peptides and test them in field sites for utility in detection subclinical infection

AKU 240409

Figure 39. Rationale for IDEAL.

CLINICAL AND VACCINE IMMUNOLOGY, Mar. 2009, p. 352–359 Vol. 16, No. 3
1556-6811/09/$08.00+0 doi:10.1128/CVI.00414-08

From Genome-Based In Silico Predictions to Ex Vivo Verification of Leprosy Diagnosis▽†

Annemieke Geluk,[1*] John S. Spencer,[2] Kidist Bobosha,[9] Maria C. V. Pessolani,[3] Geraldo M. B. Pereira,[3,4] Sayera Banu,[5] Nadine Honoré,[6] Stephen T. Reece,[7] Murdo MacDonald,[8] Bishwa Raj Sapkota,[8] Chaman Ranjit,[8] Kees L. M. C. Franken,[1] Martha Zewdie,[9] Abraham Aseffa,[9] Rabia Hussain,[10] Mariane M. Stefani,[11] Sang-Nae Cho,[12] Linda Oskam,[13] Patrick J. Brennan,[2] and Hazel M. Dockrell,[8,14] on behalf of the IDEAL Consortium

Department of Infectious Diseases, Leiden University Medical Center, Leiden, The Netherlands[1]; Department of Microbiology, Immunology and Pathology, Colorado State University, Fort Collins, Colorado[2]; Laboratory of Cellular Microbiology, Oswaldo Cruz Institute, Fiocruz, Rio de Janeiro, Brazil[3]; Laboratory of Immunopathology, School of Medical Sciences, State University of Rio de Janeiro, Rio de Janeiro, Brazil[4]; International Center for Diarrhoeal Disease Research, Bangladesh, Dhaka, Bangladesh[5]; Institute Pasteur, Paris, France[6]; Infectious Disease Research Institute, Seattle, Washington[7]; Mycobacterial Research Laboratory, Anandaban Hospital, Anandaban, Nepal[8]; Armauer Hansen Research Institute, Addis Ababa, Ethiopia[9]; Aga Khan University, Karachi, Pakistan[10]; Tropical Pathology and Public Health Institute, Federal University of Goiás, Goiânia, Brazil[11]; Yonsei University, Seoul, South Korea[12]; Royal Tropical Institute, Amsterdam, The Netherlands[13]; and London School of Hygiene & Tropical Medicine, London, United Kingdom[14]

Received 8 November 2008/Returned for modification 3 December 2008/Accepted 23 December 2008

AKU 240409

Figure 40.

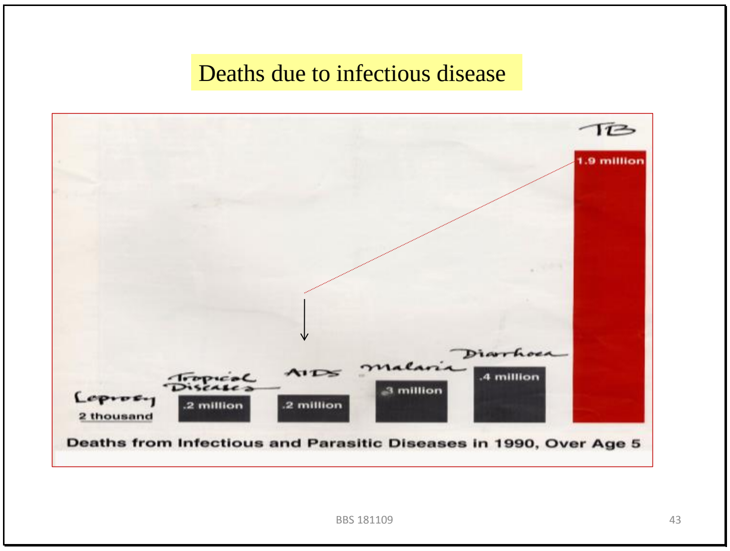


Figure 41. Deaths due to infectious disease.

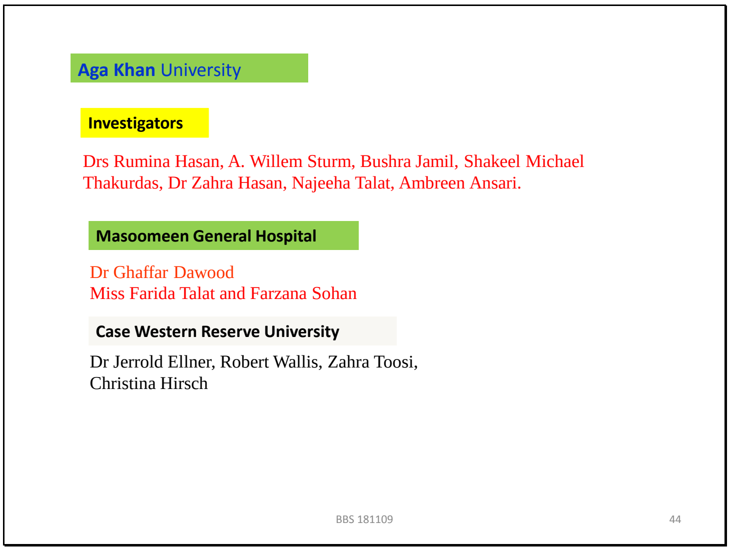


Figure 42. TB Collaborators.

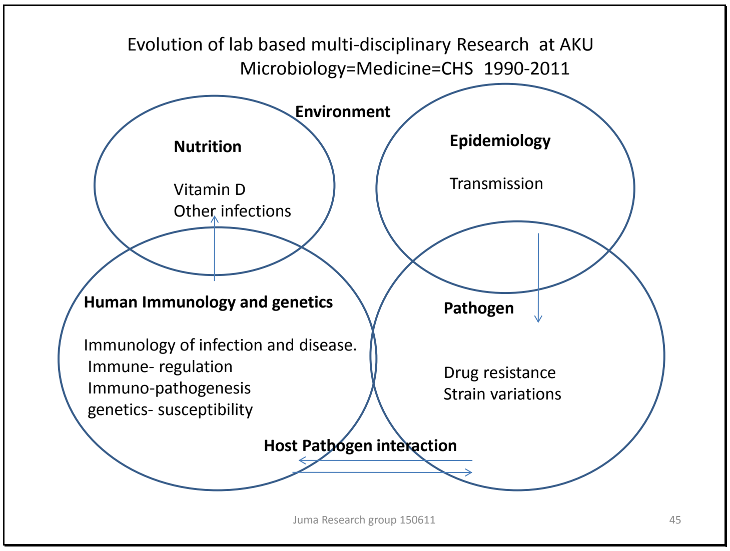


Figure 43. Evolution of lab based multi-disciplinary Research at AKU.

Key determinant of success

Sustainable and productive collaborations

Based on mutual respect and equality.

Proper documentation and collection of samples

Good communication between filed and lab

Figure 44. Key determinant of success.

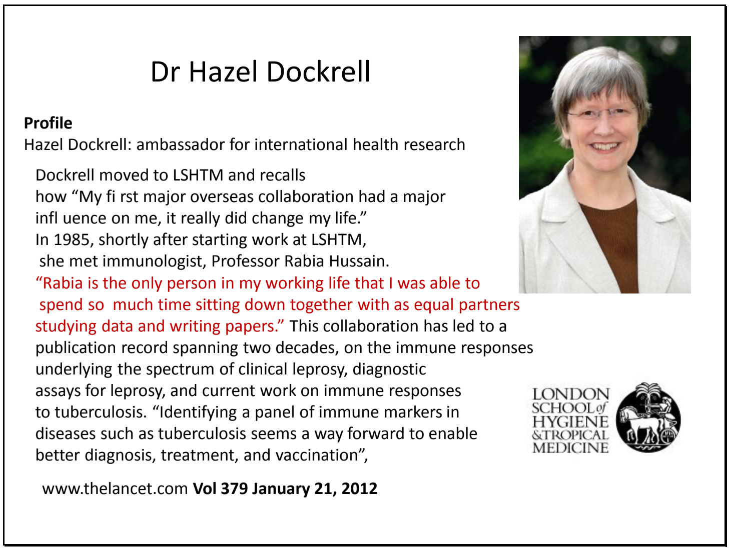


Figure 45. Dr Hazel Dockrell.

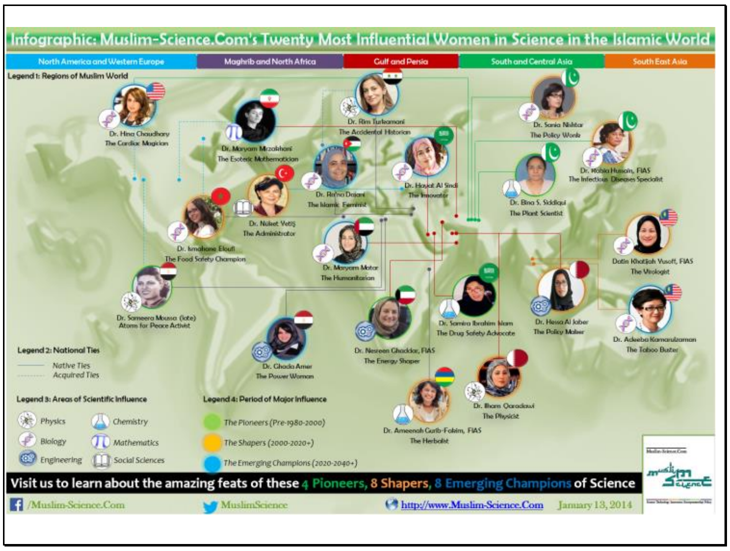


Figure 46. Muslim-Science.com's Twenty Most Influential Women in science in the Islamic world.

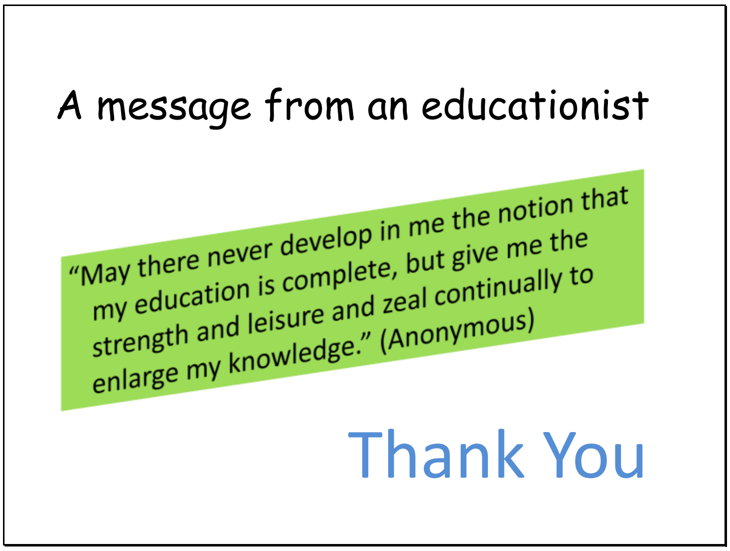
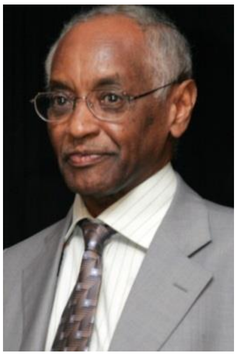


Figure 47. A message from an educationist.

Promoting STI for Sustainability and Economic Transformation in Africa

MOHAMMAD HASSAN FIAS
President, African Academy of Sciences
Khartoum, Sudan

ABSTRACT



In this presentation I will discuss the critical role of STI in promoting sustainable development for social and economic well-being in Africa, especially for the poorest and most vulnerable communities.

My talk will focus on three important and interconnected issues:

- The global challenges that Africa faces in addressing critical sustainability issues
- The new emerging opportunities for accelerated development initiatives in Africa, resulting from the rapidly advancing frontier STI.
- The global actions that should be pursued by institutions such as centres of excellence and academies of science to take full advantage of the unprecedented opportunities to find STI-based solutions to sustainability challenges in the continent

PRESENTATION

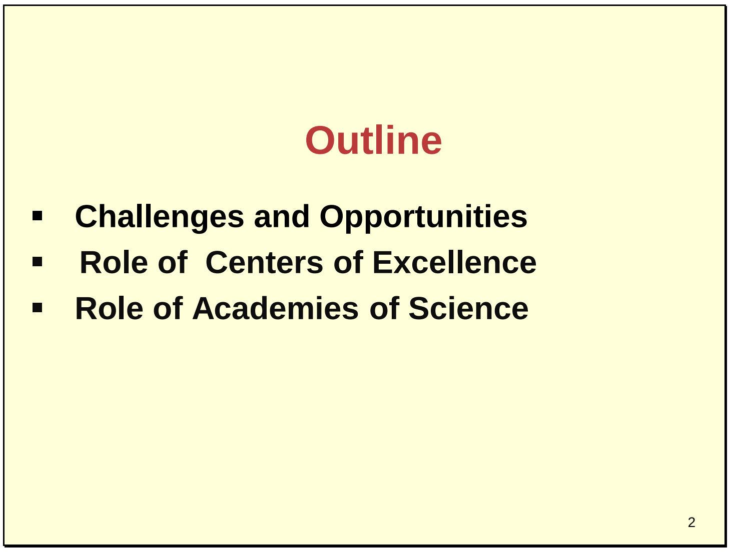


Figure 1. Outline.

Figure 2. Challenges and Opportunities.

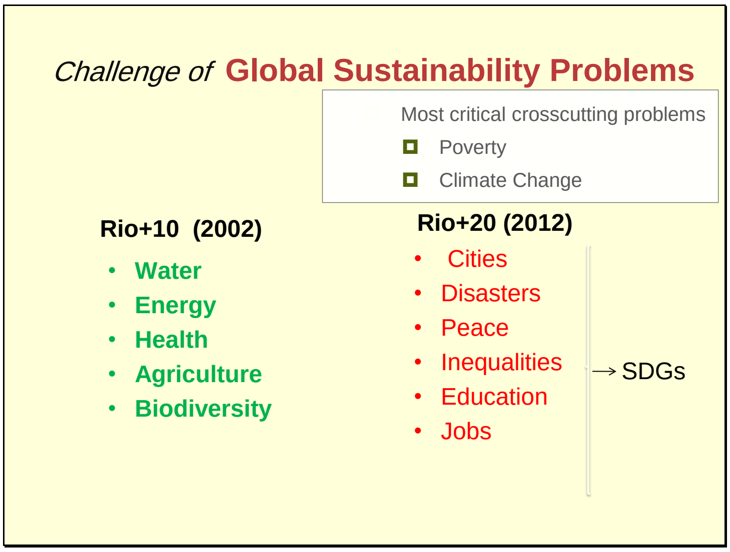


Figure 3. Challenge of Global Sustainability Problems.

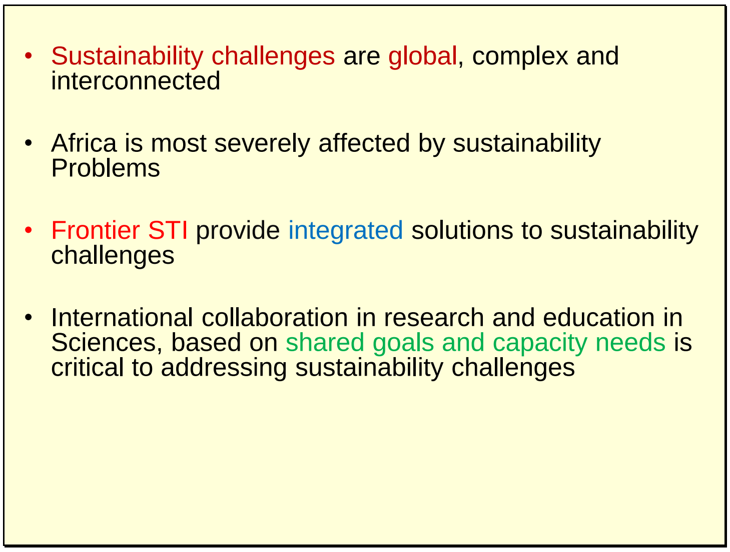


Figure 4.

Figure 5. Challenges of Global Science Disparities.

Figure 6.

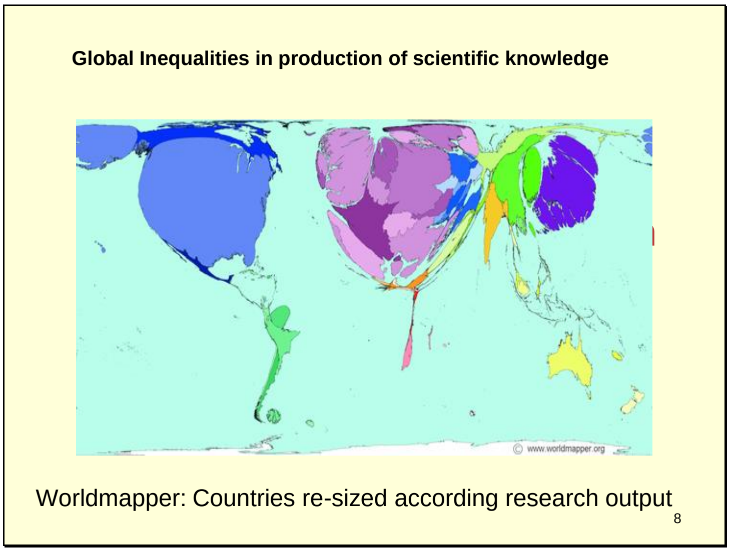


Figure 7. Global Inequalities in production of scientific knowledge.

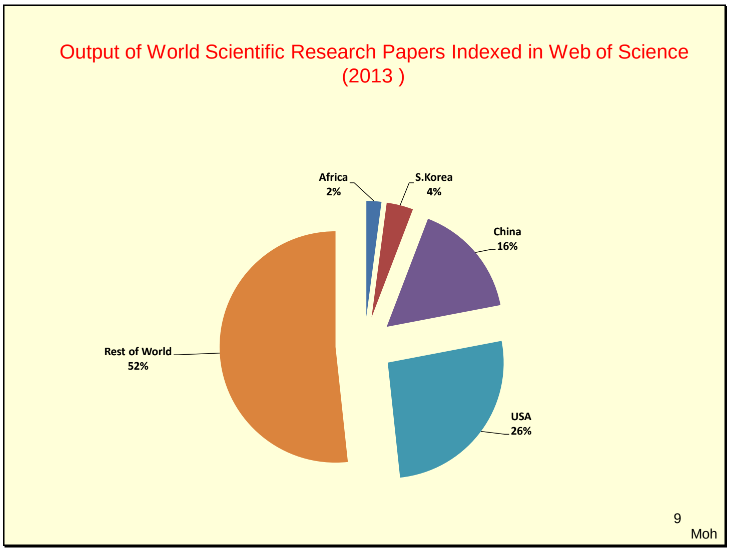


Figure 8. Output of World Scientific Research Papers Indexed in Web of Science (2013).

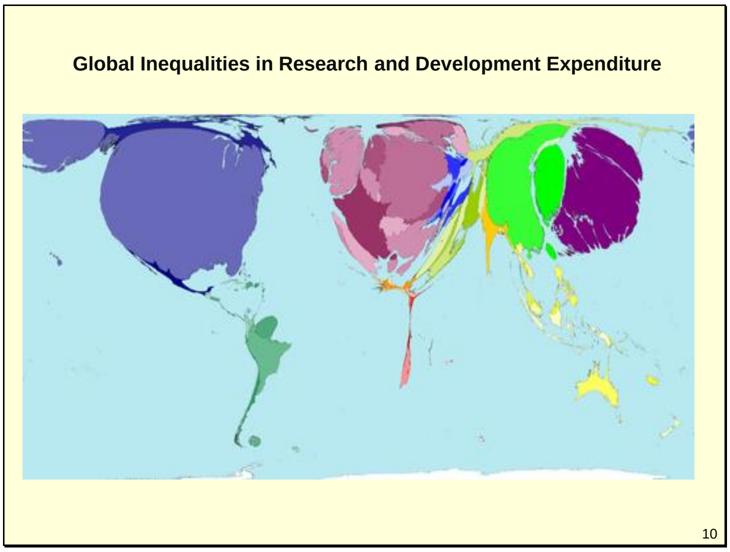


Figure 9. Global Inequalities in Research and Development Expenditure.

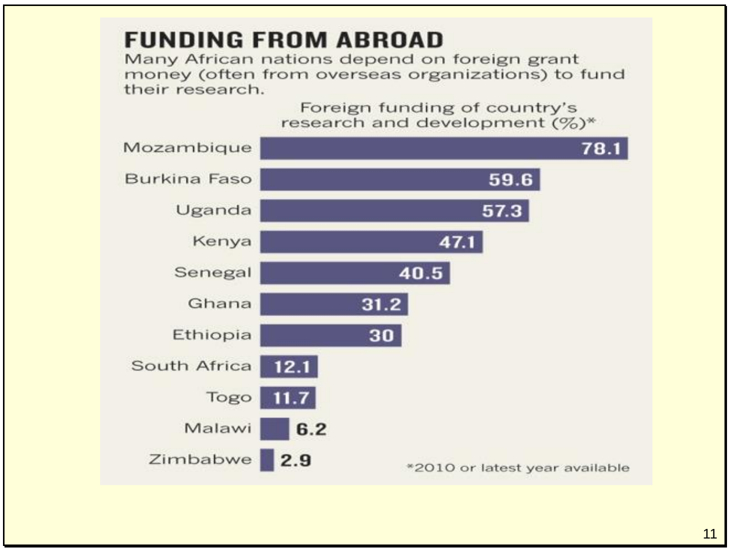


Figure 10. Funding from Abroad.

Two main challenges

Strategies for Global Sustainability should promote global partnerships to address two interrelated challenges:

- Improving quality and relevance of education and research, especially in S&T Poorest Countries, to enhance their capacities to participate in global knowledge production
- Increasing **national** and **global** investments in research and development, to generate STI-based solutions to critical sustainability problems

Figure 11. Two main challenges.

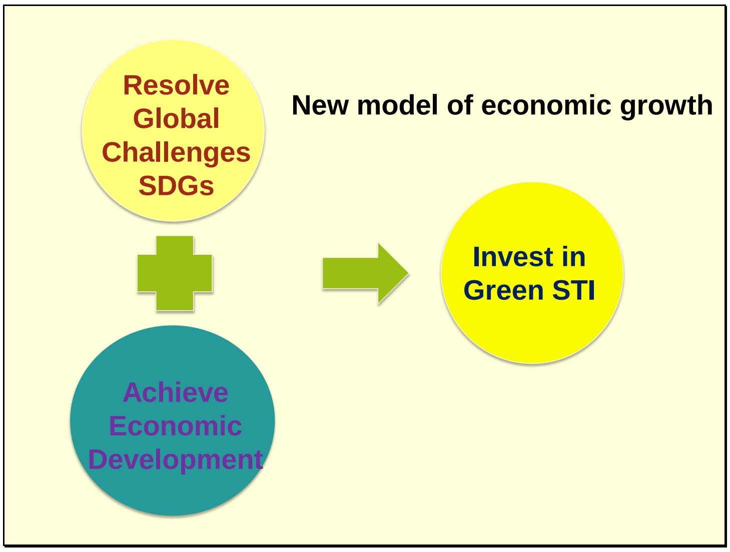


Figure 12. New model of economic growth.

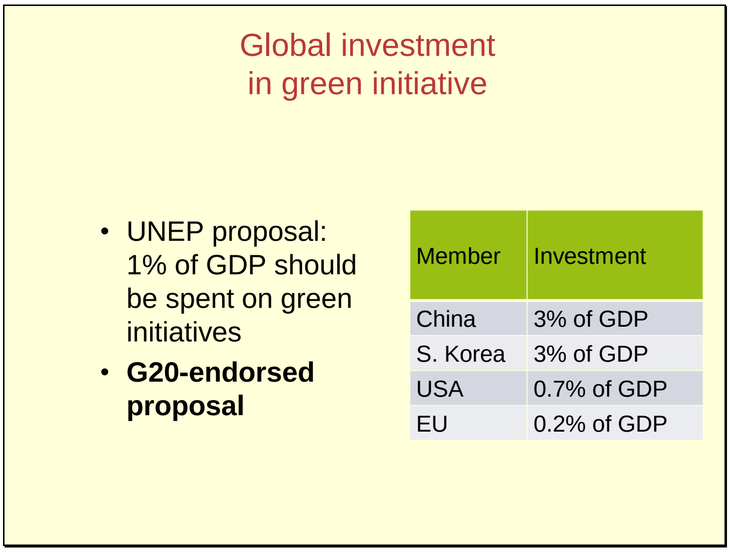


Figure 13. Global investment in green initiative.

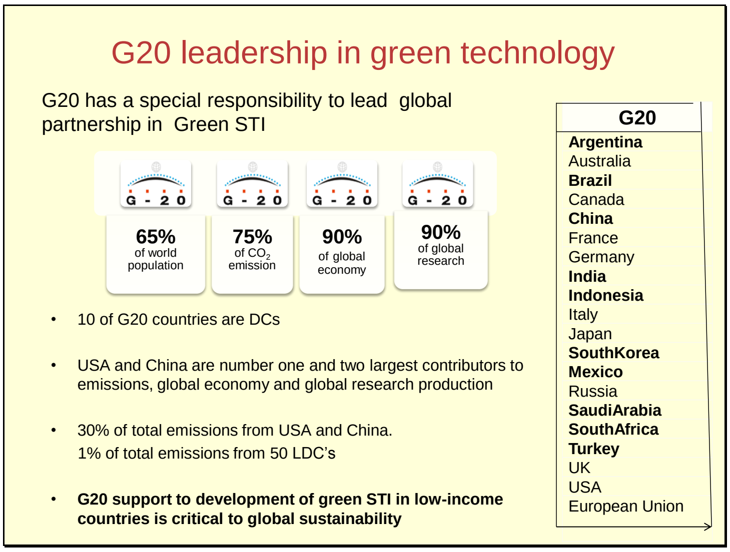


Figure 14. G20 leadership in green technology.

Figure 15. USA & China Partnership and Leadership.

Figure 16.

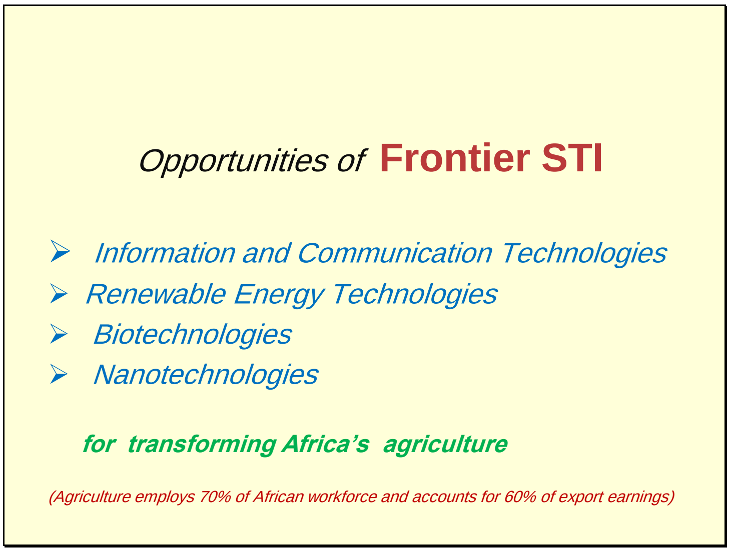


Figure 17. Opportunities of Frontier STI.

Figure 18. Information and Communication Technologies.

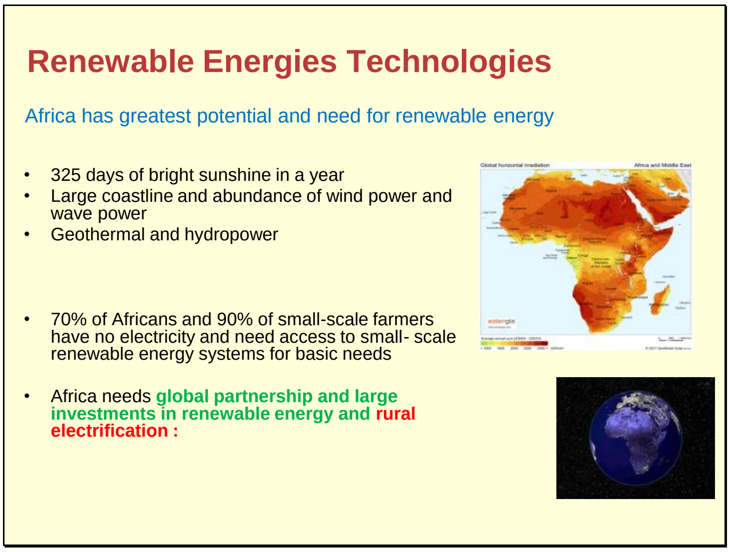


Figure 19. renewable Energies Technologies.

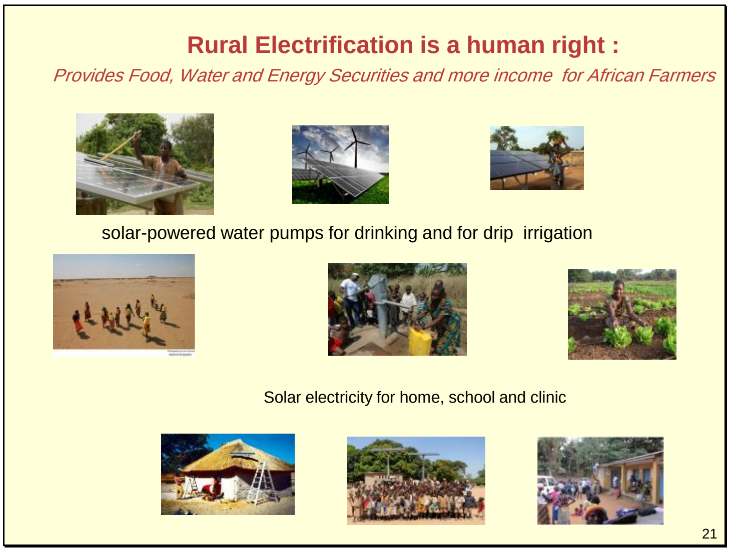


Figure 20. Rural Electrification is a human right.

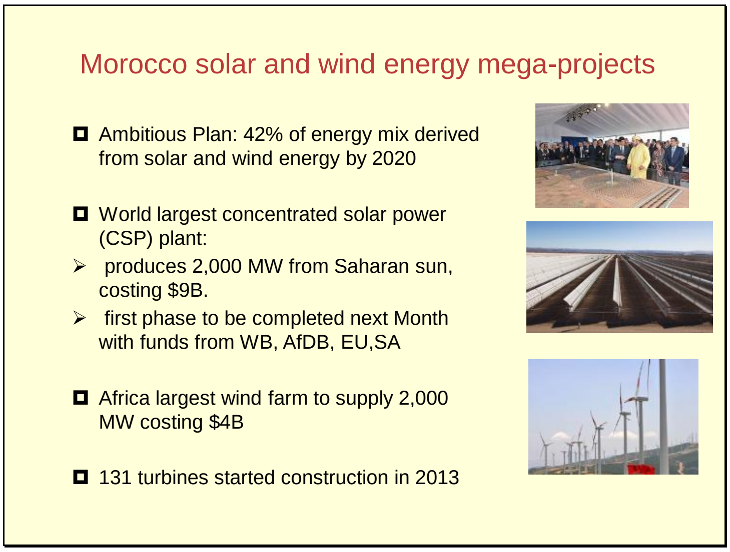


Figure 21. Morocco solar and wind energy mega-projects.

Figure 22. Ethiopia plans to power East Africa with hydropower.

Figure 23. COP21: Paris 30 November, 2015.

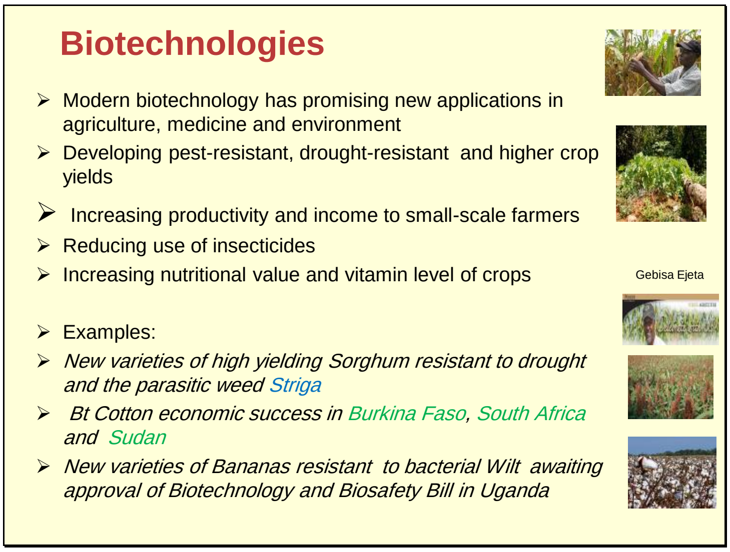


Figure 24. Biotechnologies.

- Scientists in Uganda push for law on GMOs
- Kenya biodiversity coalition demonstrates outside Parliament demanding strict adherence to labeling of GMOs
  (*The East African News April 2015*)

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Figure 25.

World Research Papers in **Biotechnology** Published in Web of Science (1995 – 2011)

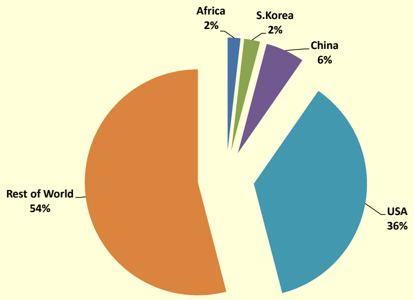

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Figure 26. World Research Papers in Biotechnology Published in Web of Science (1995-2011).

Figure 27. Nanotechnologies.

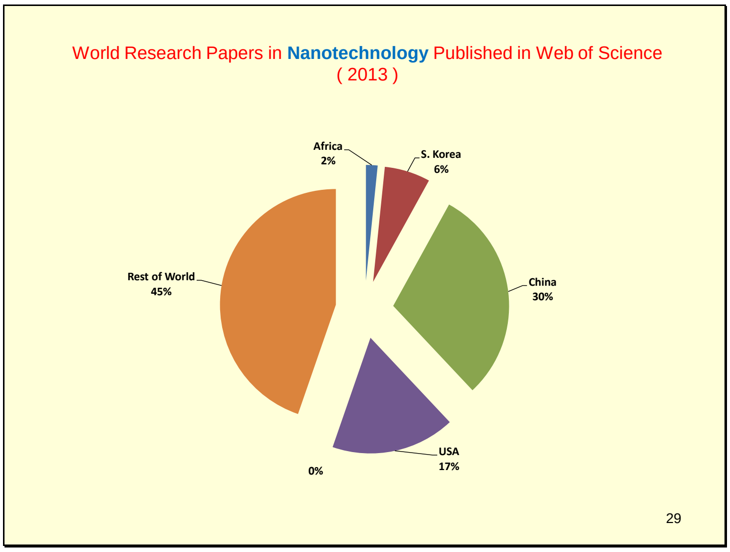

Figure 28. World Research Papers in Nanotechnology Published in Web of Science (2013).

Figure 29. Role of Centres of Excellence.

Figure 30. Centres of Excellence.

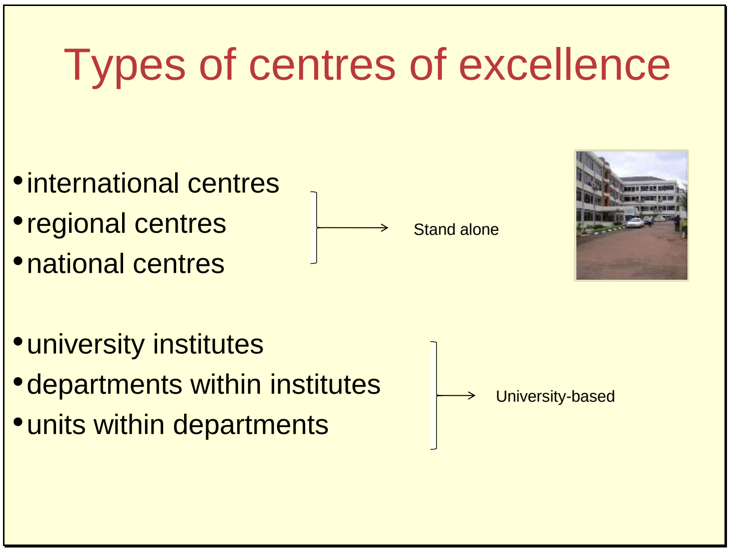

Figure 31. Types of centers of excellence.

Figure 32. International centres of excellence.

Figure 33. CERN Global Mission.

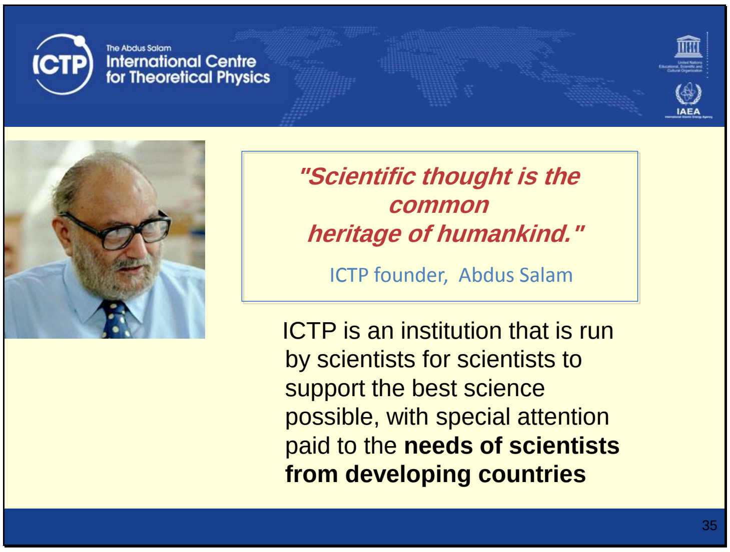

Figure 34.

ICTP training and education

- Provides training and skills to scientists from developing countries
- Organizes more than 60 conferences/workshops each year
- Welcomes 4,000 to 5,000 scientists from about 130 nations each year

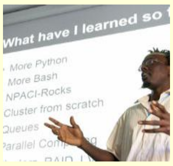

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Figure 35. ICTP training and education.

Square Kilometer Array (SKA)

- Largest Radio Telescope in the world: *survey sky ten thousand faster than current telescopes.*
- Map a billion observable galaxies to determine their formation and evolution almost from the big bang
- Explore issues such as : dark matter, dark energy, gravitational waves
- Hosts: South Africa and Australia
- Computing engines and links capacity greater than internet traffic.
- Cost $ 2 billion in infrastructure and $ 200 million per year to operate
- Construction in 2016 and full operation by 2024.
- **Open a new dawn for Science in Africa : boost Pan-African collaboration in Science and Education and foster a new generation of highly skilled computer scientists, engineers and technicians.**
- **Promote international collaboration and partnerships**

SKA AFRICA
SQUARE KILOMETRE ARRAY

Figure 36. Square Kilometer Array (SKA).

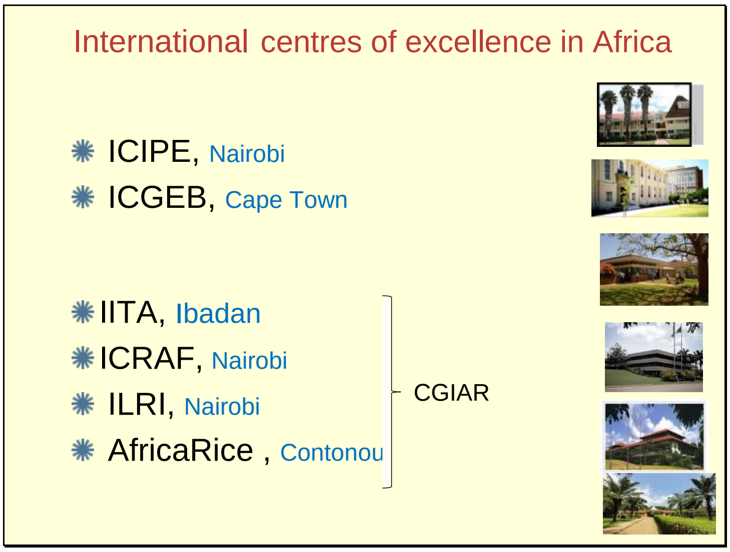

Figure 37. International centres of excellence in Africa.

Figure 38. Power of International Collaboration.

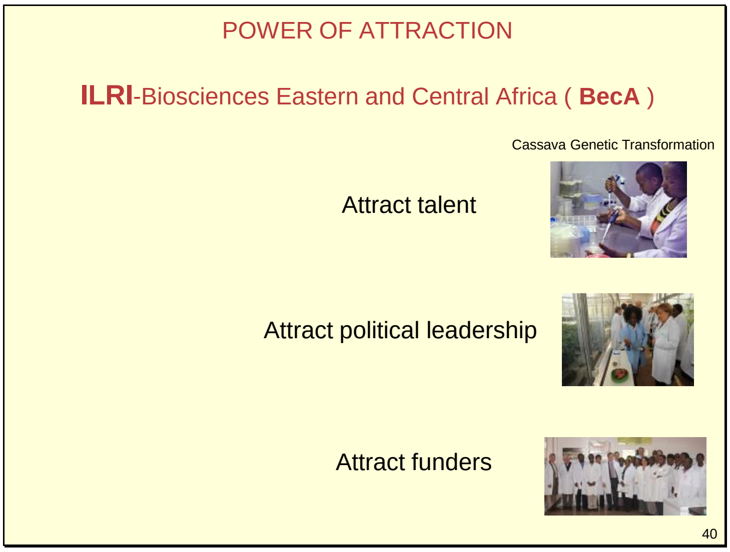

Figure 39. Power of Attraction.

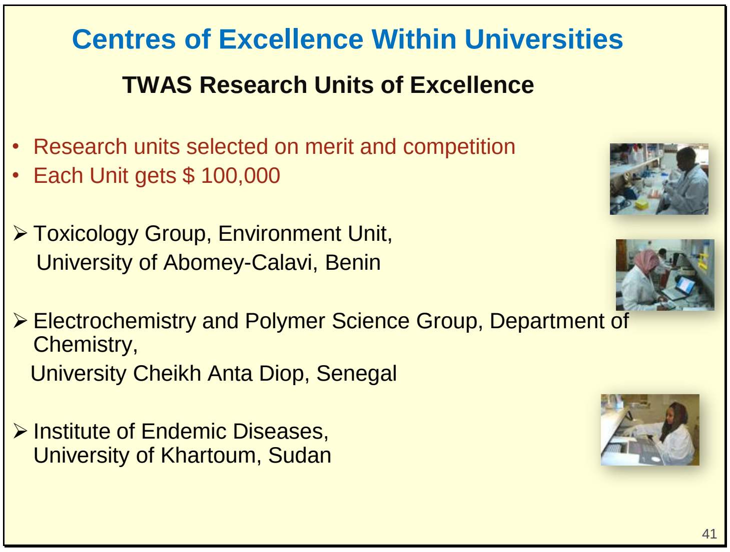

Figure 40. Centres of Excellence within Universities.

Figure 41. Centres of Excellence within Universities.

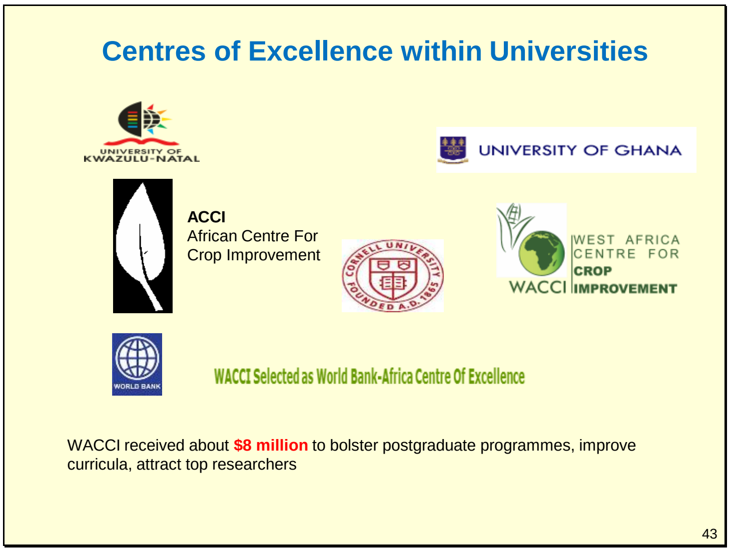

Figure 42. Centres of Excellence within Universities.

Figure 43. Centres of Excellence within Universities.

Figure 44. Role of Academies of Sciences.

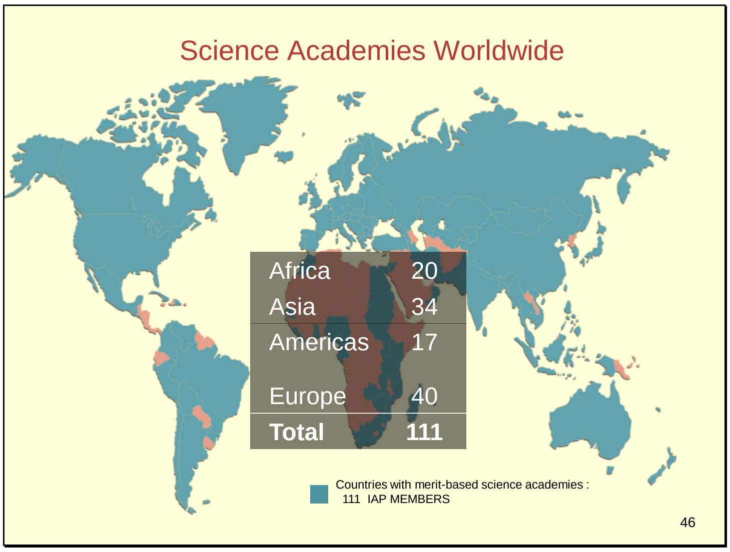

Figure 45. Science Academies Worldwide.

There are over 100 merit-based science academies in the world.
Out of the 53 African countries, only 19 countries have national science academies.
The African Academy of Sciences (AAS) draws its membership from all African countries.

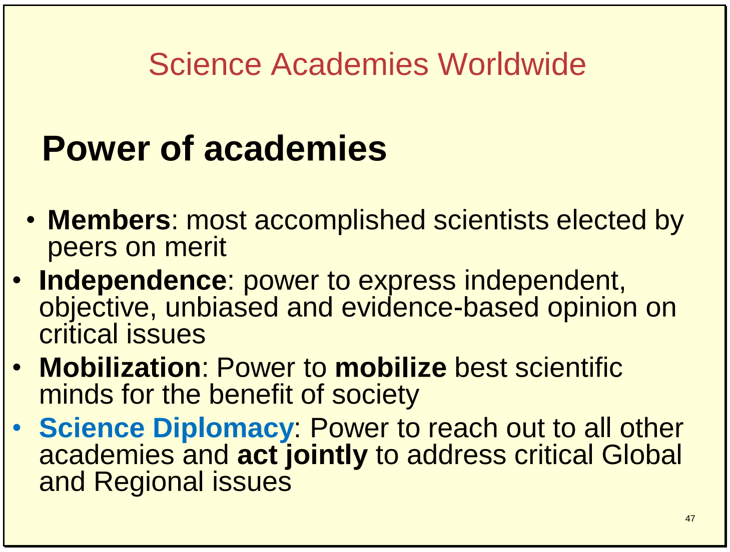

Figure 46. Science Academies Worldwide.

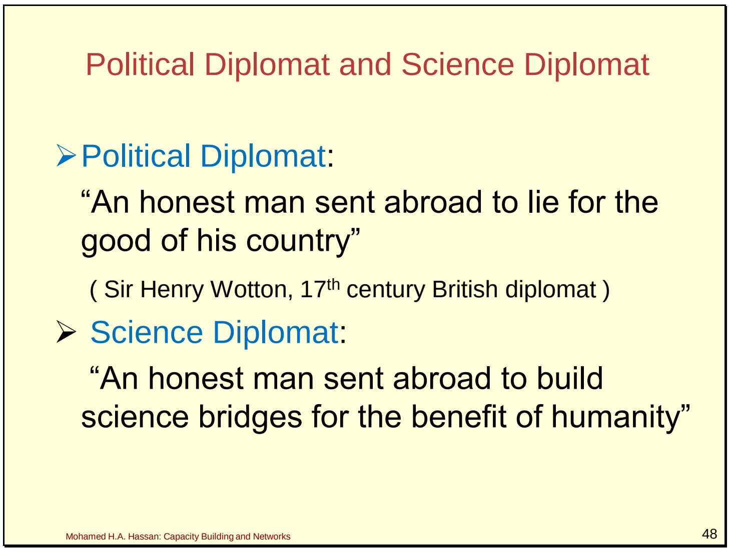

Figure 47. Political Diplomat and Science Diplomat.

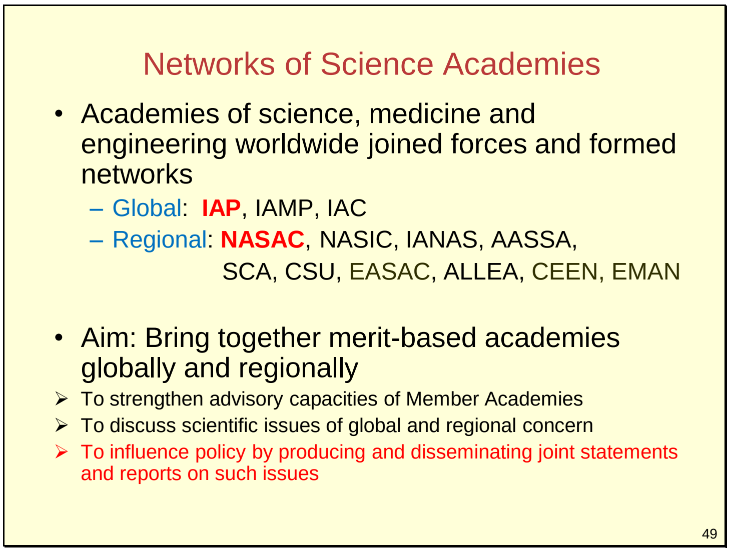

Figure 48. Networks of Science Academies.

AASA	Association of Academies of Sciences in Asia (AASA), Gyunggi-Do, South Korea.
ALLEA	All European Academies (ALLEA), Amsterdam, Netherlands.
CAETS	International Council of Academies of Engineering and Technological Sciences (CAETS), Brussels, Belgium.
CEEN	Central and Eastern European Network of Academies of Science (CEEN), Salzburg, Austria
CSU	The Caribbean Scientific Union (CSU), Santo Domingo, Dominican Rep.
EASAC	European Academies' Science Advisory Council (EASAC), London, UK.
FASAS	Federation of Asian Scientific Academies and Societies (FASAS), Kuala Lumpur, Malaysia
IAC	InterAcademy Council (IAC), Amsterdam, Netherlands.
IAMP	InterAcademy Medical Panel (IAMP), Trieste, Italy.
IANAS	InterAmerican Network of Academies of Sciences (IANAS), Rio de Janeiro, Brazil.
NASAC	Network of African Science Academies (NASAC), Nairobi, Kenya.
NASIC	Network of Academies of Science in OIC Countries (NASIC), Islamabad, Pakistan.
SCA	Science Council of Asia (SCA), Tokyo, Japan.

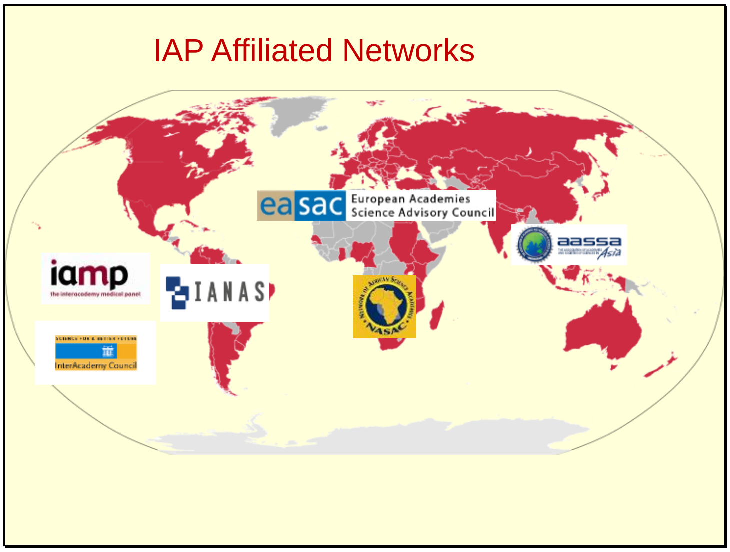

Figure 49 IAP Affiliated Networks.

Action by Global Networks of Academies

Science for Policy

Evidence-based advice on global issues		
iap the global network of science academies	iamp the interacademy medical panel	InterAcademy Council science for a better future
Short policy statements on global issues: • Science Education • Teaching of evolution • Cloning • Biosecurity • Forestry • Ocean acidification • Population (Rio + 20) • Synthetic Biology	Short policy statements on health issues: •Controlling Infections •Health / Climate change • Health Research in DC's	Comprehensive reports on global issues: • Capacity Building • African Agriculture • Women for Science • Sustainable Energy • IPCC Review • ASADI Review

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Figure 50. action by Global Networks of Academies.

Action by G8 and NASAC Academies

Short Policy Statements on topics of global significance

- **G8 academies**: Climate change, energy security, global health, infectious diseases, innovation, ...
  *(G8 Summits in UK, Russia, **Germany**, Japan, 2005-2012)*
- **NASAC + G8**: Science and technology for African development
  (G8 Summit, UK, June 2005)
- **NASAC**: Sustainability, energy efficiency and climate change
  *(G8 Summit, **Germany,** June 2007)*
- **NASAC + SCA**: Role of science, technology and innovation in promoting global development
  (G8 Summit, Japan, June 2008)

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Figure 51. Action by G8 and NASAC Academies.

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Figure 52.

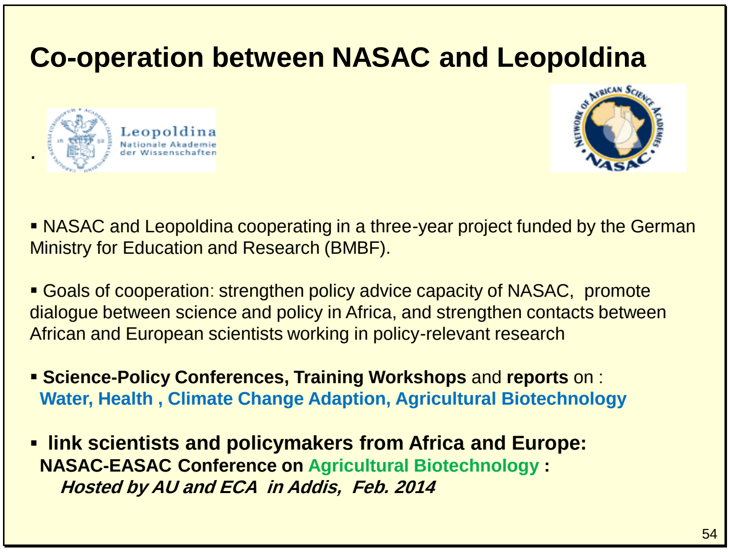

Figure 53. Co-operation between NASAC and Leopoldina.

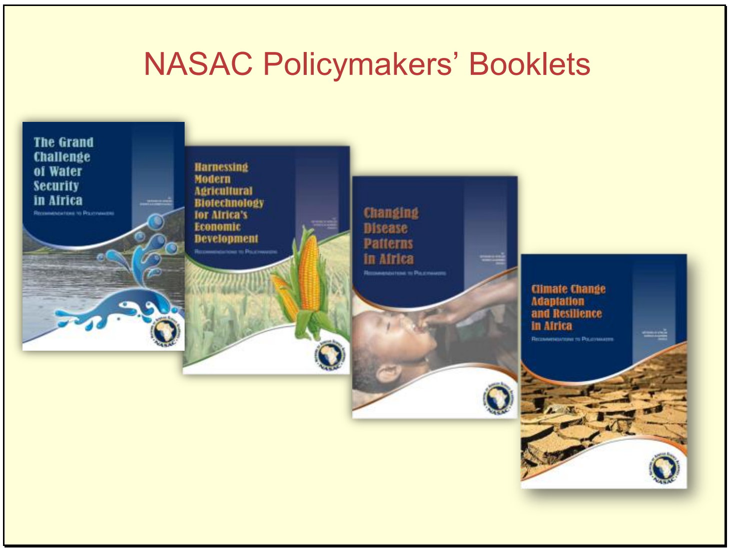

Figure 54. NASAC Policymakers' Booklets.

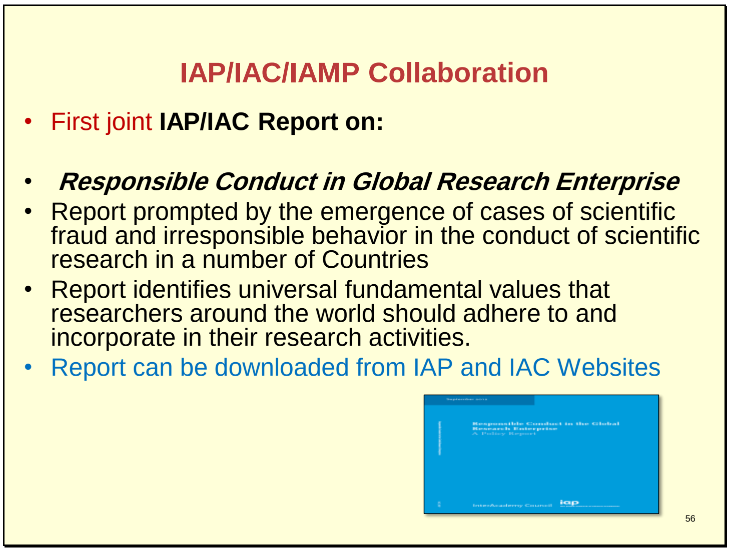

Figure 55. IAP/IAC/IAMP Collaboration.

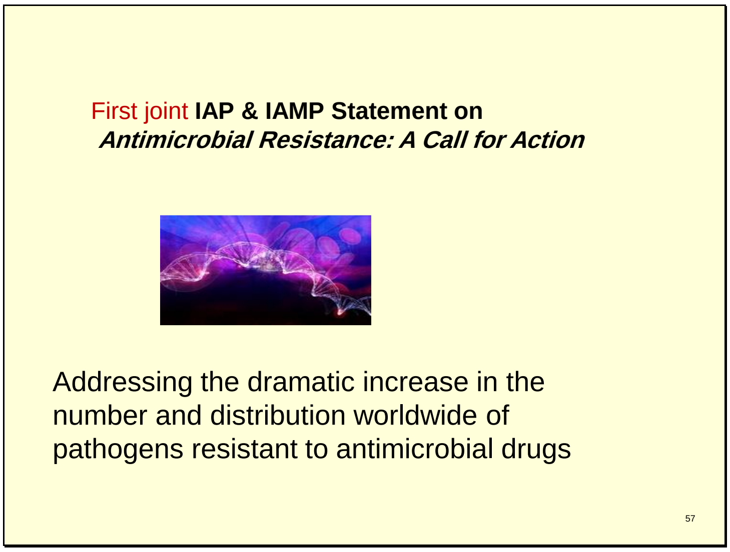

Figure 56. First joint IAP & IAMP Statement on Antimicrobial Resistance: A Call for Action.

Figure 57. IAP Executive Committee, IAC Board and IAMP Executive Committee Joint Session, May 2014.

Figure 58. Joint Session, May 2014, hosted by the Accademia Nazionale dei Lincei, and chaired by the 6 Co-chairs.

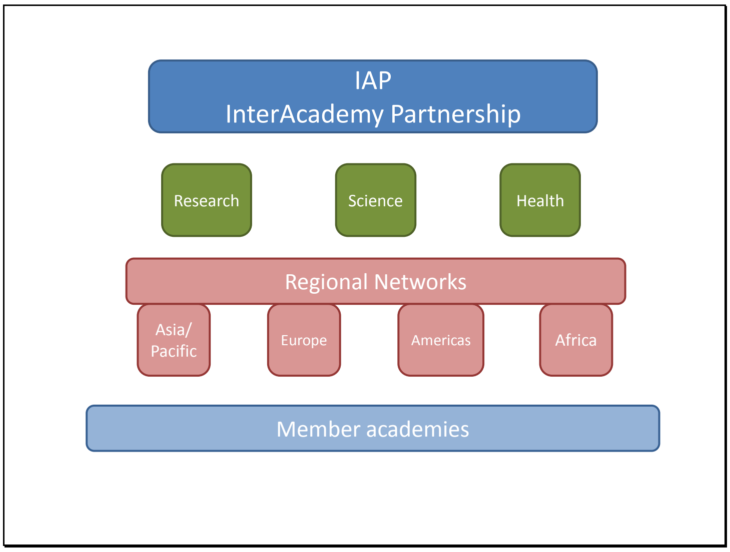

Figure 59. IAP InterAcademy Partnership.

Future Action by the new IAP

- Continue to strengthen the advisory capacity of Member Academies to provide better services to the scientific community, policy community and general public
- Continue to produce joint, authoritative and policy-relevant statements and reports on critical sustainability issues to impact policy and decisions
- Organize global and regional Workshops and Conferences to jointly address critical problems and build “Science bridges” across nations
- Explore possibilities of becoming independent authoritative advisor to the UN, G77, G20, ……., on critical, science-based sustainability issues

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Figure 60. future Action by the New IAP.

In Conclusion

Promoting STI for sustainability and economic transformation in Africa will require :

- Strengthening quality of scientific research and training in higher education institutions to train and retain a new generation of talented problem-solving researchers, especially in frontier, interdisciplinary S&T
- Cooperation and partnership with international scientific and financial institutions.

Centres of Excellence and Academies of Science are critical in guiding the future development of green STI for economic transformation in Africa

This will require having in each Country:

- ***A good number of University-based Centres and Units of research and training excellence in basic sciences and frontier STI***
- ***An active merit-based science academy that can mobilize accomplished scientists, mentor young talent and advise Government***

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Figure 61. In Conclusion.

Figure 62. 2015: Global Agreement.

International Collaboration in Science:
The African Perspective

OUSMANE KANE

Fellow, the National Academy of Science and Techniques of Senegal (ANSTS)
Chairman, Commission of Relations with Partners
Senegal Academy of Science and Technology
Senegal

ABSTRACT

Science, as it is well known, is a crucial instrument to overall and sustainable development of nations. It is also a real gateway for understanding among people, as it is a key facilitator of dialogue, peace and friendship as well as of rational human relationships allowing, everywhere, a high quality of life to people.

Today, what is designated as ***"Knowledge Economy" (KE)*** arises, above all, from the application of twin forces of globalization and technological advances, resulting from a closer linkage, between science, technology and innovation. Therefore, KE requires a proper Knowledge Management which is a multidimensional process, involving context, culture, content, mechanisms, infrastructure, policy, etc.

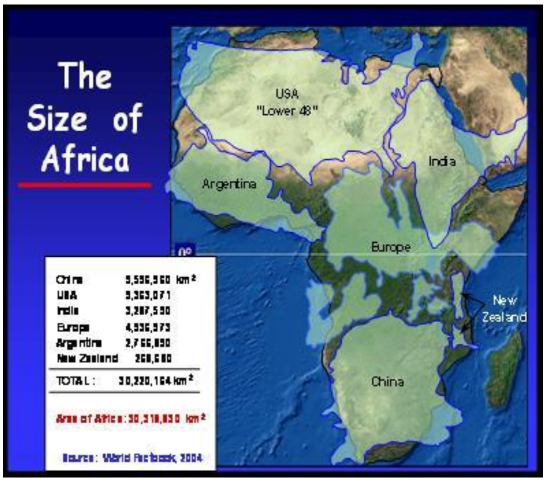
A successful KE also requires a strong economic and institutional regime, a well-educated and skilled manpower, an efficient innovation system, articulated to a dynamic information and communication infrastructure. In fact, the real wealth of any country is its people, and the core of any development process has always been knowledge, particularly in the field of Science, Technology and Innovation (STI). In this regard, fundamental enablers of KE are mostly scientists and technologists, with regard to the acquisition and mastering of scientific and technical skills, which are key factors for creating, sharing, disseminating and effectively utilising knowledge achievements for development purposes, through the innovation process.

Scientists, with their problem solving approach and common language for explaining phenomena, are major actors of mankind achievements and, as such, are among elites who define the cultural, social and economic essence of each nation's civilization conducive to a greater society. Also, in many advanced and emerging countries, scientists are key advisors to political leaders, to allow policy making decisions based on scientific evidence.

The presentation illustrates major challenges and shows how African Governments should clearly lay the ground for Africa's readiness to resolutely embark on KE dynamics to promote long lasting overall sustainable development and become a key partner of the world economy and trade. After a brief recall of various initiatives taken at regional level, it will also consider prospects of collaboration and partnerships Africa could develop throughout the continent, within the *Ummah,* as well as with other regions, to reverse the tendency of being a continent well endowed with both natural and human resources, but hosting the poorest people.

PRESENTATION

Map 1: The size of Africa in comparison to selected continents/countries



COURTESY OF DBSA (May 2009)

Figure 1. Map 1: The size of Africa in comparison to selected continents/countries.

International Collaboration in Science: The African Perspective

I. GENERAL CONSIDERATIONS

II. MAJOR CHALLENGES FOR AFRICA's INTERNATIONAL COLLABORATION IN SCIENCE

III. MAJOR INITIATIVES ON STI PARTNERSHIPS - COOPERATION IN AFRICA

IV. THE WAY FORWARD AND GENERAL PRINCIPLES

Figure 2. International Collaboration in Science: The African Perspective.

Figure 3. Need for International Collaboration in Science.

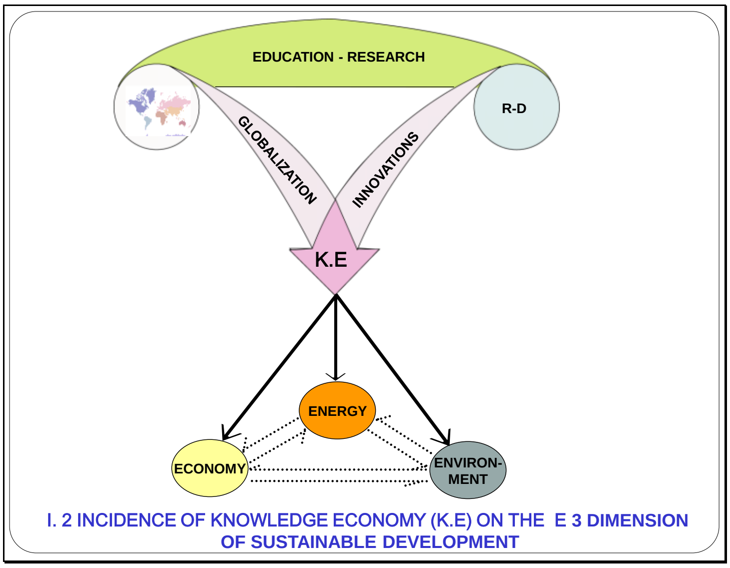


Figure 4. Incidence of Knowledge Economy (KE) on the E3 Dimension of Sustainable Development.

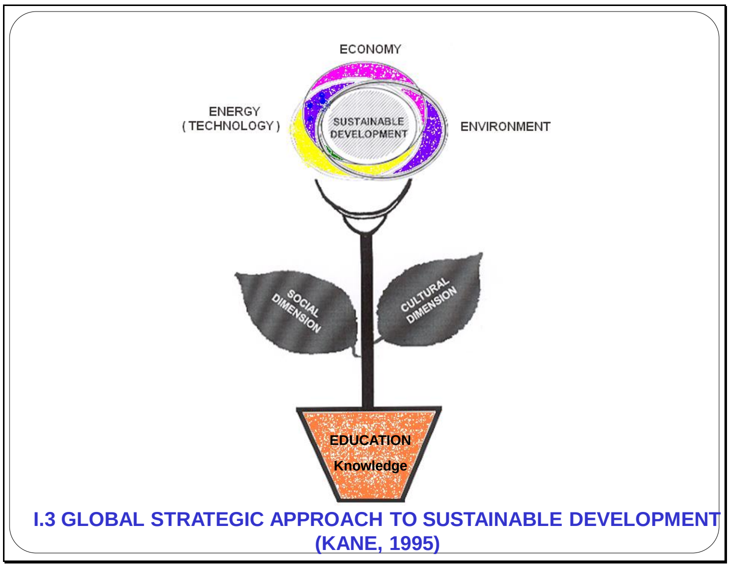


Figure 5. Global Strategic Approach to sustainable Development (Kane, 1995).

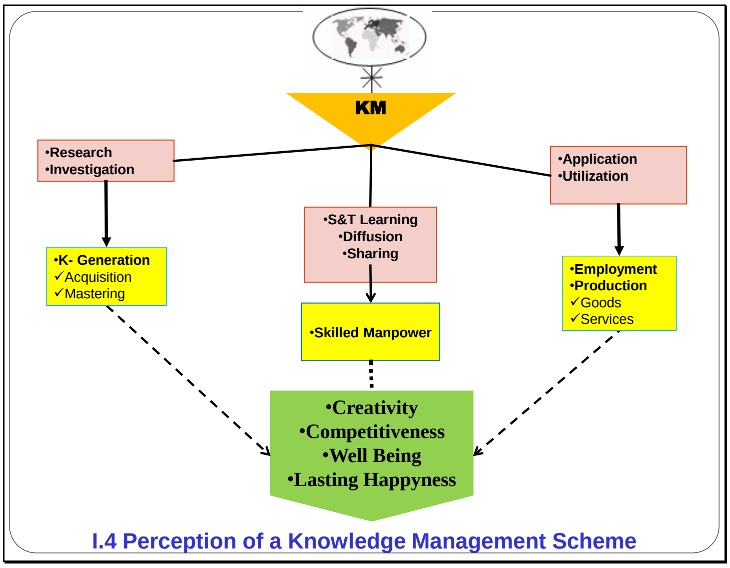


Figure 6. Perception of a Knowledge Management Scheme.

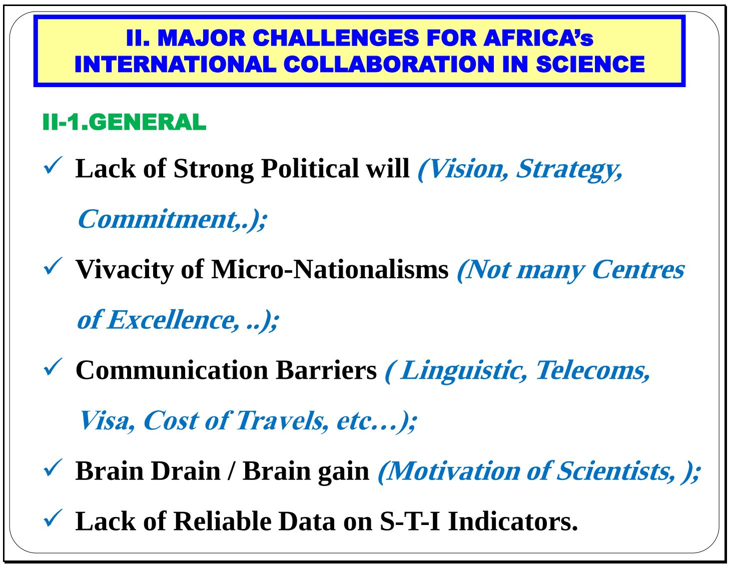


Figure 7. Major Challenges for Africa's International Collaboration in Science.

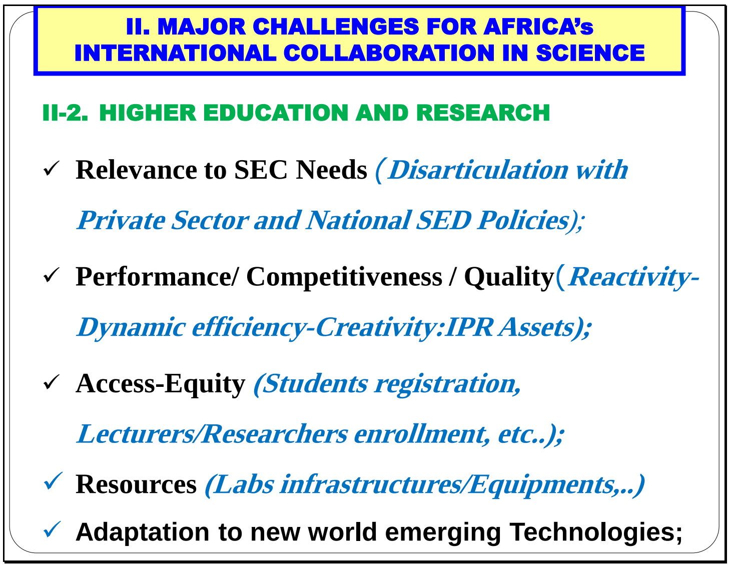


Figure 8. Major Challenges for Africa's International Collaboration in Science.

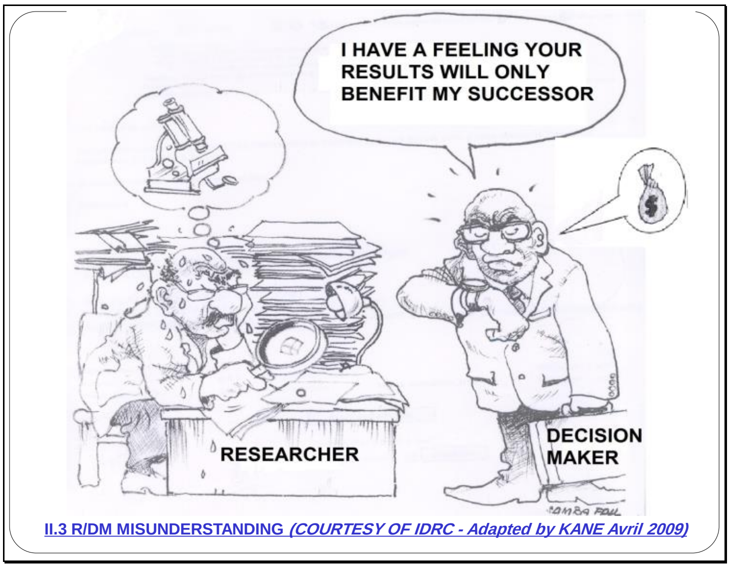


Figure 9.

Figure 10. Major Initiatives on STI Partnership/Collaboration in Africa.

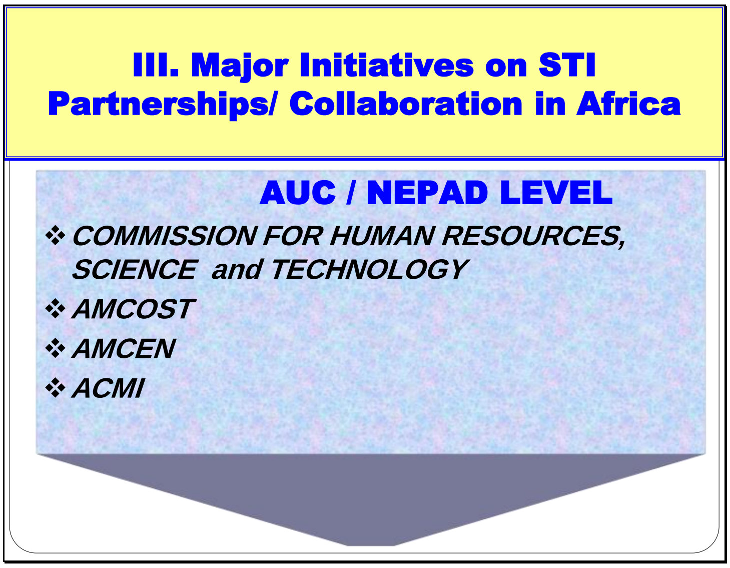


Figure 11. Major Initiatives on STI Partnership/Collaboration in Africa.

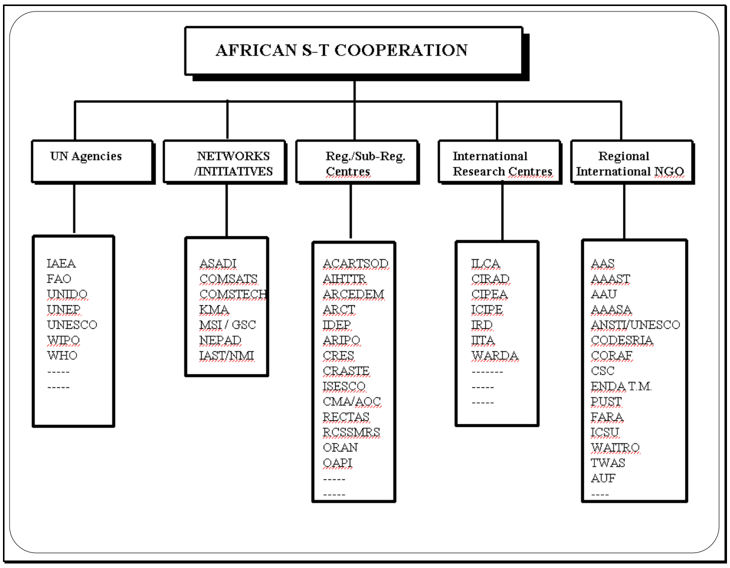


Figure 12. African S-T Cooperation.

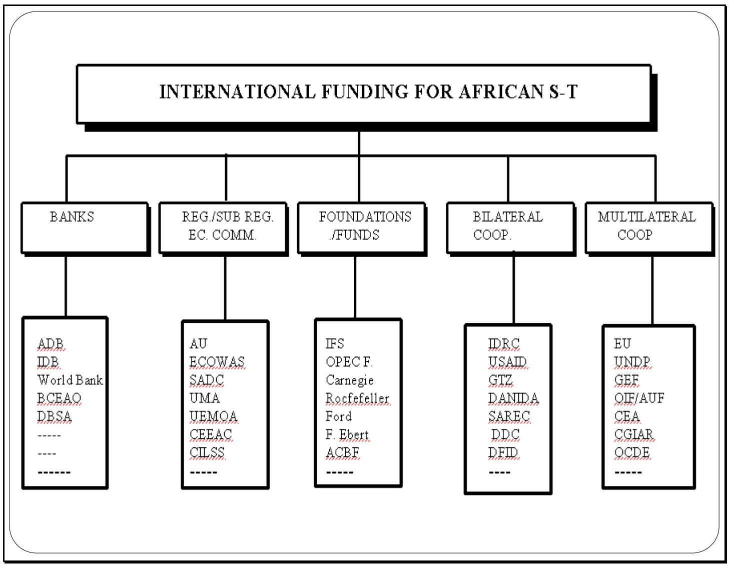


Figure 13. International Funding for African S-T.

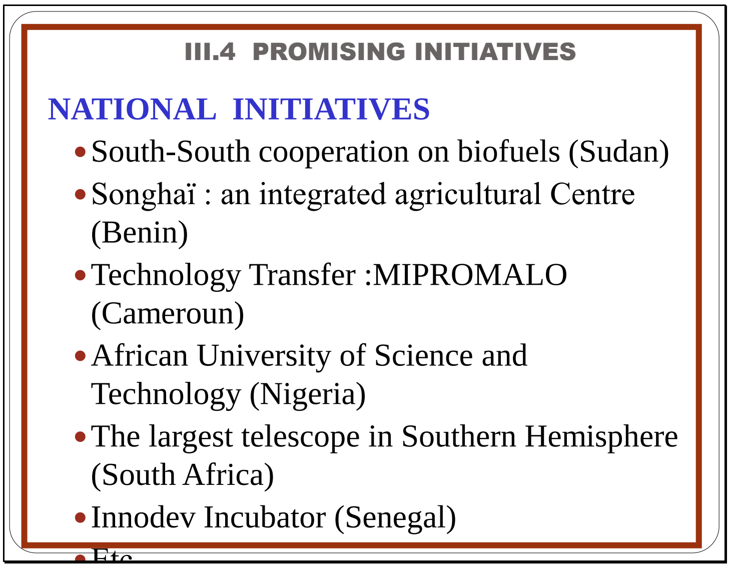


Figure 14. Promising Initiatives.

III.5 PROMISING INITIATIVES (ctnd)

REGIONAL AUC/NEPAD INITIATIVES

- Science, ICTs, and Space, an EU-Africa Program
- African STI Policy Initiative (ASTIPI - UNESCO)
- African STI Indicators Initiative (ASTII)
- African Observatory for STI Indicators(AOSTI)
- Consolidated Plan of Action for S&T (CPA)
- The Great Green Wall (GMV)

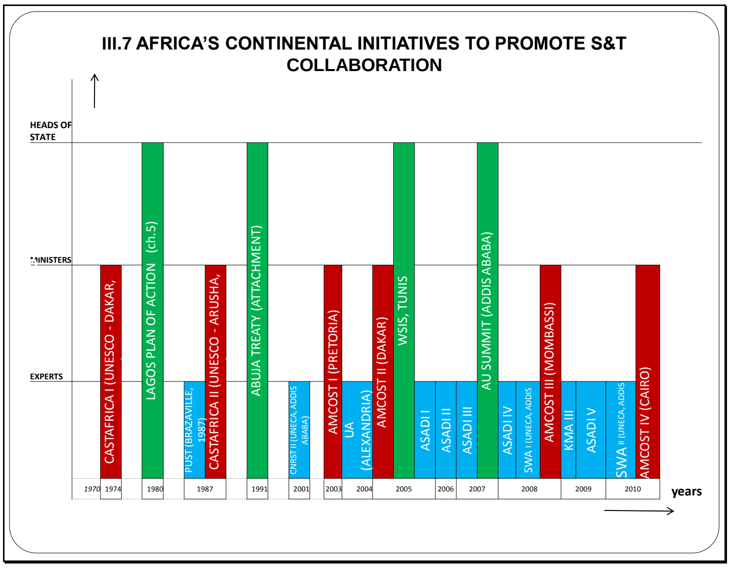
Figure 15. Promising Initiatives (Ctnd.)

III.6 PROMISING INITIATIVES (ctnd)

OTHER REGIONAL INITIATIVES

- Network of African Science Academies (NASAC)
- African Academy of Science (AAS)
- African Association of Universities (AAU)
- African Science Academy Development Initiative (ASADI) – US NAS/ B&M Gates Foundation
- Knowledge Management Africa (KMA-DBSA)

Figure 16. Promising Initiatives (Ctnd).



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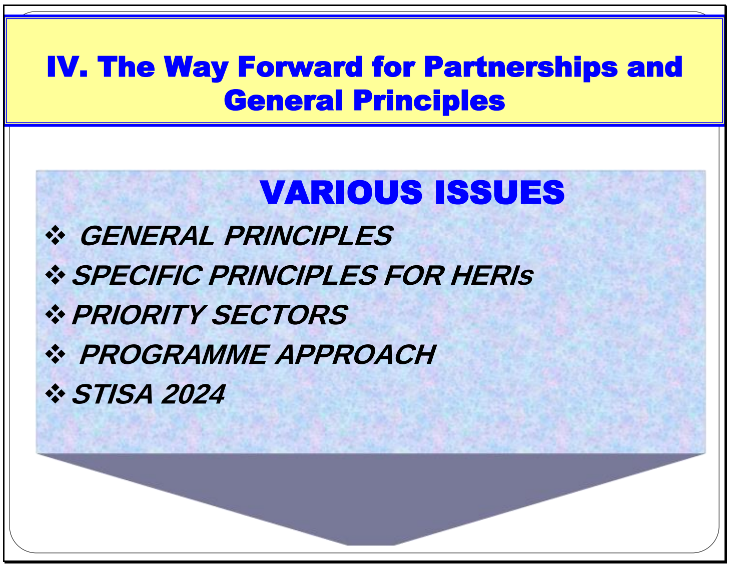

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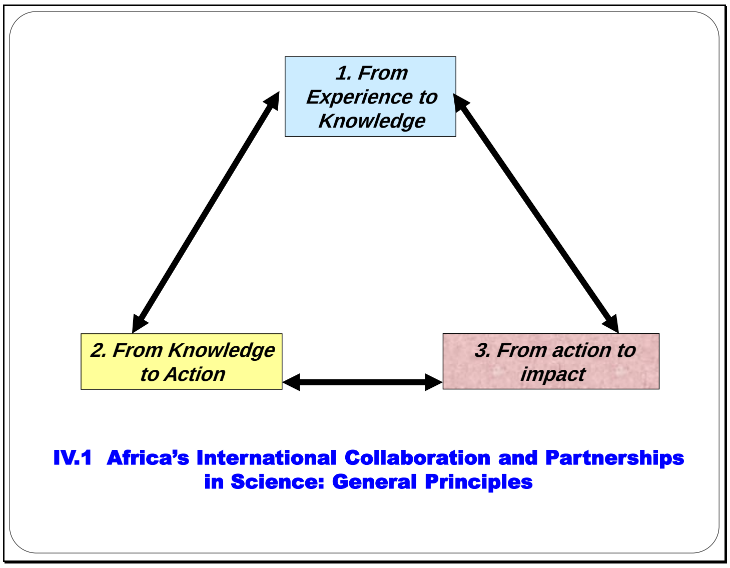

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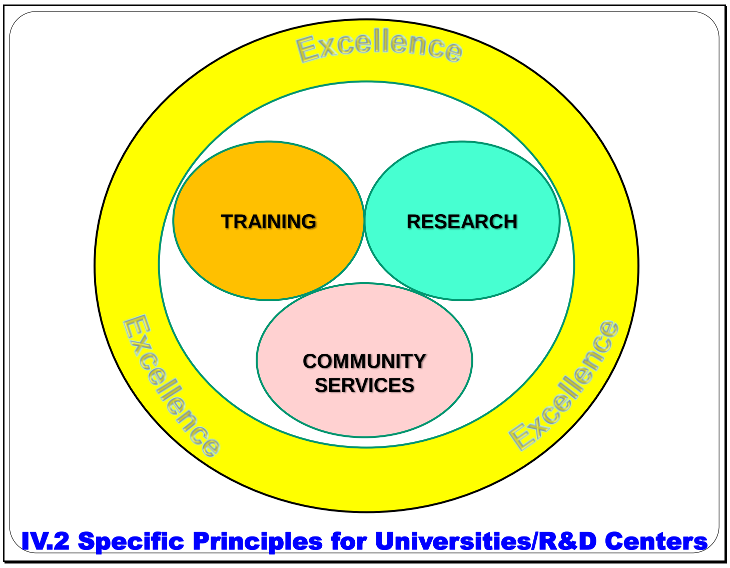

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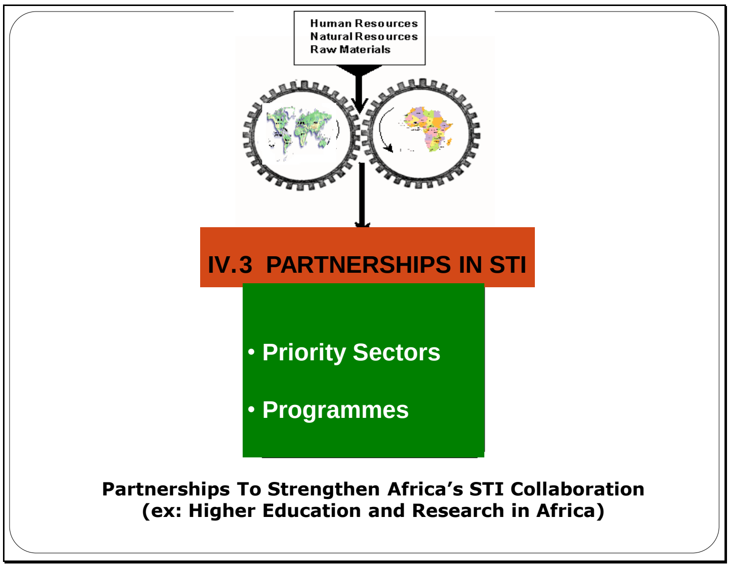

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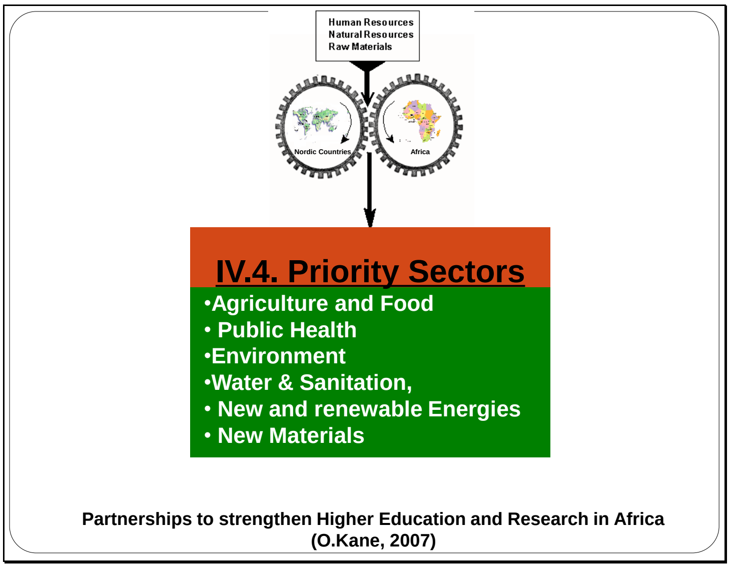

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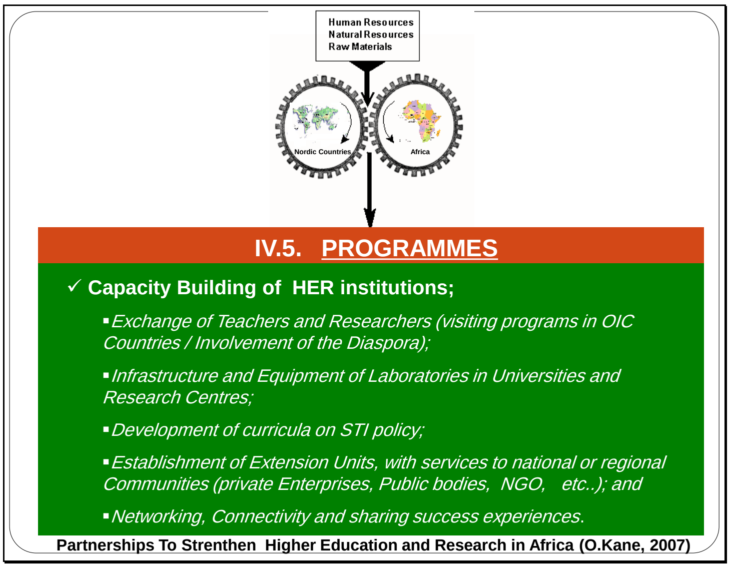


Figure 23. Programmes.

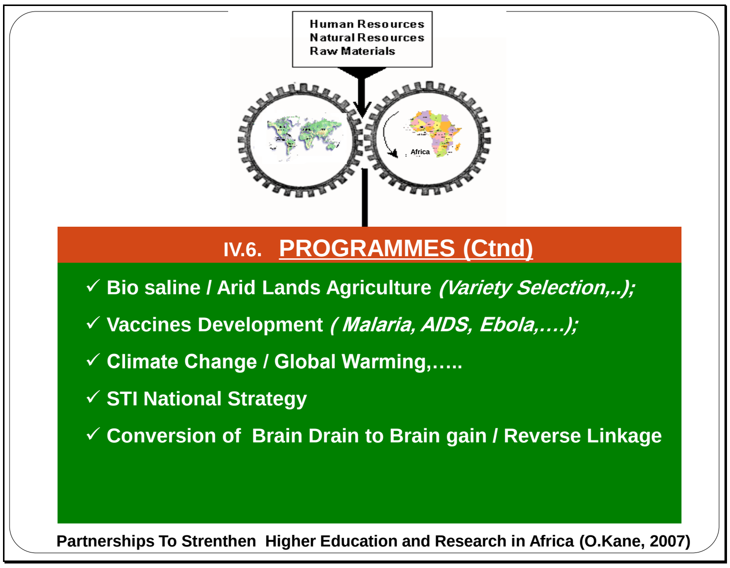


Figure 24. Programmes (Ctnd).

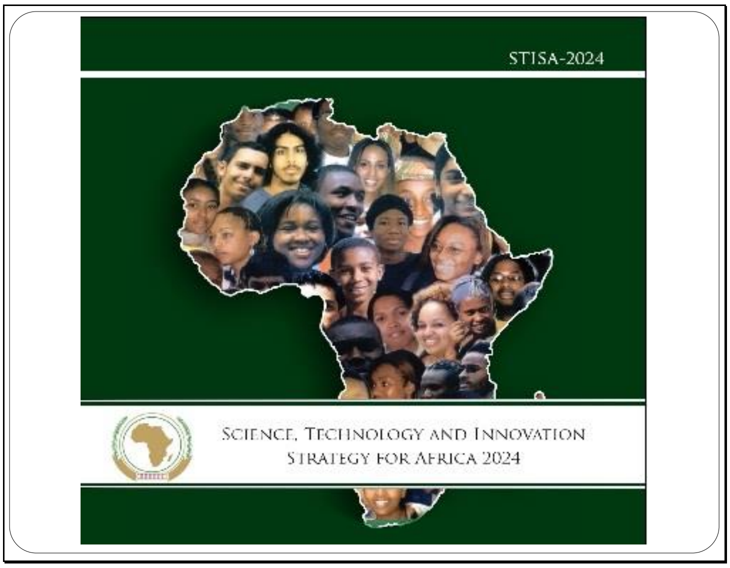
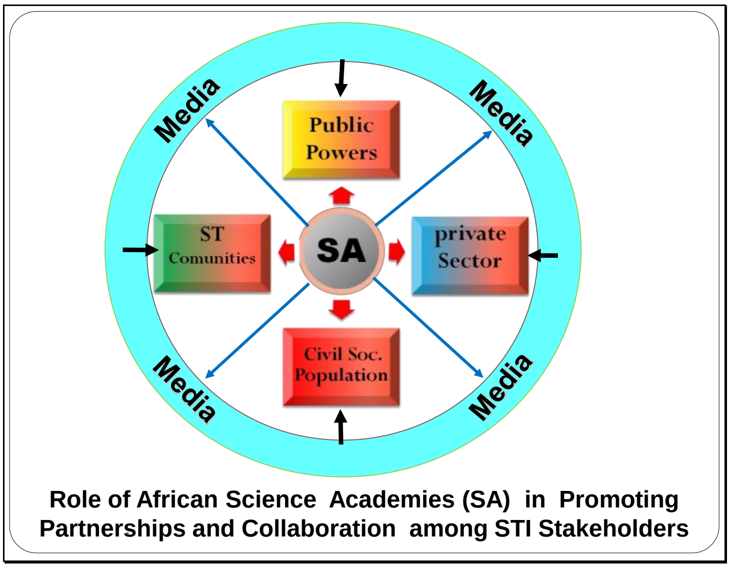


Figure 25. Science, Technology and Innovation Strategy for Africa 2024.

Figure 26. Innovation Strategy for Africa 2024.

Figure 27. Science, Technology and Innovation Strategy for Africa 2024.



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Science, Technology and Innovation in Africa: A Snapshot

BERHANU ABEGAZ
African Academy of Sciences
Nairobi, Kenya

ABSTRACT

The African Union’s Science, Technology and Innovation Strategy for Africa (STISA 2024) constitutes the first decadal strategy of achieving Agenda 2063. The vision of this Agenda is: an integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in the global arena.” As an implementing partner of the African Union, the African Academy of Sciences (AAS) believes that Science, Technology and Innovation are central to implementing STISA. The last two decades have seen transformative changes taking place in Africa and we are beginning to see signs of economic growth parallel with the observed economic performance of many African nations. This is in part driven also by overall better governance as indeed many African leaders appear to have some grounding in engineering, science, medicine, as well as in the social and human sciences. Although African contribution to modern world science is a low 1%, recent trends show considerable increase in scientific production of all member states, which in many cases is higher than the world average. Higher education and research establishments are increasingly under pressure not only to raise the quality of their publications, but also to be locally grounded and to pay attention to innovations leading to the development of products and services. AAS and NEPAD have, in 2015 jointly established a funding and agenda setting platform called Alliance for Accelerating Excellence in Science in Africa (AESA) through the generous support of three global funders, namely, DfID, Welcome Trust and the Bill & Melinda Gates Foundation. A number of programs focusing on excellence and innovation have been established which are supporting and encouraging excellence and innovation in Africa. This presentation will provide a snapshot of Science Technology and Innovation in Africa.

PRESENTATION

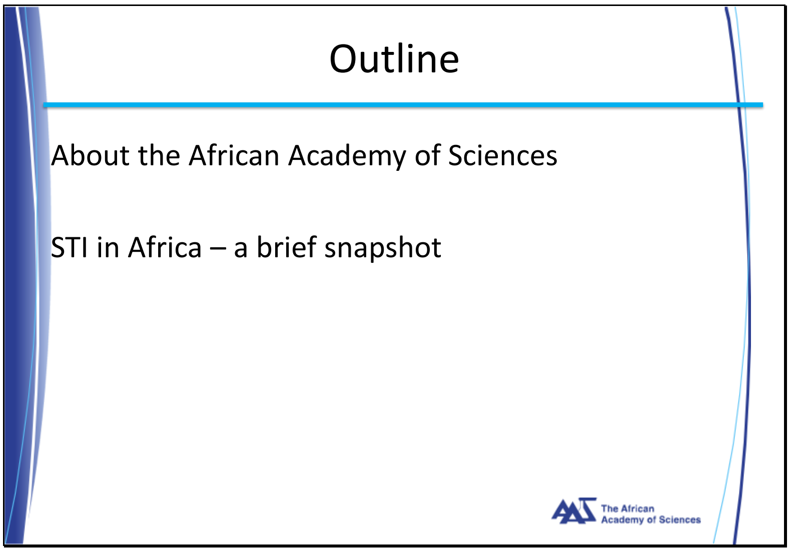
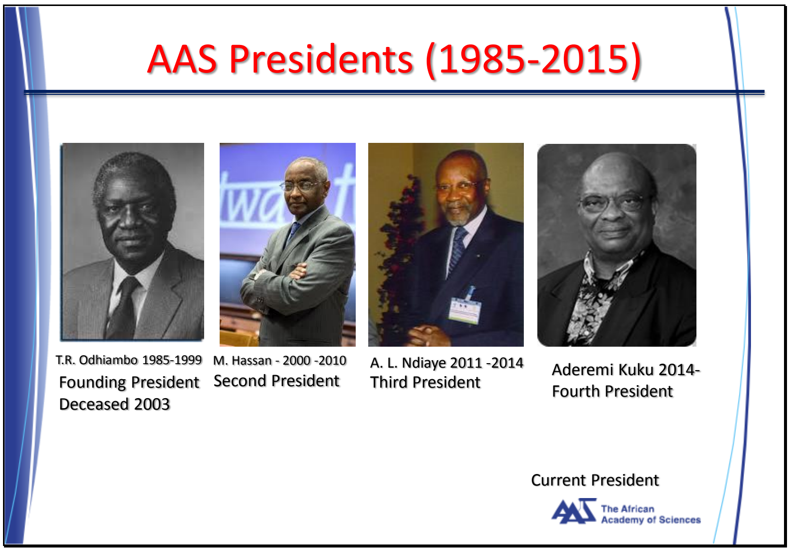


Figure 1. Outline.

Figure 2. Founding meeting of AAS, Trieste, Italy – 1985.



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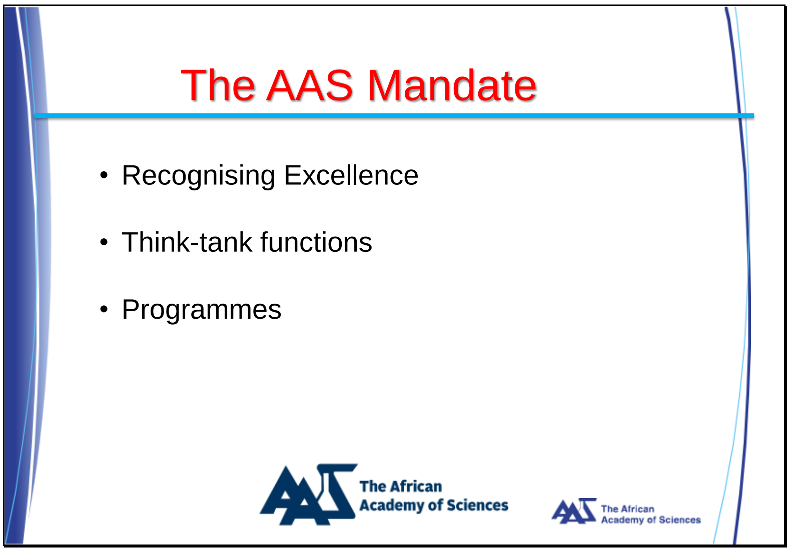

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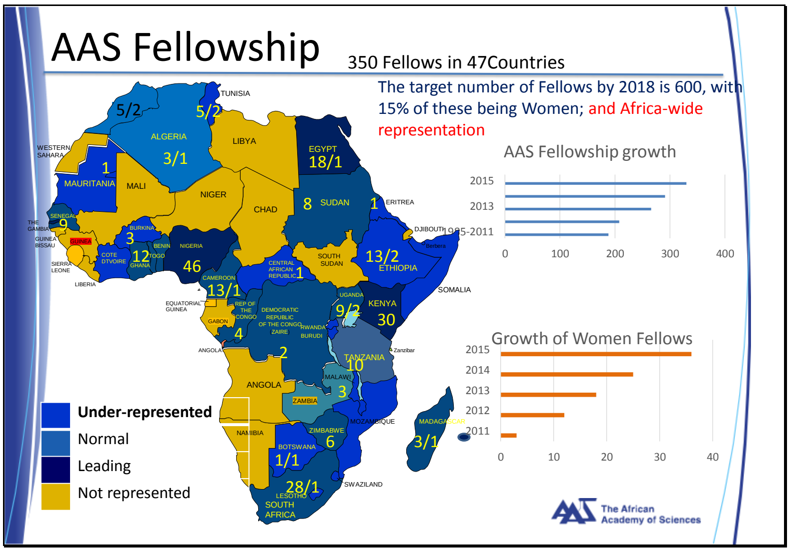

Figure 5. AAS Fellowship.

Figure 6. New AAS Fellows - 2015 – South Africa.

Figure 7. New AAS Fellows – 2015.

Figure 8. Think-Tank Functions.

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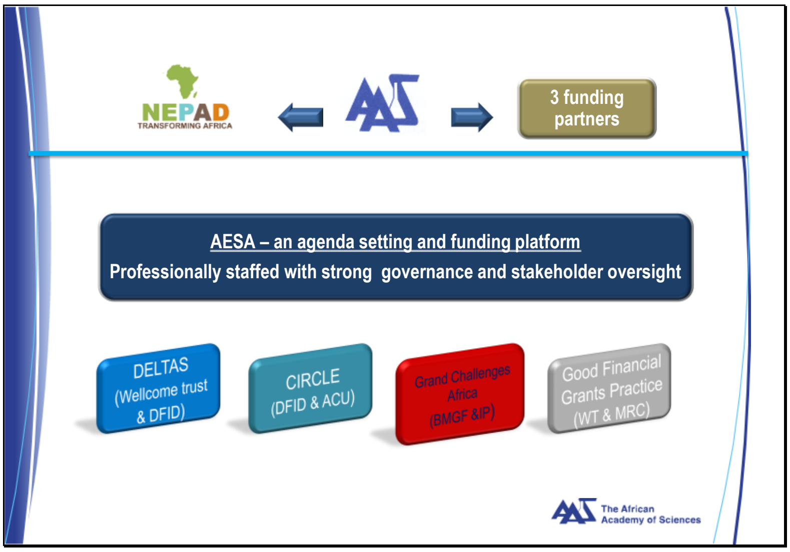
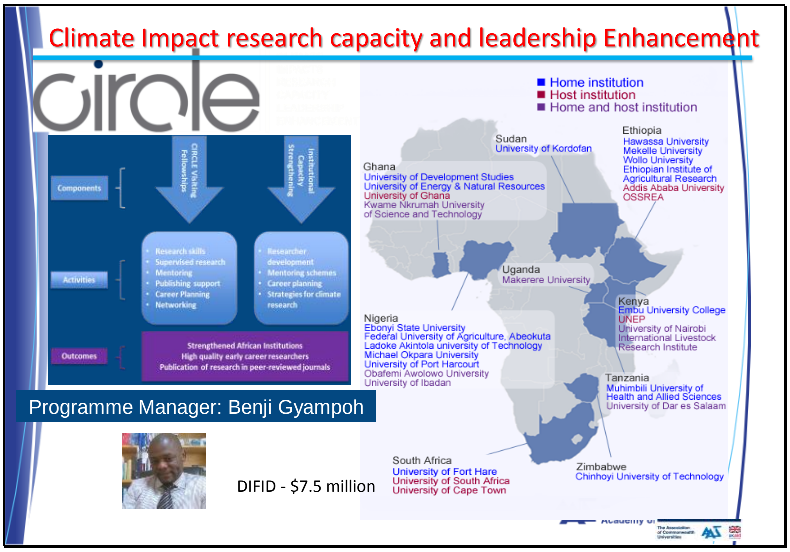


Figure 10.

Figure 11. Deltas.



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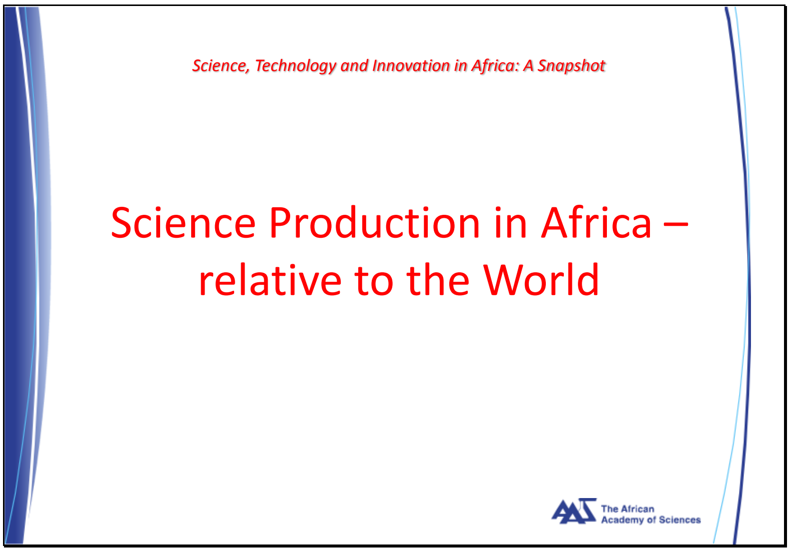

Figure 14. Science Production in Africa – relative to the world.

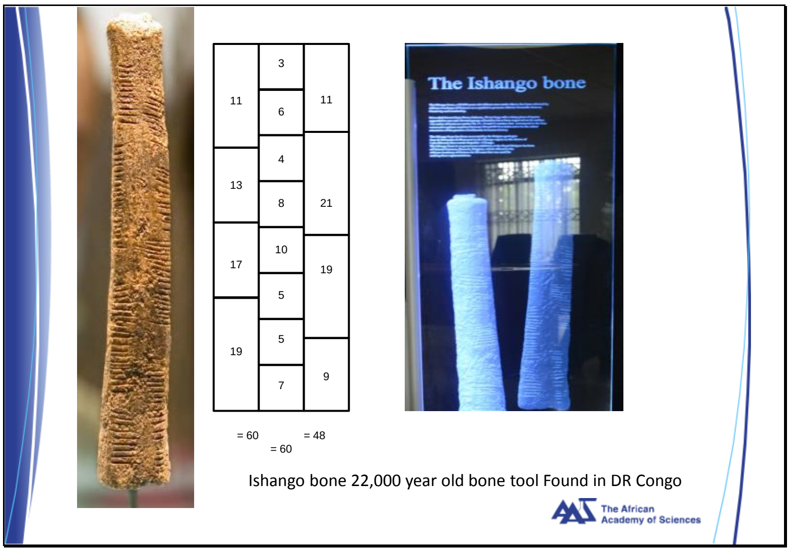

Figure 15. The Ishango Bone.

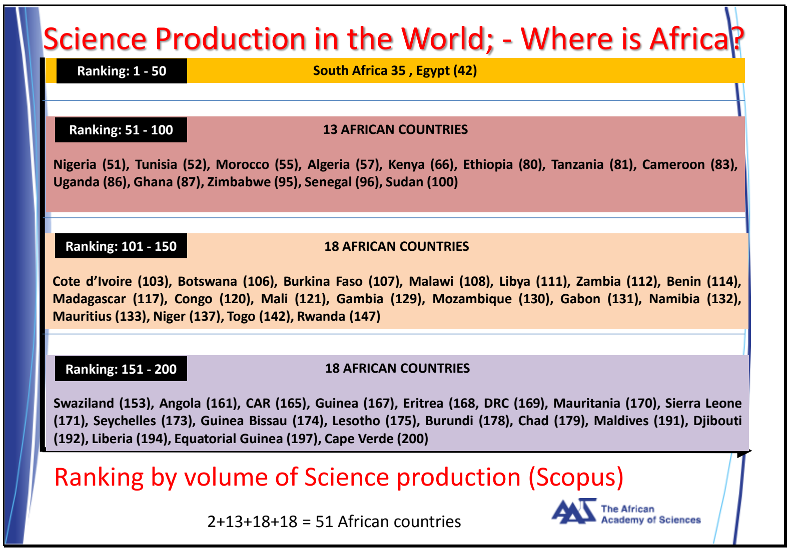

Figure 16. Science Production in the World – where is Africa?

Growth of African scientific output

Country / Group	2005-2010	2005-2007	2008-2010	% Increase 2008-2010 / 2005-2007	Growth Index
World	10,055,974	4,619,523	5,436,451	18%	1.00
African Union	181,454	74,629	106,825	43%	1.22
Community of Sahelo-Saharan States	108,575	43,507	65,068	50%	1.27
South African Development Community	61,778	27,006	34,772	29%	1.09
Common Market for Eastern and Southern Africa	60,239	24,357	35,882	47%	1.25
Arab Maghreb Union	42,836	16,461	26,375	60%	1.36
Economic Community of West African States	32,456	13,117	19,339	47%	1.25
Intergovernmental Authority on Development	15,237	6,248	8,989	44%	1.22
East African Community	13,688	5,759	7,929	38%	1.17
Economic Community of Central African States	5,239	2,343	2,896	24%	1.05

Source: Computed by Science-Metrix using the Scopus database (Elsevier)

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Figure 17. Growth of African Scientific Output.

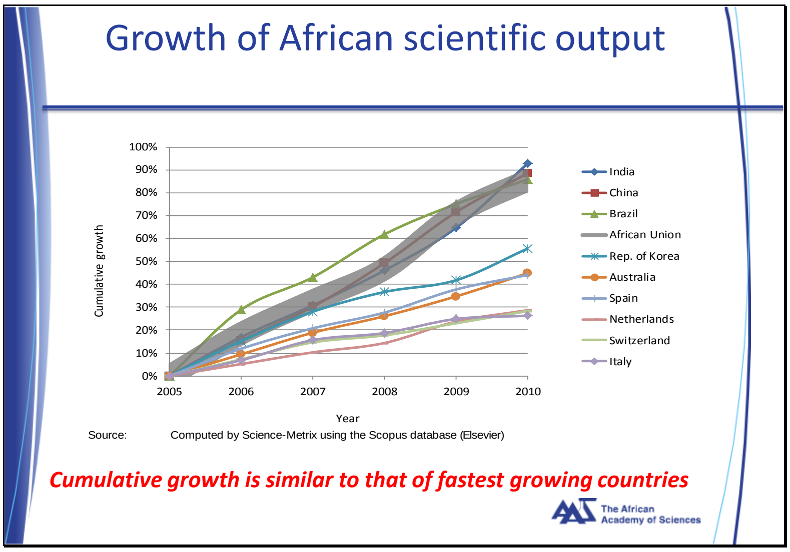


Figure 18. Growth of African Scientific Output.

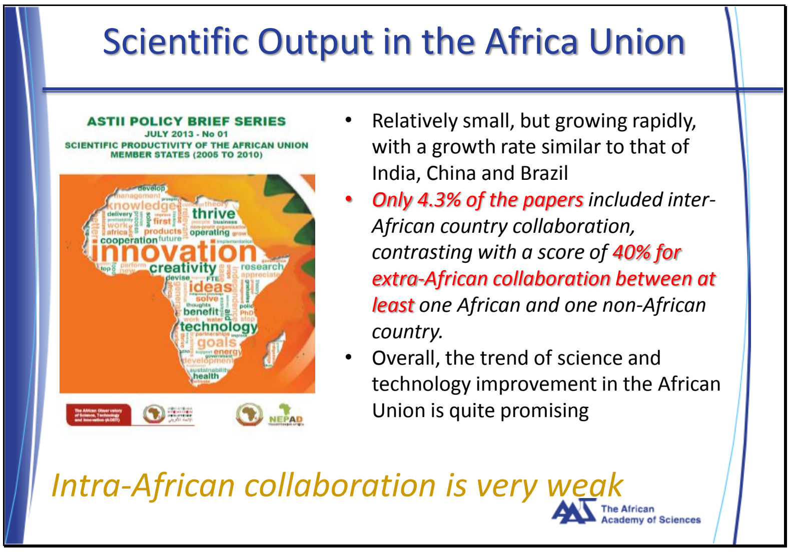


Figure 19. Scientific Output in the African Union.

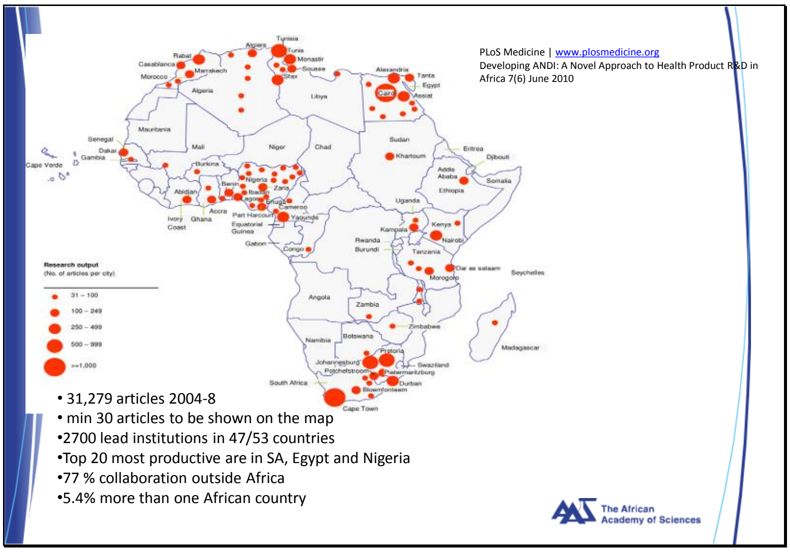
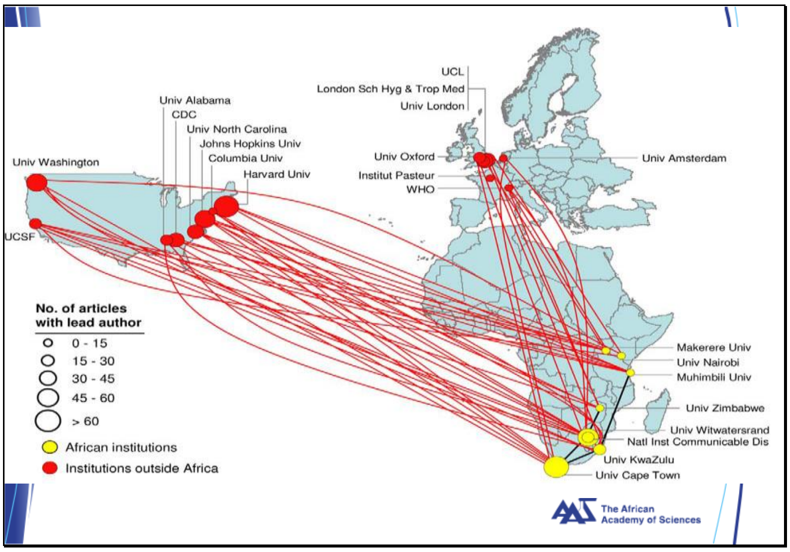


Figure 20.



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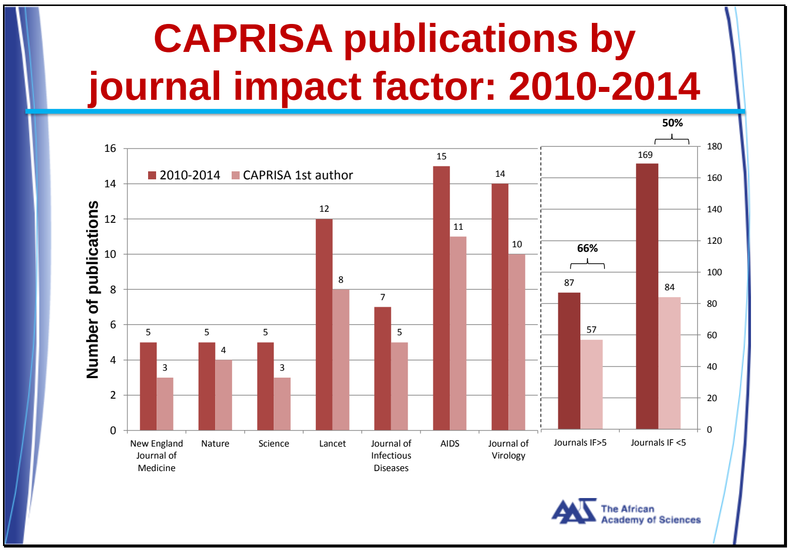

Figure 22. CAPRISA publications by journal impact factor: 2010-2014.

Figure 23. Two AAS Fellows awarded the African Union Kwame Nkrumah Continental Scientific Awards 2014 Edition.

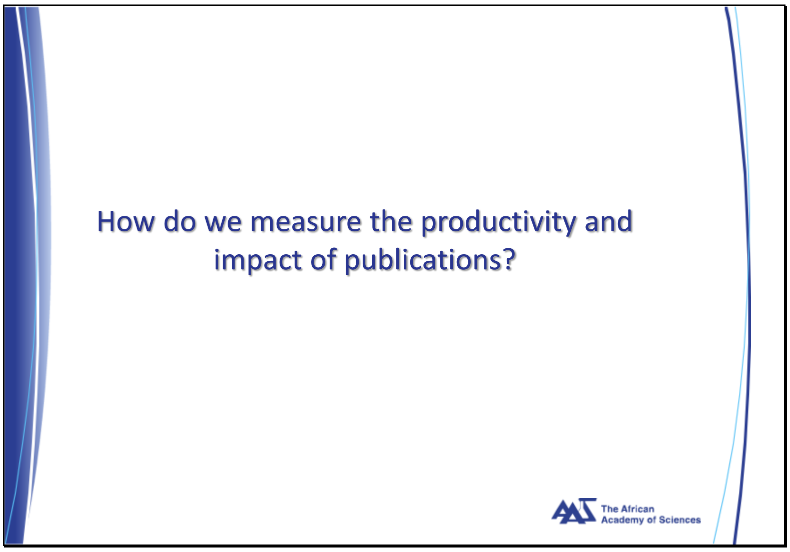

Figure 24. How do we measure the productivity and impact of publications?

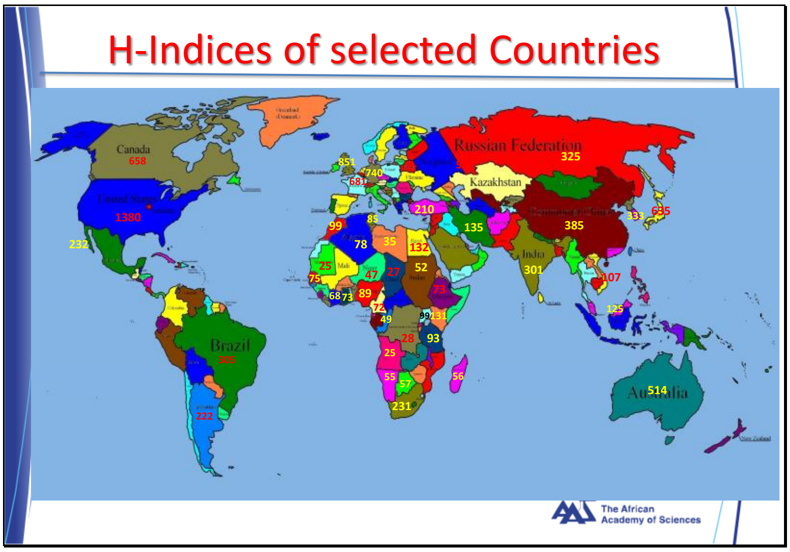

Figure 25. H-Indices of selected countries.

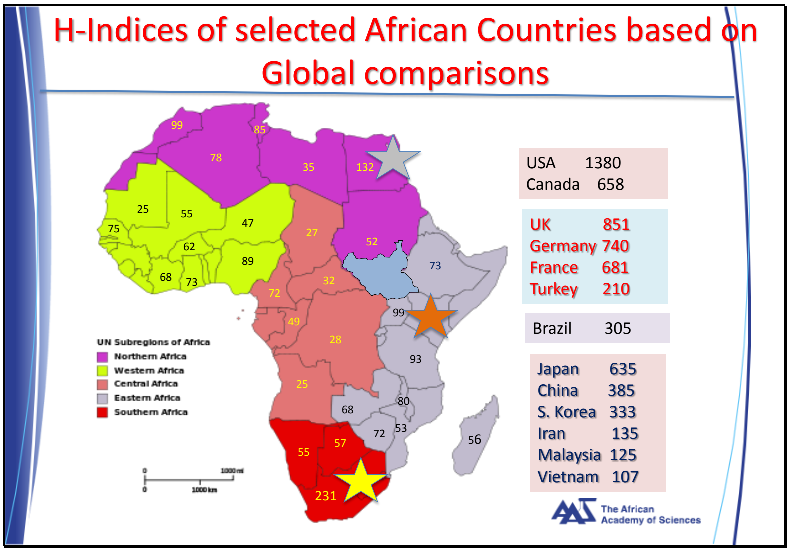

Figure 26. H-Indices of selected African Countries based on global comparisons.

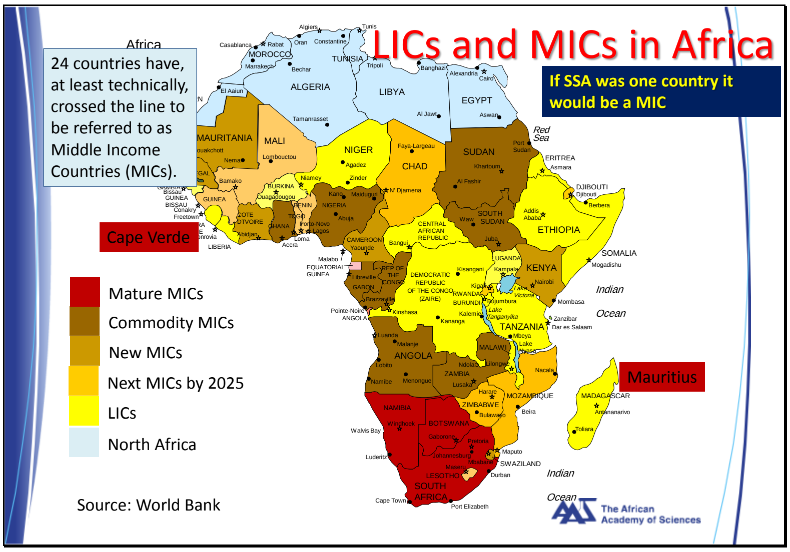

Figure 27. LICs and MICs in Africa.

Professional background of African Leaders 2015

	Fields of African Leaders	No
1	Science/Engineering	7
2	Law	9
3	Economics/Political science	10
4	Finance/MBA/Accounting	5
5	University Professor/Teacher	5
6	Military coup	5
7	Miscellaneous (Eritrea, South Africa, Sudan, South Sudan, Swaziland, etc)	13
	Total	54

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Figure 28. Professional background of African Leaders 2015.

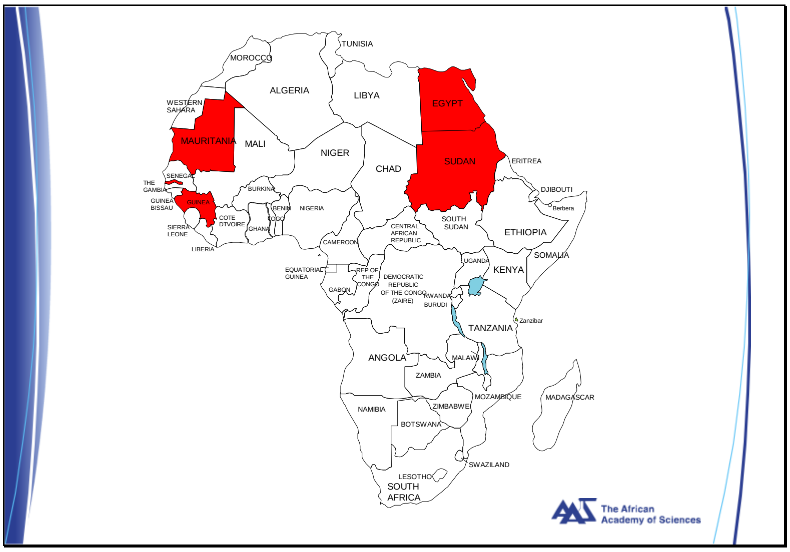
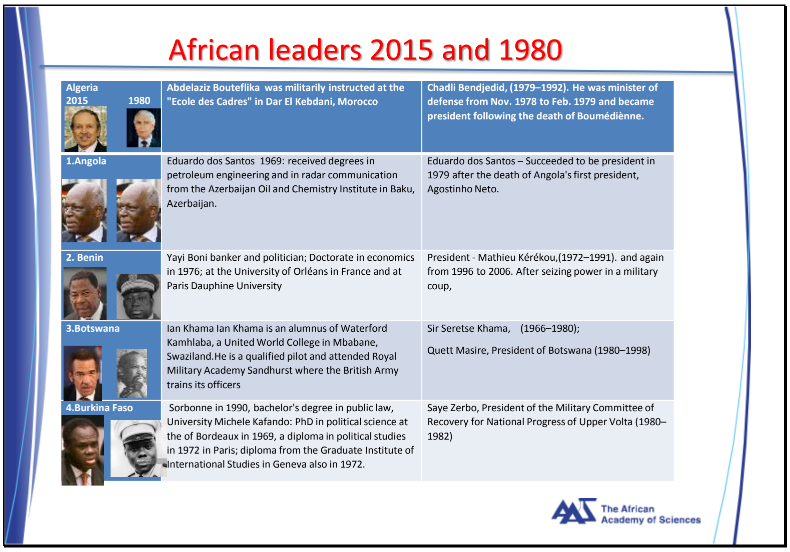


Figure 29.



Algeria 2015 1980	Abdelaziz Bouteflika was militarily instructed at the "Ecole des Cadres" in Dar El Kebdani, Morocco	Chadli Bendjedid, (1979–1992). He was minister of defense from Nov. 1978 to Feb. 1979 and became president following the death of Boumédiènne.
1.Angola	Eduardo dos Santos 1969: received degrees in petroleum engineering and in radar communication from the Azerbaijan Oil and Chemistry Institute in Baku, Azerbaijan.	Eduardo dos Santos – Succeeded to be president in 1979 after the death of Angola's first president, Agostinho Neto.
2. Benin	Yayi Boni banker and politician; Doctorate in economics in 1976; at the University of Orléans in France and at Paris Dauphine University	President - Mathieu Kérékou,(1972–1991). and again from 1996 to 2006. After seizing power in a military coup,
3.Botswana	Ian Khama Ian Khama is an alumnus of Waterford Kamhlaba, a United World College in Mbabane, Swaziland.He is a qualified pilot and attended Royal Military Academy Sandhurst where the British Army trains its officers	Sir Seretse Khama, (1966–1980); Quett Masire, President of Botswana (1980–1998)
4.Burkina Faso	Sorbonne in 1990, bachelor's degree in public law, University Michele Kafando: PhD in political science at the of Bordeaux in 1969, a diploma in political studies in 1972 in Paris; diploma from the Graduate Institute of International Studies in Geneva also in 1972.	Saye Zerbo, President of the Military Committee of Recovery for National Progress of Upper Volta (1980–1982)

Figure 30. African Leaders 2015 and 1980.

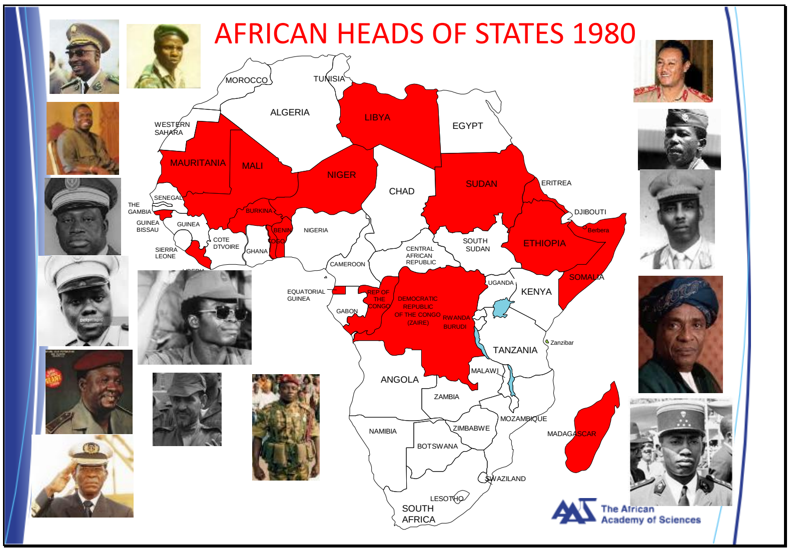


Figure 31. African Heads of States 1980.

Figure 32. Science, Technology and Innovation – go hand in hand with Research.


2000
The Economist
The hopeless continent
2012
The Economist
SPECIAL REPORT
EMERGING AFRICA
A hopeful continent
2024
????????
????????
???????
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??????
The African Academy of Sciences

Figure 33.

A Brief Story of La main à la pâte

Yves Quéré
Académie des Sciences
Pairs, France

The story starts in 1931 when a young boy, called George Charpak, age 7, coming from his birth-country, Poland, not speaking a single world of French, enters a primary school in the 19th district of Paris. About this event, he will write later: "I thought I was entering paradise"; an event which created for him a long standing love affair with school or more generally, with education.

So, it is not surprising to see this man, 60 years later – coming back to France (he had been working in CERN, Geneva), Nobel prize in pocket – telling here and there: "I want to pay my debt".

In order to pay this debt, having heard that scinece (natural science) had practically disappeared in the French schools of years 1990s, he decides in 1995 to launch a renovation of science education. Then will follow:

- A name given to the operation: La main à la pâte, an expression related, in French, to a definitely concrete action rather than some vague declaration on intentions,
- The hiring of two of his Academician colleagues to help him and to participate to the adventure,[1]
- A visit to the French Minister of Education, François Bayrou,
- A visit of a different nature, to a few US schools (in Chicago and in California) where a new system of Science education 'hands-on' has been started,
- Then a unanimous vote, in this room (1996), of the French academy of Sciences, supporting the idea.

This vote was both paradoxical an essential. This might look as a paradox, these old men of an Academy taking suddenly care of the brats of the kindergarten instead of keeping their look on Big Science and/or Universities. But George had explained with a convincing force that the important level where to look at was precisely that of children, they are those whom we have to persuade, for life, to cherish and respect science.

In the same time it was essential because manifesting the implication of the scientific community at high level into the scientific education of children , a real novelty, even though Marie Curie had brilliantly pleaded the same cause one century before, teaching a few children the inquiry way (*Leçons de Marie Curie*, EDP Ed., 2003). Nowadays, we have hundreds of 'high level' scientists and thousands of University students and retired engineers, who devoted or have devoted themselves, not to teach the children but to help the teachers. We should be thankful to our late friends Jacques Friedel, Paul Germain, Hubert Curien, Pierre-Gilles de Gennes, together with Jean Dercourt, Jean François Bach and François Gros, the Secrétaires perpétuels of that time, to have encouraged the Assembly to vote in the right direction.

Now the adventure may start and it will be a fascinating one.
First we will have to answer the two questions of the minister: *Why* to teach science to children (they might quite well learn it later, at the *lyceé?)*; and, if yes, *how* to do it?

1. There is a first, relatively commonplace answer to the *why*: we should familiarize early our children to the world around them. One will remember here the moving story of the young Tilly Smith, a 10 year old girl from surrey, who saved the lives of *ca* 100 people sitting

[1] Pierre Léna and Yves Quéré.

quietly on a Thailand beach on the sinister day of December 26, 2004, when, seeing the sea receding, she shouted a stampede, she had understood that this meant the occurrence of a tsunami, a phenomenon which she had studied a few months earlier in her school.
The second answer is still more important. Science education is expected to contribute most significantly to shaping, or training, our mind. It stimulates both the curiosity (a word close to the empathy by which we 'take care' (latin *cura*) of what is around us; a word which then carries an ecological flavour) and the imagination (that is the faculty to create images of what is hidden behind the wall). It introduces us to the difficult concept of the truth in a world invaded by a spineless relativism (*tout est relatif*! *A chacun sa vérité*, etc.). In the same time, it tells us that we do not know everything, the founding sentence of science being "I do not know" (to which we have to add "…but I would like to know"), which implies a hue of modesty in our behaviour and also, possibly, for the child, a desire to search and become a scientist. Finally, it tends – together with mathematics – to create logic and rational thinking in our brain.
2. as for the question about the *how*, the answer was clear: children should, as far as possible, learn science by doing it rather than reading it on the blackboard or in a book. Ideally, this means, for the teacher, organizing in the classroom the following sequence:

(i) Starting from a question of a child about some object or some phenomenon which he/she has encountered and which he/she does not know or does not understand.
(ii) Throwing back the question to the other children ("What is your opinion about this question? What would be your own answer?"), urging the children to express their hypotheses. As naïve as they may be, accepting them.
(iii) Having them install an experiment, a simple and completely comprehensible one, on small tables where, now, children practice group-working, trying to interpret the result in the same way as they would hold an inquiry. Getting (in principle) the answer to the initial question.
(iv) Last but far from least, requesting the students to write down the small intellectual and manual adventure which they have just been living through. This means, for them, an effort to select the right words (not the 'tree', but the 'larch', the 'pine', the 'fir' …) and to construct well-structured sentences, the ability to speak a correct and understandable language being probably the most important gift which school should offer to these children.

Obviously this way of teaching is not new. But brand-new were some ingredients which La main à la pâte (*lamap*) added in the basket, including:

- The before-mentioned implication to the *scientific community*,
- The creation, in the *Académie*, of a substantial *website*, aimed at teachers for the whole country, proposing to them hundreds of possible experiments and explanations, with partial translations in Arabic, Chinese, English, Portuguese, Spanish, Vietnamese, …,
- The installation of pilot-centres, in fact medium cities, from where the *lamap* principles could be diffused in the region around,
- A number of training sessions for the teachers, with a special mention to the *Fondation des Trielles* which has welcome a lot of them, and the writing of a number of books, most of them translated free of charge in several languages.
- The creation of a special prize for the Academy for schools having performed excellent science lessons, the prize being awarded in this room to the teachers and the children, always in the presence of the Minister of Education.

What is the present situation 20 years after George's pioneering action? One side of the coin is definitely positive while the other one is marked by preoccupation. We may smile with, all together, a few tears.
Clearly, science has now come back in the French schools, either in the *lamap* way, or on a more traditional one. According to an estimate by the Ministry, the *lamap* procedure is used

by a big 1/3, or a small ½, of the teachers. Considering the major change of the pedagogical behaviour required from them, this is a positive result. Moreover, all evaluations (essentially local, by teachers themselves and inspectors) show a definitely positive effect on the reaction of children – and interestingly enough, that of parents – towards science. Moreover, the implication of scientists in the school system has greatly contributed to take the school teachers out of this kind of intellectual isolation where they often are.

Also most positive has been the creation of a Foundation (*Fondation La main à la pâte*) which continues George's action especially by the creation of a few *Maisons pour la science* (now in: Bordeaux, Clermont-Ferrand, Lille, Nancy, Orléans, Rennes, Strasbourg, Toulouse, not forgetting the *Centre national* in Paris), linked to the local University, all devoted to teacher's training in science.

However, there remains the fact that more than one half of the teachers have not been converted to *lamap*. One reason is obvious: many fear not to be able to answer a question from children and prefer to teach in a non-risky 'classical' way. Another one relates to the evaluation of the children, many teachers considering that this is easier if children are just required to repeat sentences learnt by heart.

In parallel, we received, as early as 1998, an invaluable gift, that of an international expansion of these ideas. Being at that time, the Foreign Secretary of the *Académie*, I could confront our problems to those of other Academies and countries and I discovered that, unexpectedly, many of them, had identical concerns about science education and identical ambitions as ours. This was the start of a most exciting series of meetings, sessions, conferences, crossed visits to schools… with countries or regions as different as Australia, Cambodia, Chile, china, Japan, Latin America, Malaysia, Mali, South Africa, Sweden, Tunisia, United Kingdom, United States… So, a sort of 'invisible college' was coming to life at the size of the world, reaching a quasi-unanimity about the 'how-to-teach', facilitated by two universals: that of science (no such 'college' would be easily possible for grammar, or for history) and that of children. The former is obvious, the latter becomes clear when one visits schools in Columbia, in Indonesia or in Denmark: the same desire of children to know, the same ingenuousness, the same openness to nature and to people.

In order to conclude, I wish to give the floor to a French Ambassador. He was, in his beautiful residence, welcoming a dozen of hosts, going courteously from one to the other. He came to me: "You are a scientist aren't you?" – "Oui Monsieur l'Ambassadeur" – "Oh Science, this is great!" [deep silence then]: "You know I have forgotten everything which I learnt at school in science" [a laugh, then]" "But, Monsieur, this is not important since, in my job, the main thing is culture".

Let us hope that our children, if they have practised science at school, if they have loved it, it will never commit the blunder of the Ambassador and that, contrary to him, they will take science for what it is in reality: not an isolated land, somewhere far away, but a superb continent of human culture.

Swiftlets and their Gold Mine Saliva: Edible Bird-Nest - Towards Competitiveness and Sustainability

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Malaysia

ABSTRACT

Swiftlets are birds living in caves and specialized built houses, commonly present in South East Asia. They are swallow-like birds which are able to navigate through dark caves using echolocation, similar to bats, and are highly valued for their ability to produce edible nests, made up of glutinous secretion from their two sublingual salivary glands. The nests are used traditionally as food delicacy and also an important ingredient in Chinese Medicine for health enhancing effects and strengthening the immune system. Demands for the nests continue to increase and sold at high price, some reaching USD3000 or more, per kilogram, depending on the quality and grade of the nests. Edible bird-nest [EBN] industry has been identified as one of the projects under New Economic Model, Malaysia, that can generate high income to the ranchers and has high export value due to the demand for EBN worldwide. The current EBN industry of more than RM1.5 billion and growing at estimated 20% annually, with the target export value of RM5 billion by the year 2020, is therefore of great economic potential to the ranchers and the country. In order to achieve this target, it is important that all information about the swiftlets [Aerodramus species] and their EBN are scientifically researched and documented. The Ministry of Agriculture and Agro-based Industry, Malaysia, has recently set up the EBN Centre of Excellence in relation to research and development (R&D) to ensure the sustainability of the industry and its competitiveness. The Centre has identified six main focus areas for R&D. These include:

1. Genetic characterisation of Malaysian EBN swiftlets.
2. Ecology and behaviour of swiftlets, including feeding behaviour in different habitats.
3. Optimising production of EBN which includes housing design, feeds and feeding.
4. Quality assessment and standards for EBN, including contaminations, adulterations and development of detection kits.
5. Health monitoring and disease surveillance.
6. Economics and Downstream activities

Another important area in the study includes processing and marketing strategies of EBN. This paper highlights important on-going research projects and their achievements.

PRESENTATION

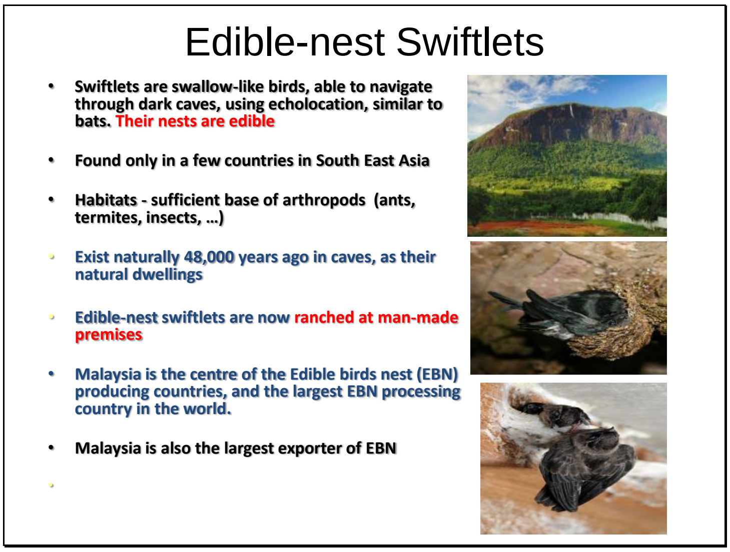

Figure 1. Edible-nest Swiftlets.

Figure 2.

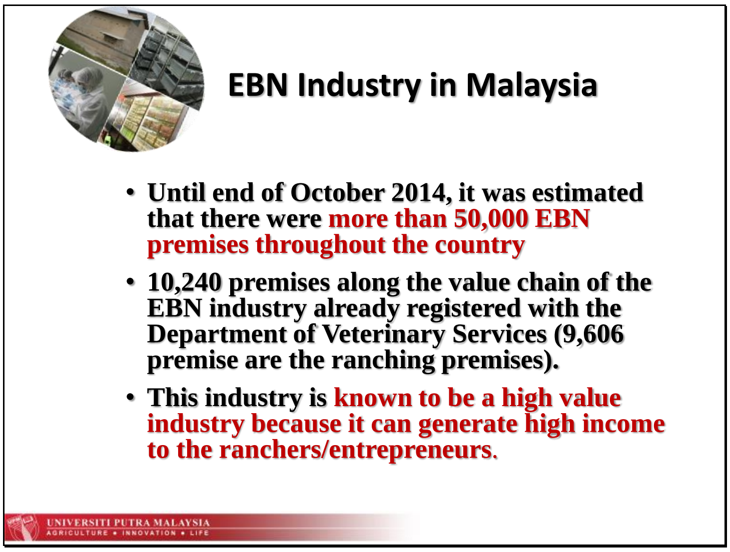

Figure 3. EBN Industry in Malaysia.

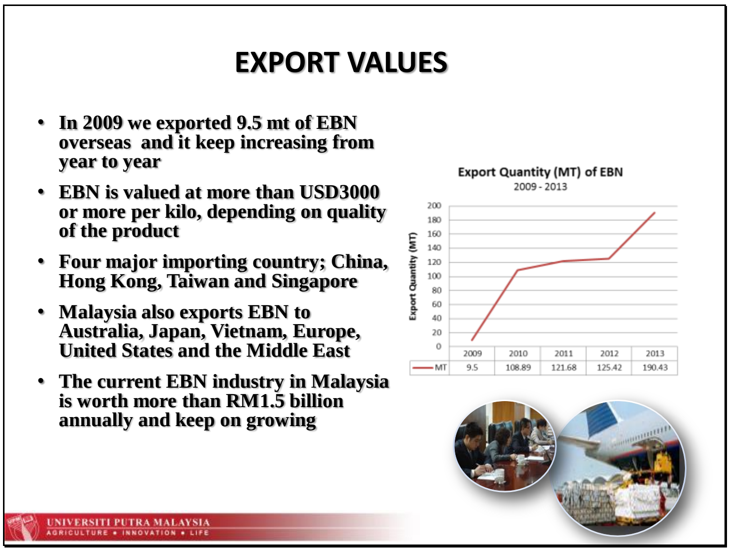

Figure 4. Export Values.

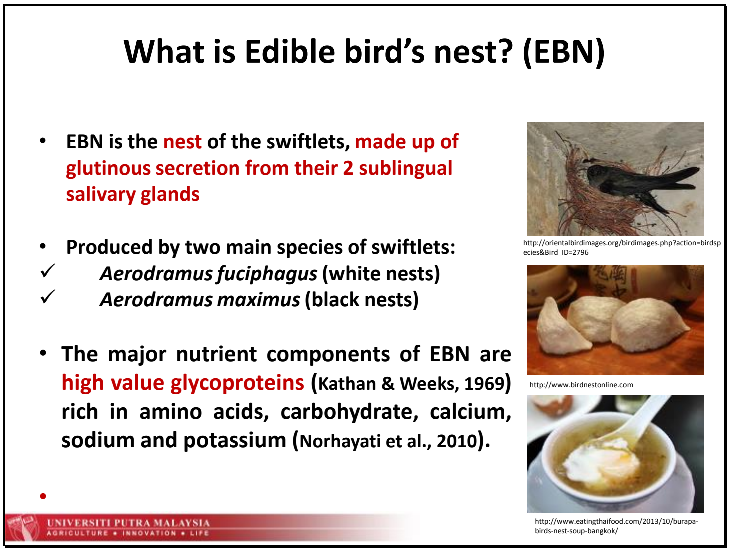

Figure 5. What is Edible bird's nest? (EBN).

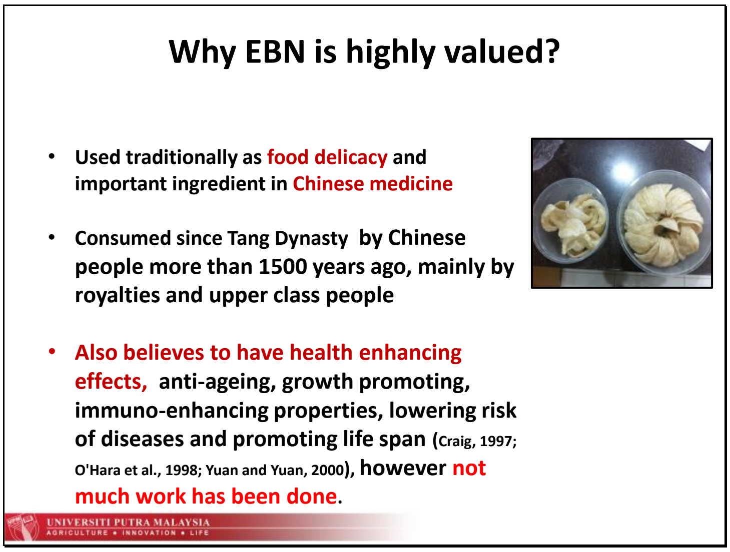

Figure 6. why EBN is highly valued?

Figure 7.

Figure 8. Research Clusters.

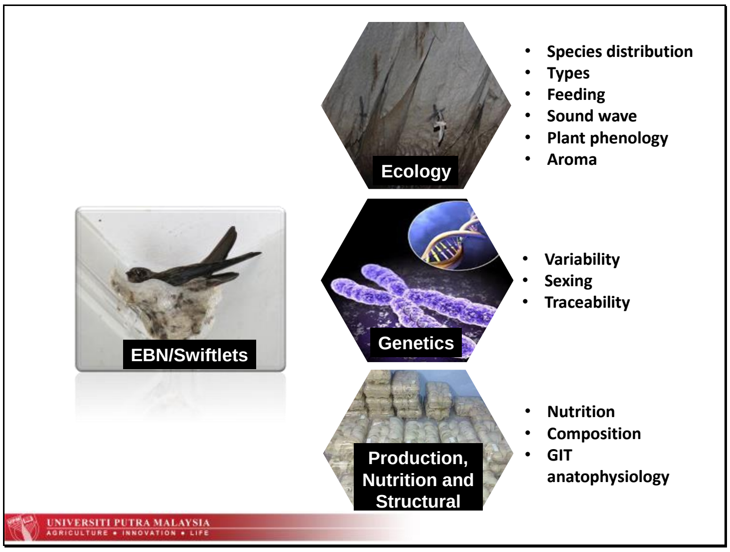

Figure 9.

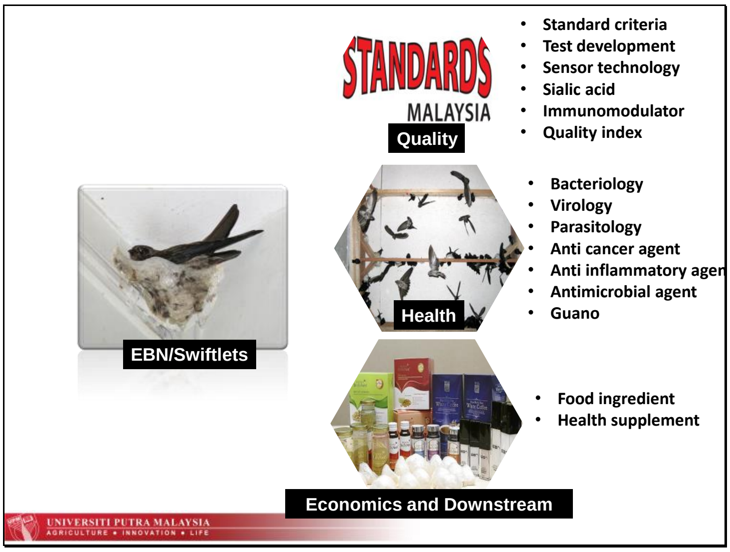

Figure 10. Standards.

Figure 11.

Figure 12.

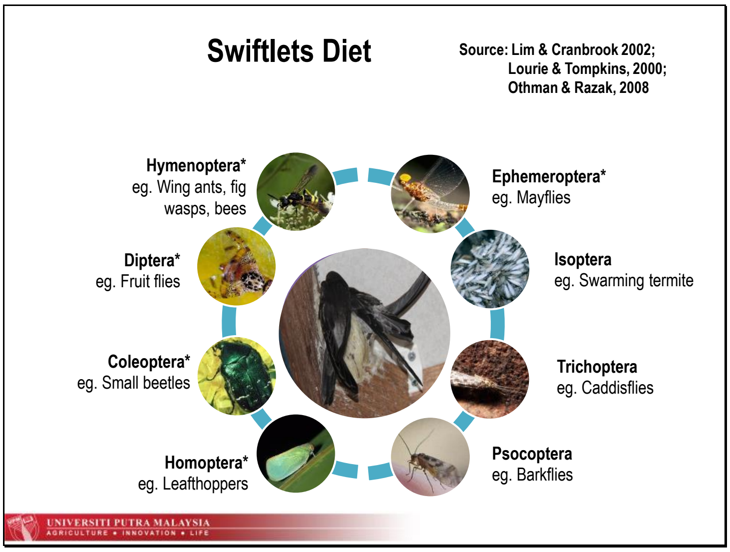

Figure 13. Swiflets Diet.

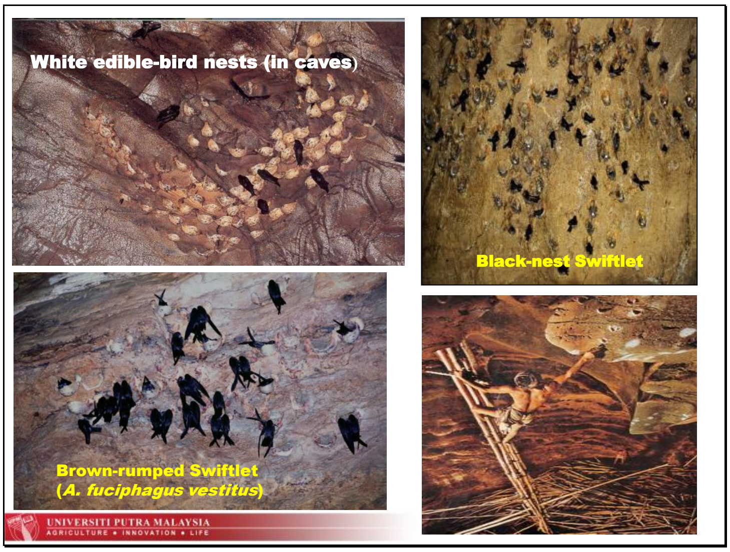

Figure 14.

Figure 15.

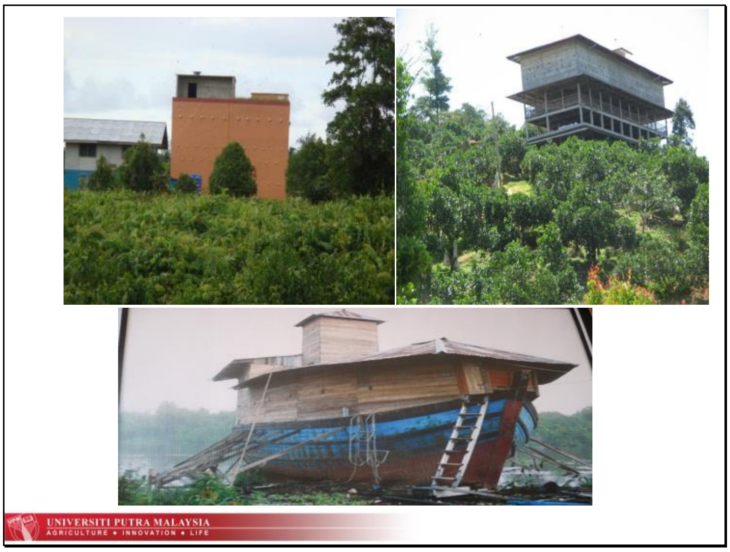

Figure 16.

Figure 17.

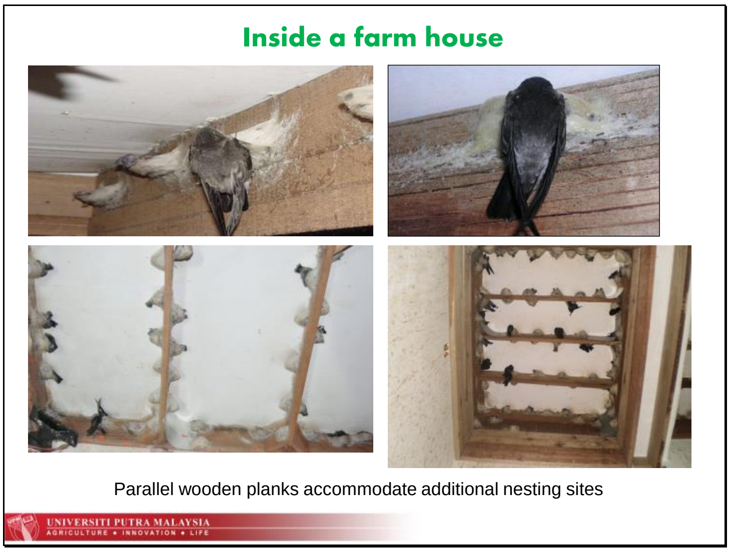

Figure 18. Inside a farm house.

Figure 19.

Figure 20.

Figure 21.

Figure 22. Development of Nests.

Figure 23.

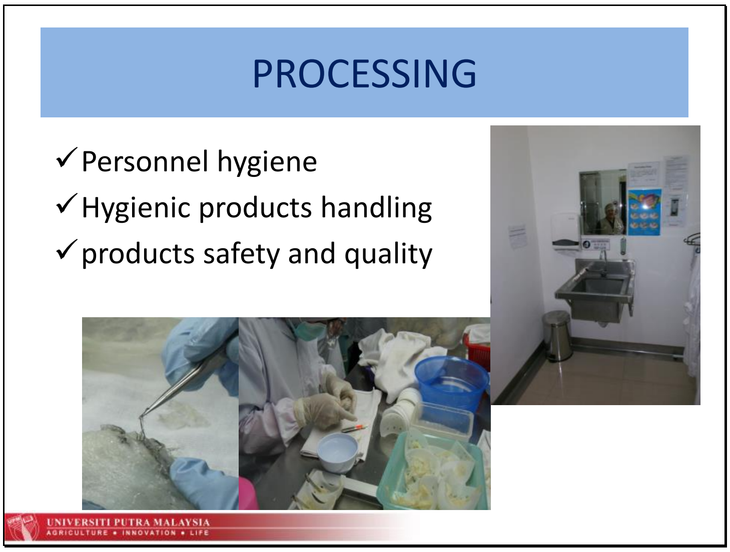

Figure 24. Processing.

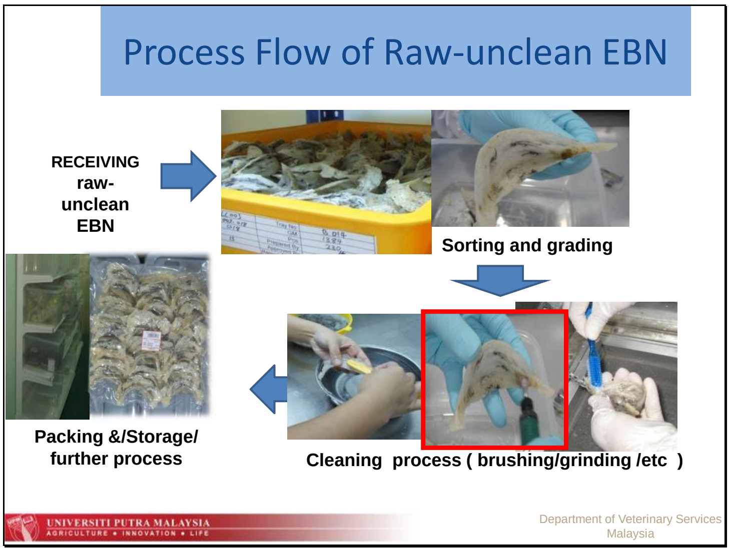

Figure 25. Process Flow of Raw-unclean EBN.

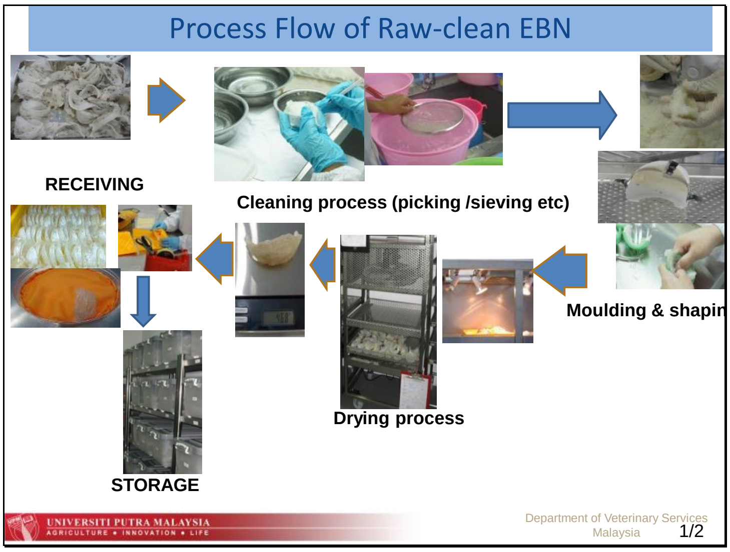

Figure 26. Process flow of Raw-clean EBN.

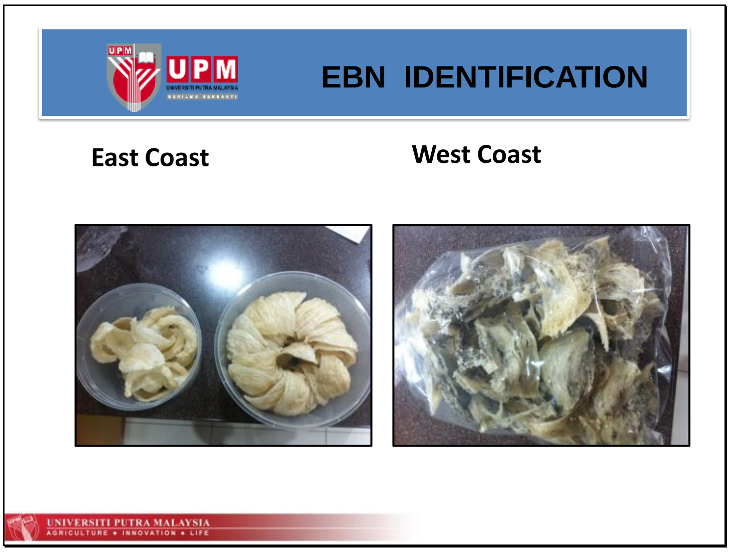

Figure 27. EBN Identification.

Examples of specific projects

- Authentication analysis of Edible Bird's Nest based on Proteomics-Based methods in combination with Chemometrics.
- Development of PCR-ELISA method for rapid and simultaneous identification of edible birds‘s nest (EBN) and related swiftlets species.
- Quality and anti-aging determinants of Edible Bird's Nest (EBN) By nutrigenomic and metabolomic strategies.

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Figure 28. Examples of specific projects.

- Transcriptome profiling for identifying novel biomarkers in swiftlets of conservation and industry importance.
- Structural and conformational studies of edible birds' nest proteins.
- Roosting and Nesting Behavior of White-nest Swiftlets (*Aerodramus fuciphagus*).
- The Effect of Edible Bird's Nest Extract on Chondrocytes isolated from Osteoarthritic Articular Cartilage.

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Figure 29.

Figure 30. Successful production of EBN.

EBN DOWNSTREAM PRODUCTS

- Development of downstream products from bio-technologically processed edible bird nest produced new value-added, innovative invention products from the traditional raw edible swiftlet nests.

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Figure 31. EBN Downstream Products.

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Figure 32.

Figure 33. Bird Nest Products.

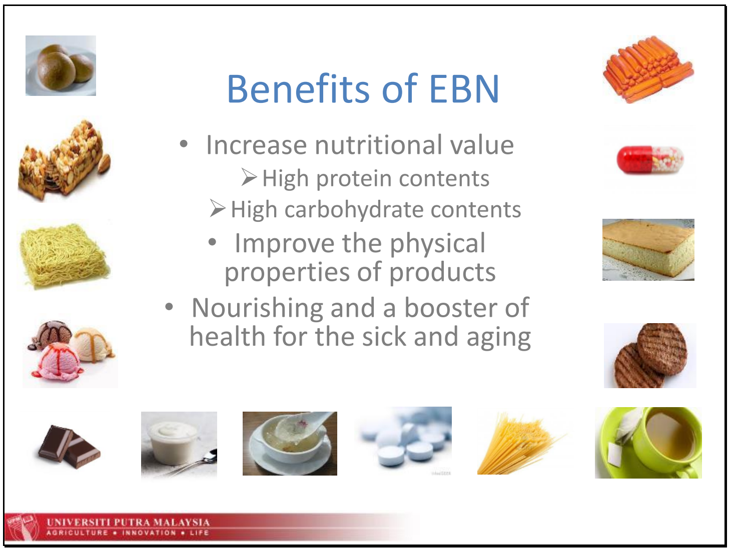

Figure 34. Benefits of EBN.

The Potential of Interdisciplinary Research in Toxicology

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Faculty of Pharmacy
Tehran University of Medical Sciences
Tehran, Iran

ABSTRACT

Interdisciplinary research is a common method of study in research and technology, which is rapidly increasing in the globe. Interdisciplinary research is a type of study or research that tie up two or more disciplines in order to create new models, approaches, and instruments that could not occur if they were separately handled. Toxicology as an academic discipline describes existence or absence of harmful toxic effects of any compound providing safety measures for humans and other species in the environment. In terms of interdisciplinary, toxicology is in major need to be interdisciplinary to make link to all basic and clinical sciences from chemistry, biochemistry, immunology, pharmacology, physiology, pathology, human and veterinary medicine, to the environmental sciences. For instance, environmental toxicants such as pesticides can induce many diseases and need extensive interdisciplinary research to diagnose such links and prevent their consequences. It has been established that the existence of some environmental toxicants in the human life chain, cannot be avoided. In this regard, there is huge evidence on the relation between exposure to environmental toxicants and elevated rate of chronic diseases such as different types of cancers, diabetes, neurodegenerative disorders, and reproductive disorders and so on. A disorder of the reproductive system leads to infertility and therefore has been at the center of attention within the recent decades. Although there have been a countless of studies conducted so far on the relation of toxicology and many disorders, there is a gap in elucidating the precise mechanistic pathways of such effects needing interdisciplinary studies to be able to find effective therapies.

PRESENTATION

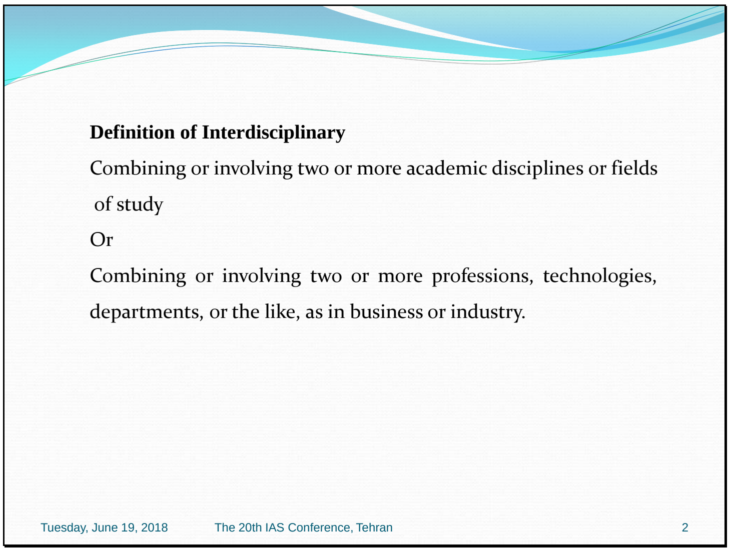

Figure 1. Definition of Interdisciplinary.

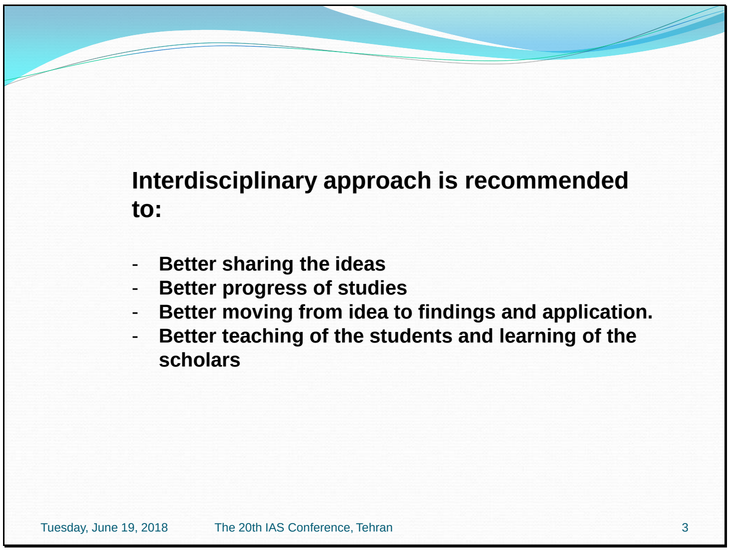

Figure 2. Interdisciplinary Approach is Recommended.

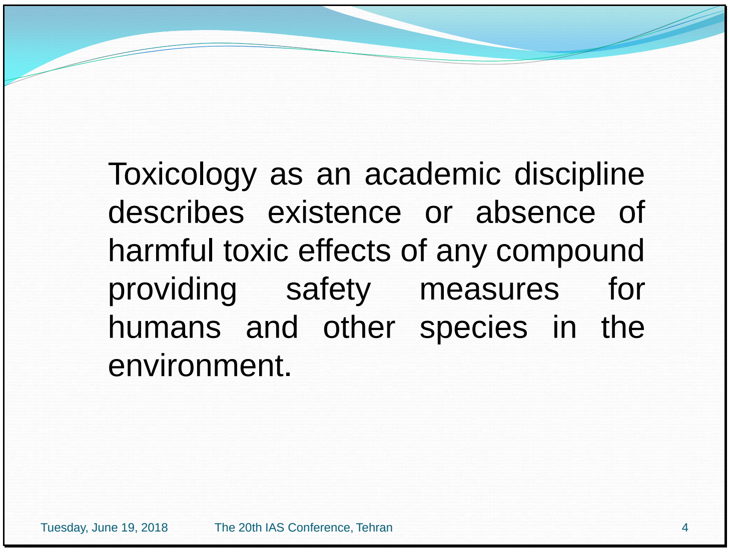

Figure 3.

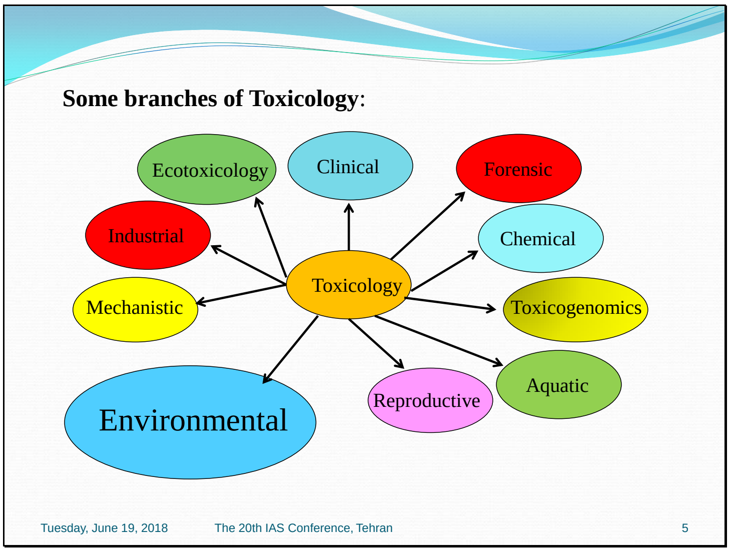

Figure 4. Some Branches of Toxicology.

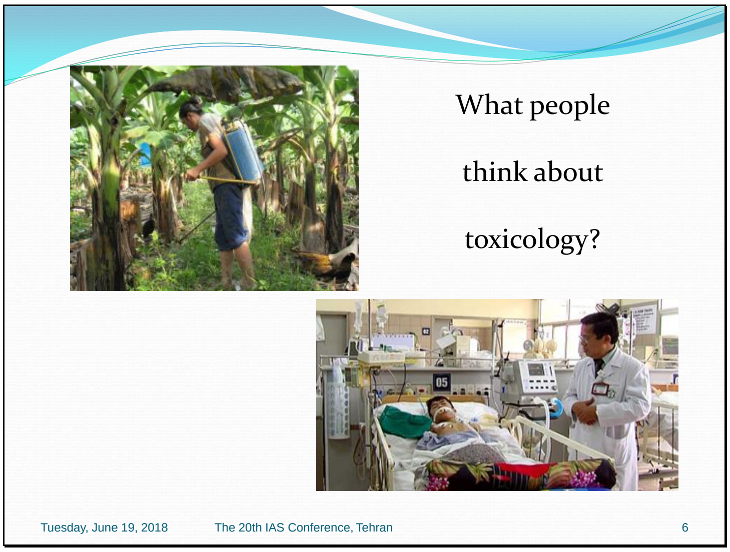

Figure 5. What people think about Toxicology?

Figure 6. Modern Toxicology includes Interdisciplinary Studies on Different Levels.

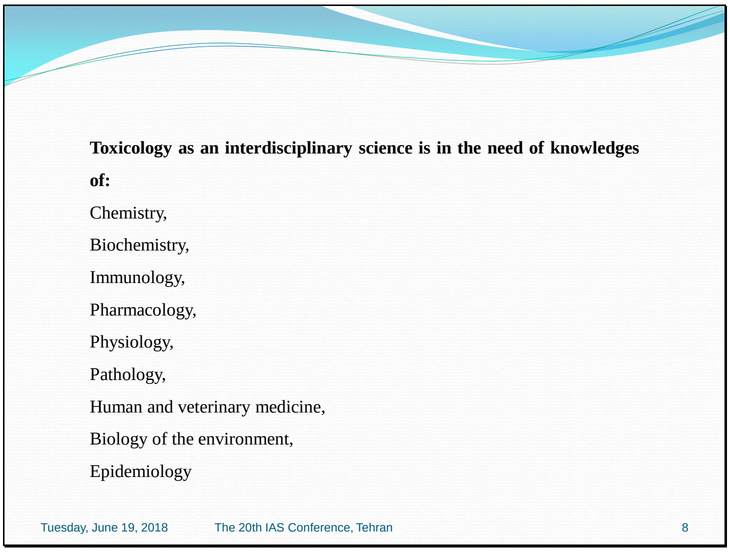

Figure 7. Toxicology as an Interdisciplinary Science is in the Need of Knowledges.

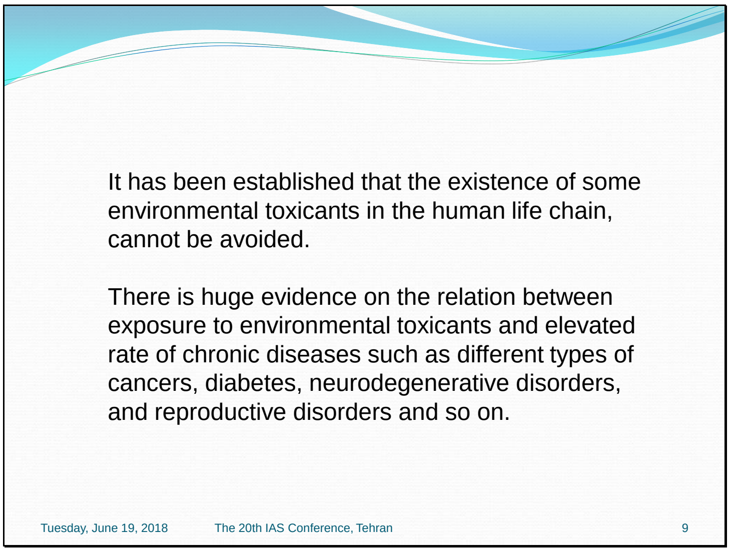

Figure 8.

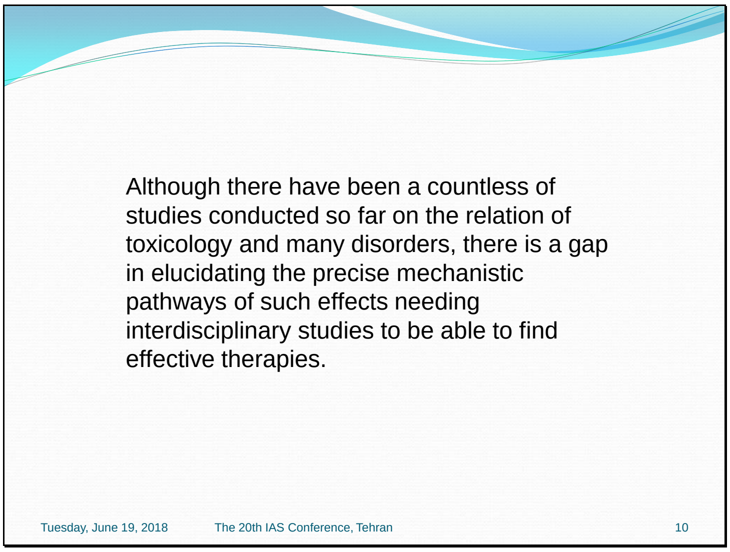

Figure 9.

Figure 10. Toxicology and Applied Pharmacology.

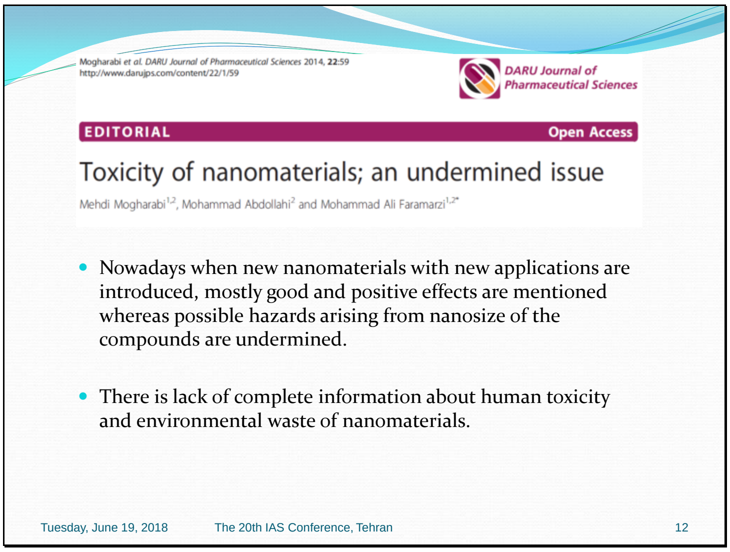

Figure 11. Toxicity of nanomaterials; an undermined issue.

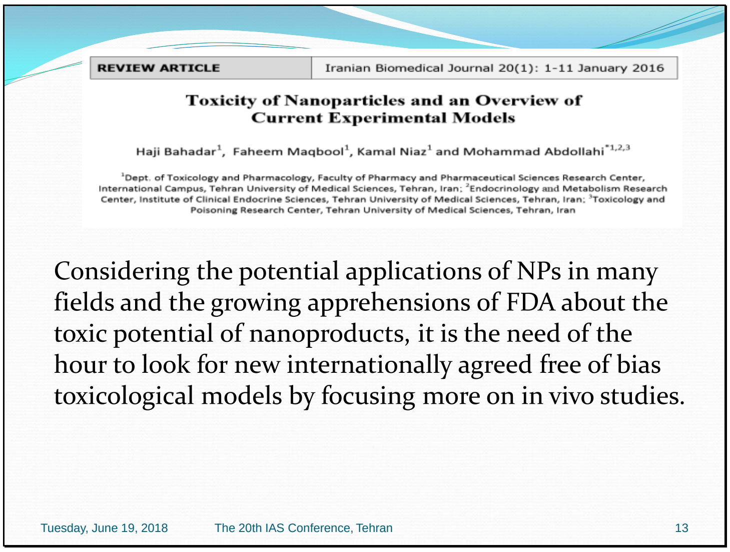

Figure 12. Toxicity of Nanoparticles and an Overview of Current Experimental Models.

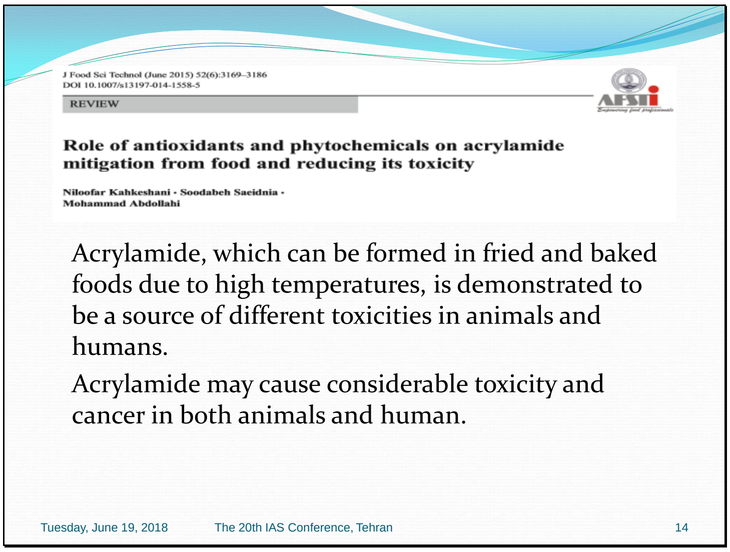

Figure 13. Role of Antioxidants and Phytochemicals on Acrylamide Mitigation from Food and reducing its Toxicity.

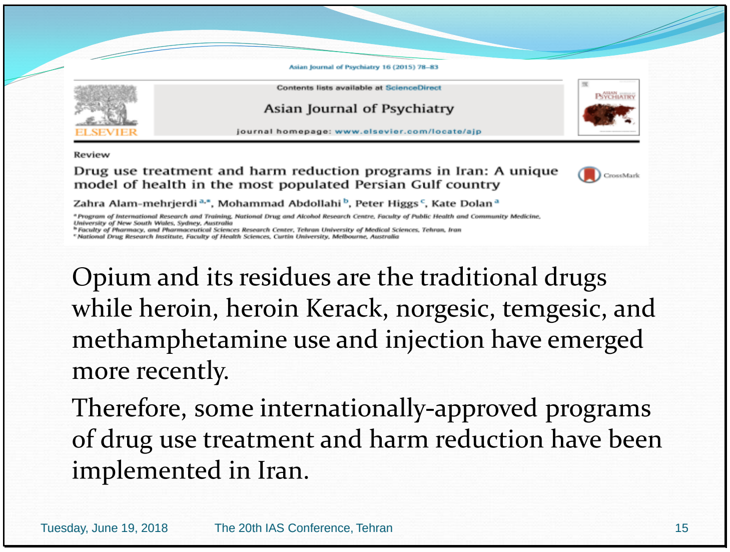

Figure 14. Asian Journal of Psychiatry.

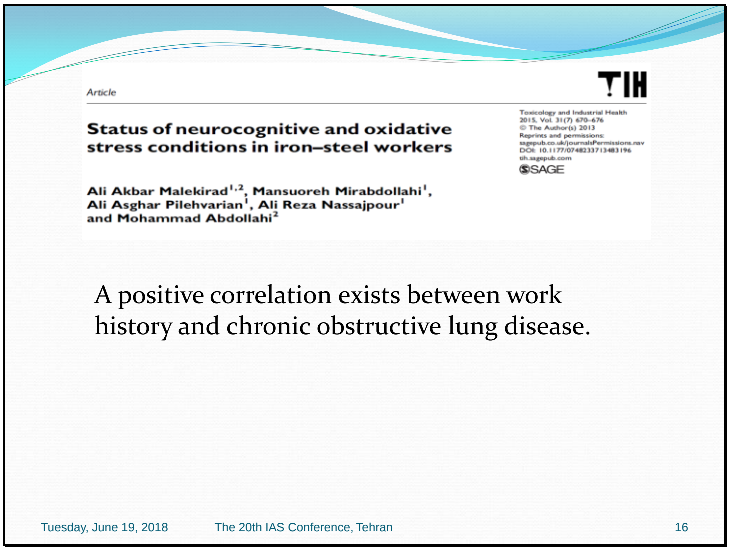

Figure 15. status of Neurocognitive and Oxidative Stress Conditions in Iron-Steel Workers.

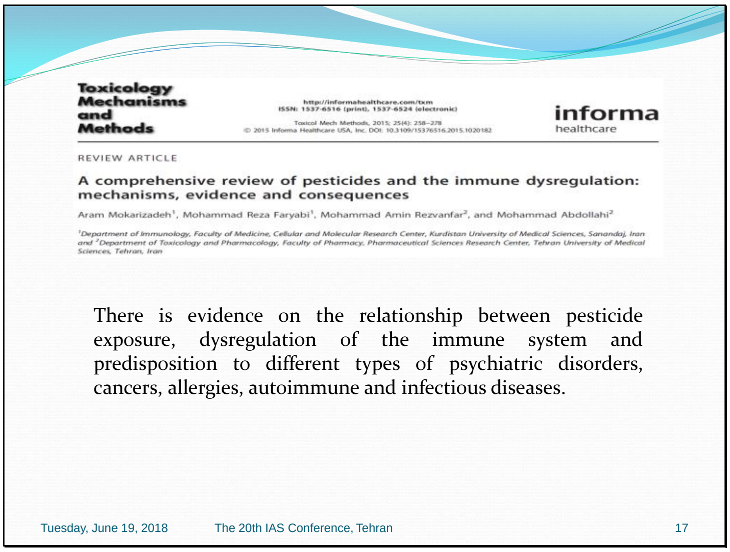

Figure 16. A comprehensive Review of Pesticides and the Immune Dysregulation: Mechanisms, Evidence and Consequences.

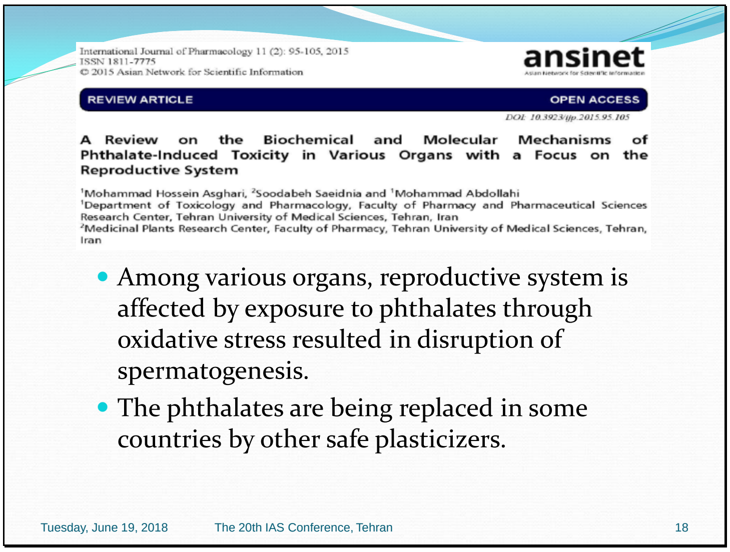

Figure 17. A Review on the Biochemical and Molecular Mechanisms of Phathalate-induced Toxicity in Various Organs with a Focus on the Reproductive System.

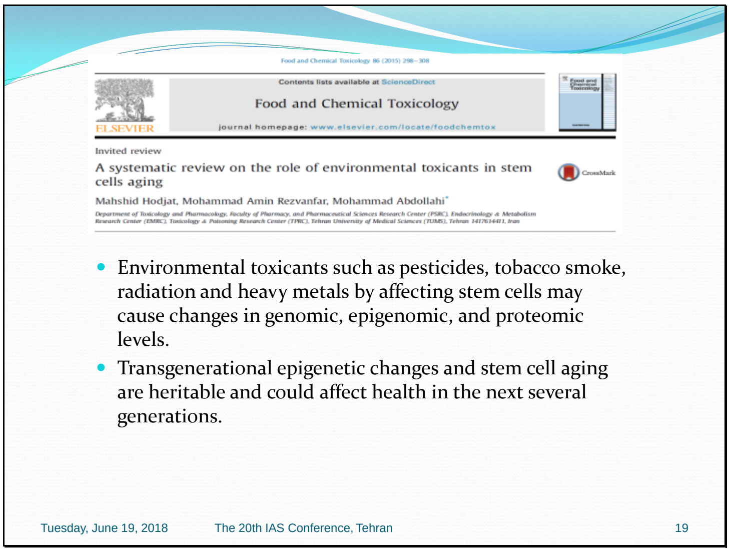

Figure 18. Food and Chemical Toxicology.

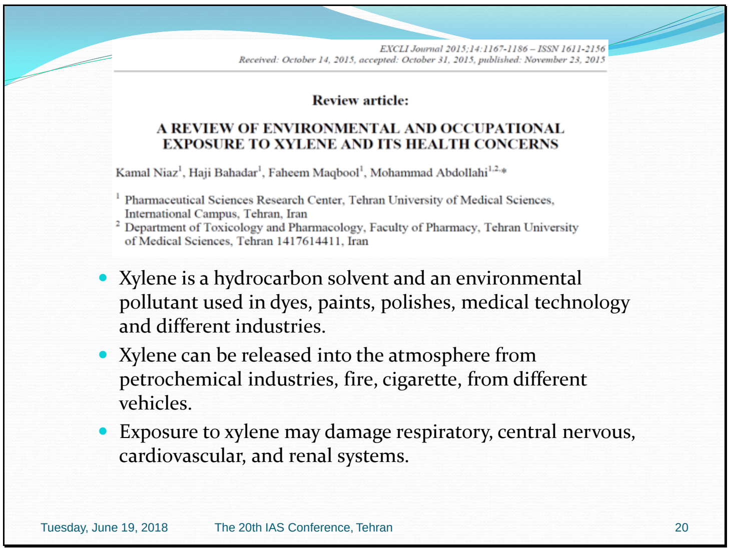

Figure 19. A Review of Environmental and Occupational Exposure to Xylene and its Health Concerns.

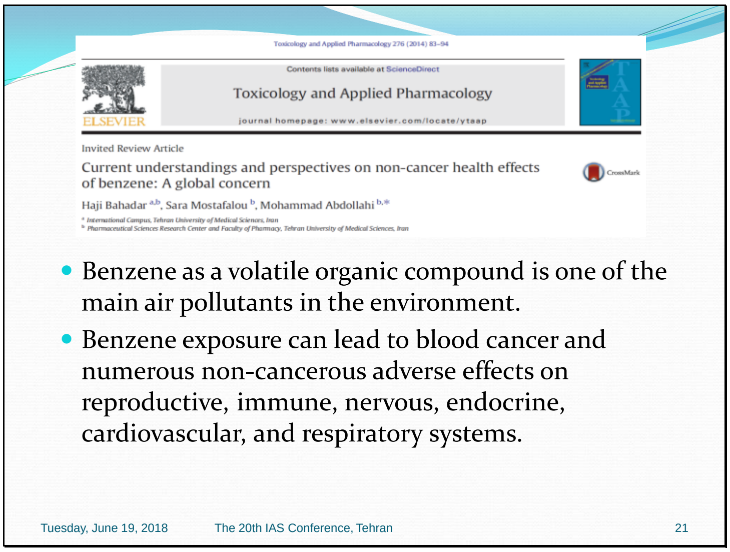

Figure 20. Toxicology and Applied Pharmacology.

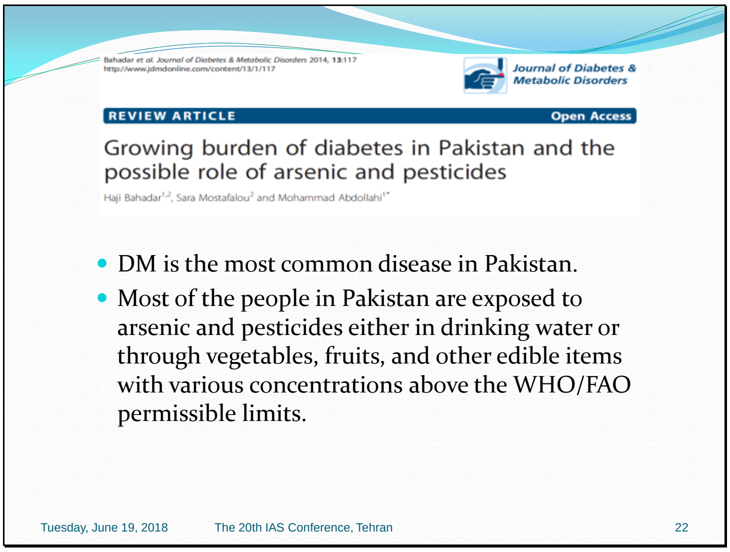

Figure 21. Growing Burden of Diabetes in Pakistan and the Possible Role of Arsenic and Pesticides.

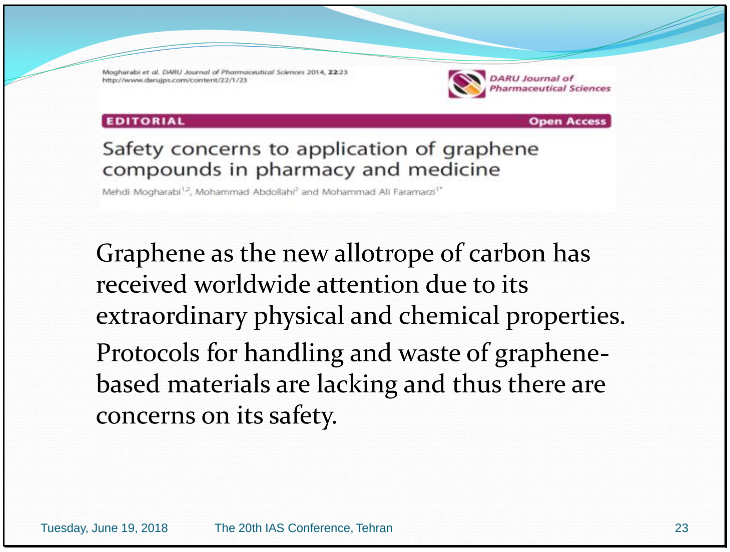

Figure 22. Safety Concerns to Application of Graphene Compounds in Pharmacy and Medicine.

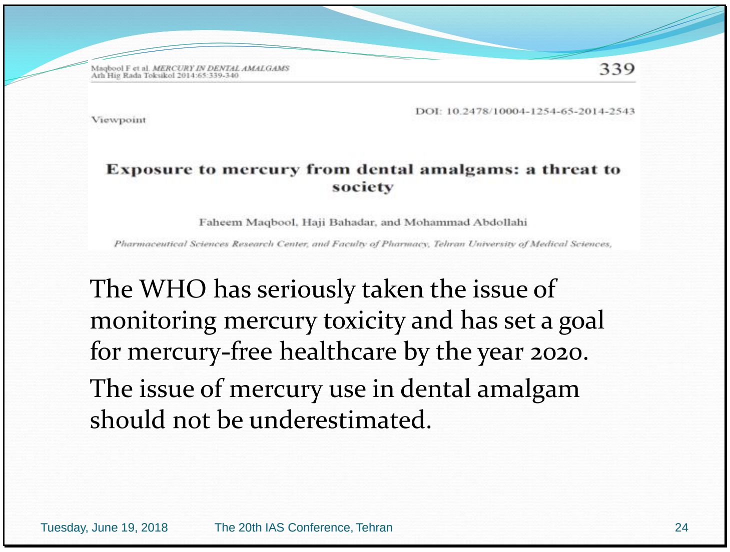

Figure 23. Exposure to Mercury from Dental Amalgams: A Threat to Society.

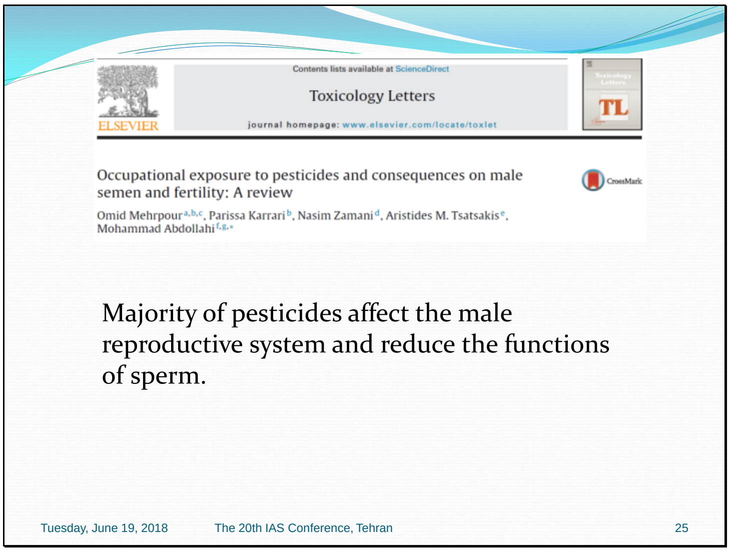

Figure 24. Toxicology Letters.

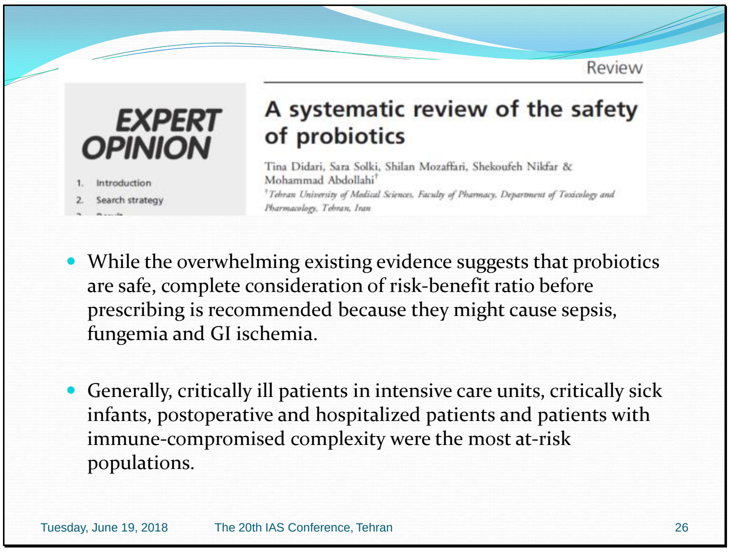

Figure 25. A Systematic Review of the Safety of Probiotics.

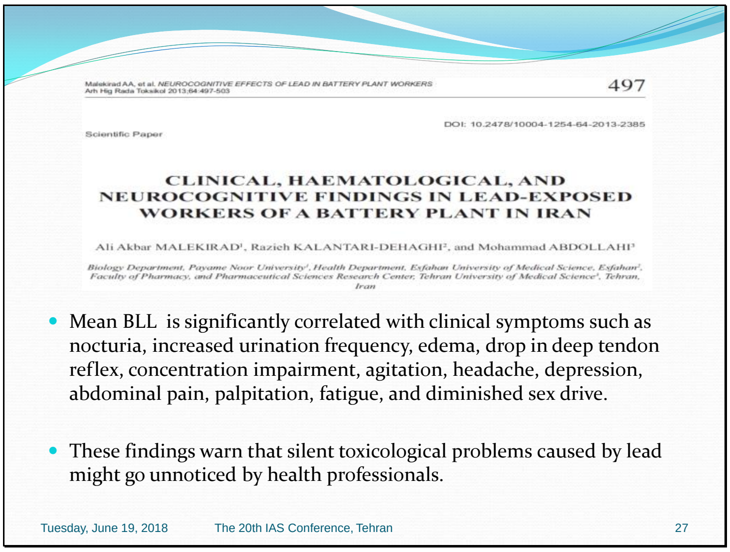

Figure 26. Clinical, Haematological and Neurocognitive Findings in Lead-Exposed

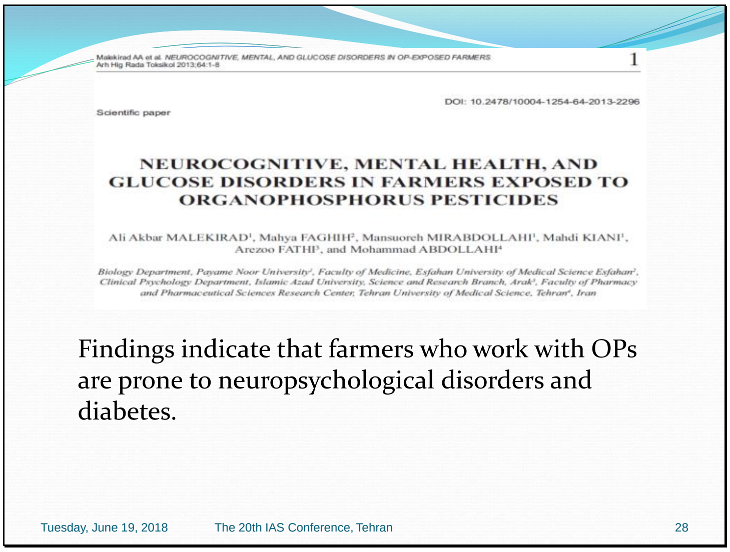

Figure 27. Neurocognitive, Mental Health and Glucose Disorders in Farmers Exposed to Organphosphorus Pesticides.

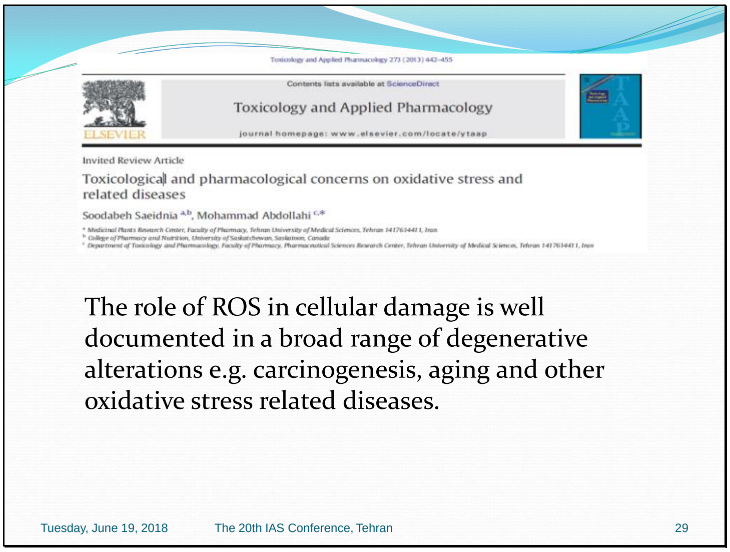

Figure 28. Toxicology and Applied Pharmacology.

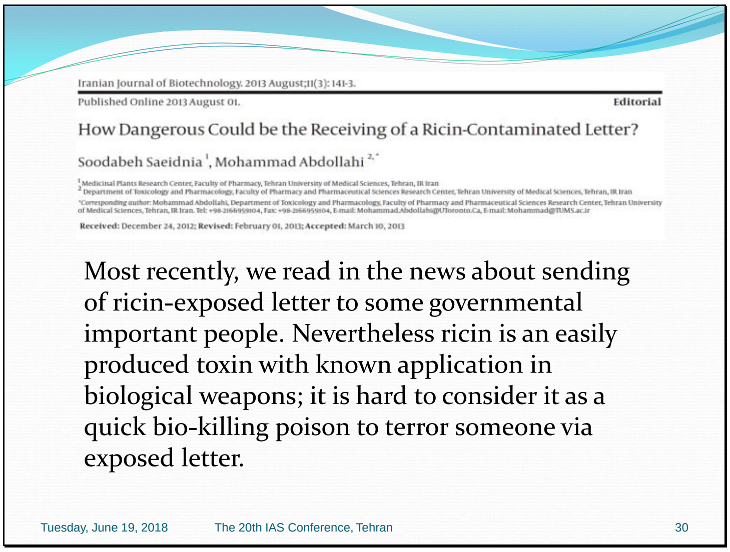

Figure 29. How Dangerous Could be the Receiving of a Ricin-Contaminated Letter?

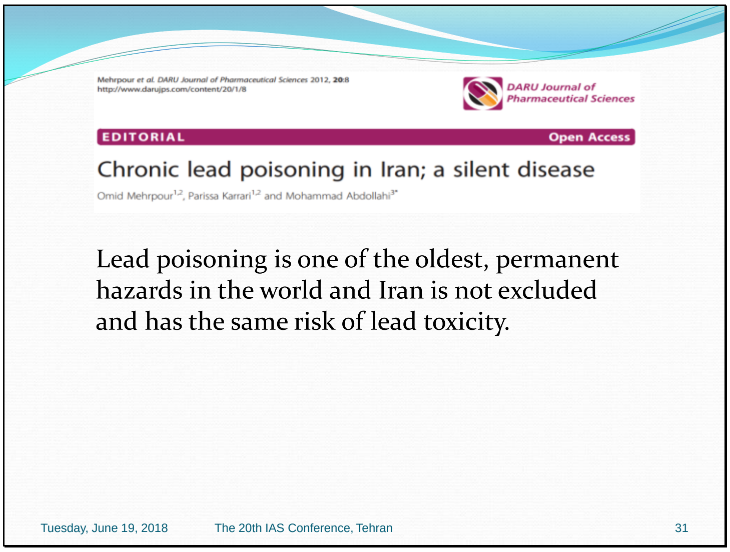

Figure 30. Chronic Lead Poisoning in Iran; a Silent Disease.

Figure 31.

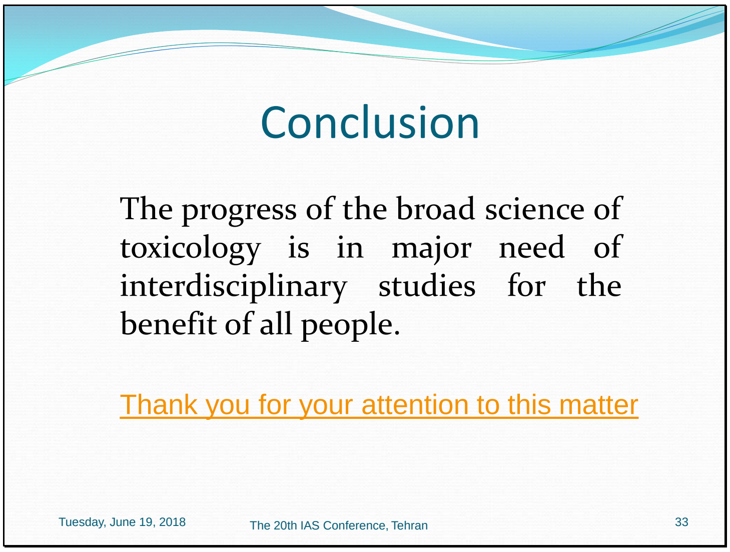

Figure 32. Conclusion.

Biomedical Research and Large-Scale Health Care: A Perspective from Bangladesh

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ABSTRACT

In the late 1980s a Biomedical Research Group (BMRG) was initiated in the Bangladesh Institute of Research & Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) which is operated by a non-profit social organization, the Diabetic Association of Bangladesh (DAB). In the initial years the Program was mainly supported by the Department of Medical Cell Biology and the International Program in the Chemical Sciences (IPICS), Uppsala University (Sweden), but in the later years the Program could mobilize further intellectual and logistic resources from a large number of collaborating and sponsoring groups from home and abroad. With continuous influx of young and enthusiastic researchers and students from multidisciplinary origins, BMRG could significantly stimulate academic and research activities at BIRDEM as evidenced by postgraduate degree programs, scientific publications & presentations and collaborative research projects.

In the mid-nineties BIRDEM was already recognized as a WHO Collaborating Centre for Research on Prevention & Control of Diabetes. Apart from direct contribution to science, the Group has played a vital role in turning DAB into the largest non-governmental health care chain in Bangladesh. In addition to providing organized comprehensive (primary, secondary & tertiary) health care to nearly 3.0 million diabetic patients through its 108 health care facilities (spread all over the country) DAB serves almost equal number of general patients at a reasonable cost. The Research group particularly contributed in the planning and realization of a large scale health care chain of 20 general hospitals under a large scale Project (the Health Care Development Project or HCDP) supported mainly by the Netherlands Government. In the last financial year the Project catered about 1.0 million patient visits with comprehensive care up to peripheral rural areas. The central hospital of HCDP (with a fairly big area of land given by the Govt.), in addition to its health care delivery function, became the nucleus of further academic and research activities through the establishment of the Bangladesh Institutes of Health Sciences (BIHS) under Dhaka University in 2008 and later conversion of BIHS into the Bangladesh University of Health Sciences (BUHS) in 2012. From BMRG to BUHS through BIHS, efforts have always been made not to confine the development effort only in the country, but to extend it to the relevant countries particularly in the region. Accordingly, a number of students and researchers from Asian and African countries have earned their postgraduate degrees and training from BMRG-BIRDEM, BIHS and BUHS. The spirit as well as the human resources created by BMRG became the driving forces for creating the new university which is the second to the only one public university and the sole private university in the health sector of Bangladesh. With its multidisciplinary approach involving basic, clinical, paraclinical, engineering and social sciences the University is trying to create broader concept of health in an 'overmedicalized' environment.

PRESENTATION

Figure 1.

Creating a sustainable socially responsible health care delivery system is a challenge particularly for developing countries. This is mostly due to inefficient political organizations, insufficient resources and inefficient managerial organizations.

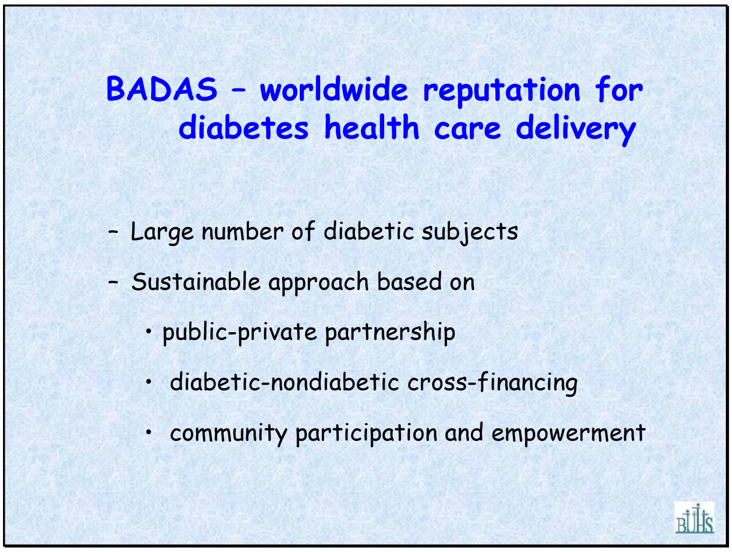


Figure 2. BADAS – worldwide reputation for diabetes health care delivery.

Diabetic Association of Bangladesh or BADAS has earned worldwide reputation by providing comprehensive diabetes care to a large number of diabetic subjects with a sustainable approach based on public-private partnership, diabetic-nondiabetic cross-financing and community participation and empowerment.

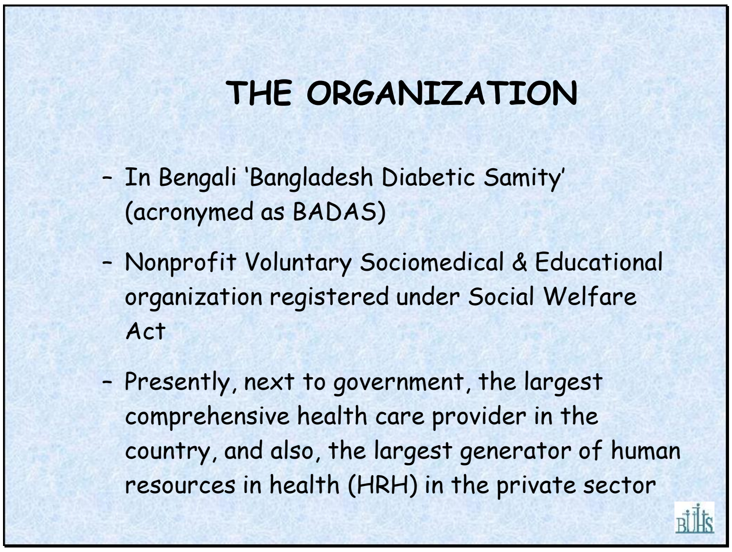


Figure 3. The Organization.

Diabetic Association of Bangladesh or BADAS has earned worldwide reputation by providing comprehensive diabetes care to a large number of diabetic subjects with a sustainable approach based on public-private partnership, diabetic-nondiabetic cross-financing and community participation and empowerment.

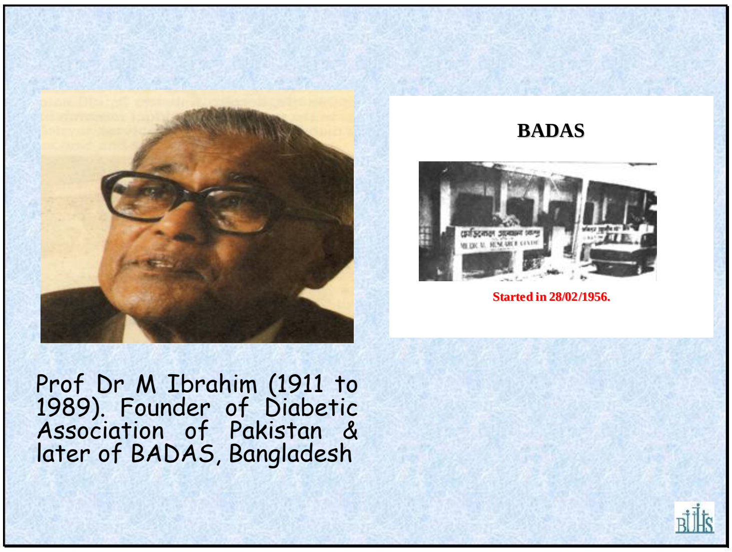


Figure 4.

We would like to pay tribute to the Founder of the Association Prof M Ibrahim who started the journey in 1956 with only 39 patients in a small tin-shade.

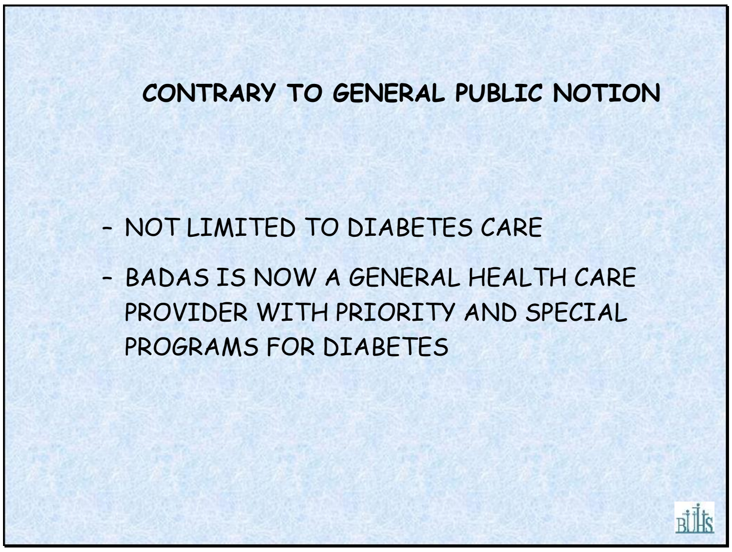


Figure 5. Contrary to General Public Notion.

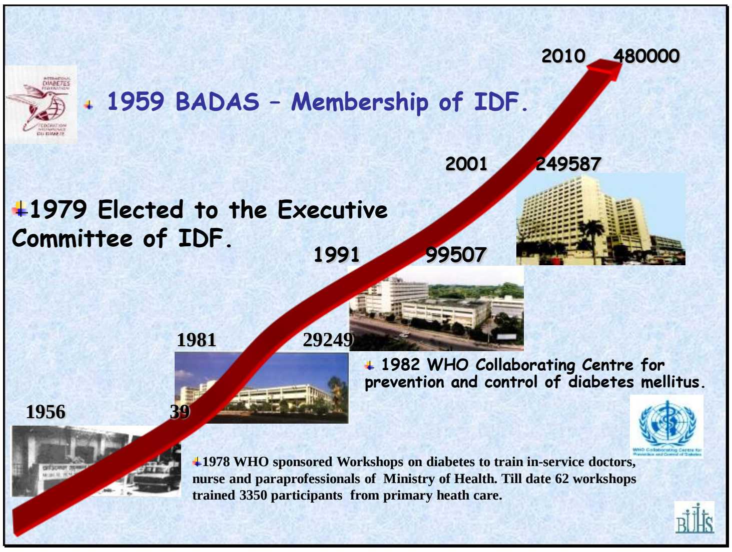


Figure 6. 1959 BADAS – Membership of IDF.

From that small tin shade BADAS created one of the largest diabetes care centre in the world, known as BIRDEM , within 50 yrs.

Figure 7.

BADAS is now the largest health care chain as well as health manpower generating organization in Bangladesh next to the public sector with 90 hospital/health centres. It is now like a corporate which delivers care through a number of Institution/Projects.

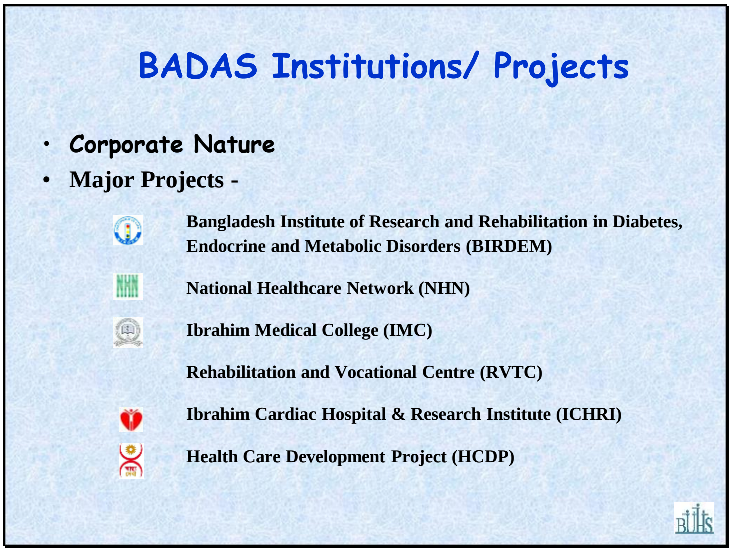


Figure 8. BADAS Institutions/ Projects.

BADAS has organized its activities through a number of institution and projects. The large institution and Projects are…

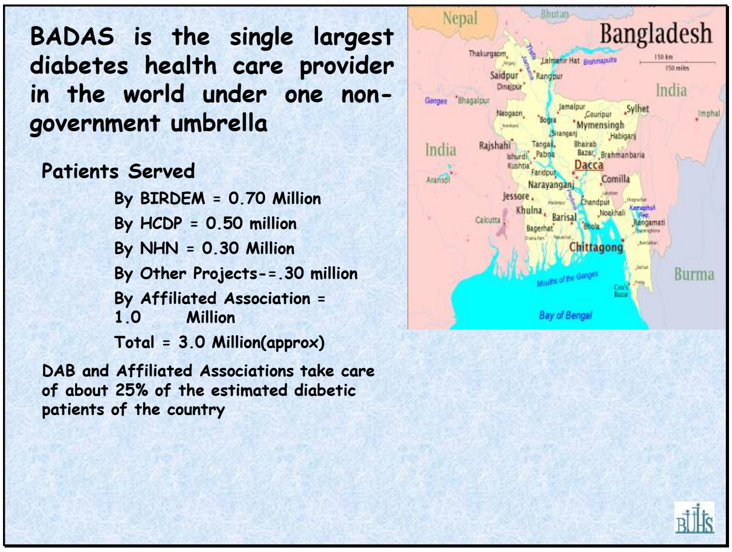


Figure 9.

The hospitals and health centres of BADAS are spread all over the country and currently it provides diabetes care to about 1.51 million diabetic patients and almost equal number of nondiabetic patients.

Figure 10.

Figure 11. BIRDEM Facilities.

Comprehensive Diabetes care

- All level of Clinical care
- Diabetes Education
- Nutritional adv
- Social welfare
- Record keeping
- Evaluation & Monitoring

Figure 12. Comprehensive Diabetes Care.

Figure 13. Comprehensive Diabetes Care.

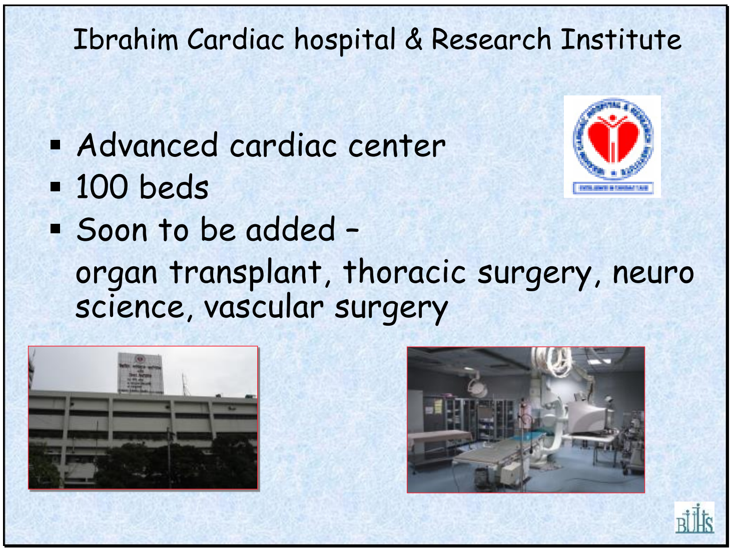


Figure 14. Ibrahim Cardiac Hospital and Research Institute.

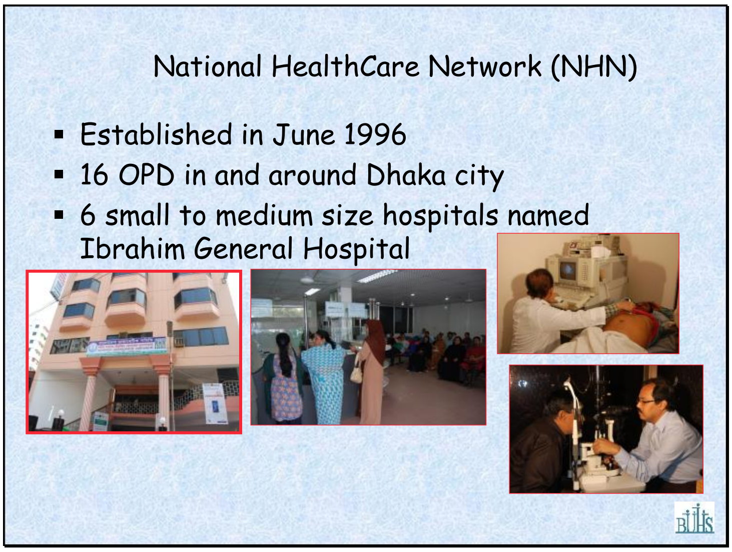


Figure 15. National HealthCare Network (NHN).

Figure 16. National HealthCare Network (NHN).

Figure 17. MPL-Ibrahim General Hospital.

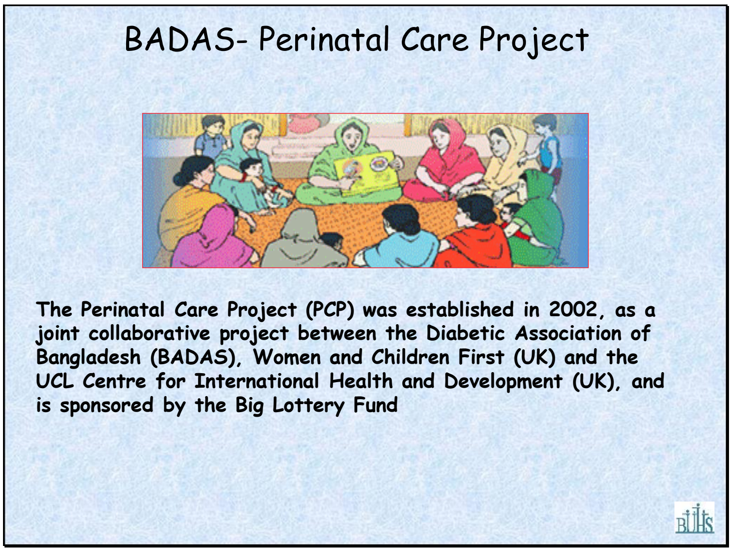


Figure 18. BADAS-Perinatal Care Project.

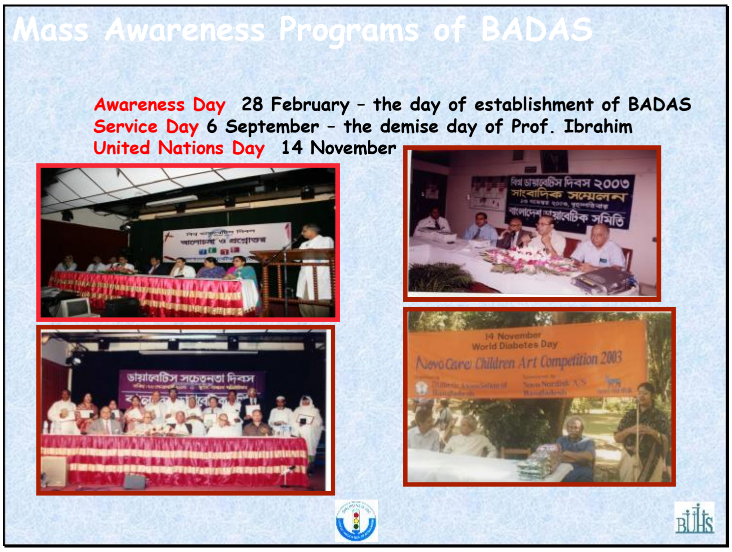


Figure 19. Mass Awareness Programs of BADAS.

Figure 20. Mass Awareness Programs of BADAS.

Figure 21. Mass Awareness Programs of BADAS.

Figure 22. Mass Awareness Programs of BADAS - Child Camp.

Figure 23. Mass Awareness Programs of BADAS – WDD Radio Program.

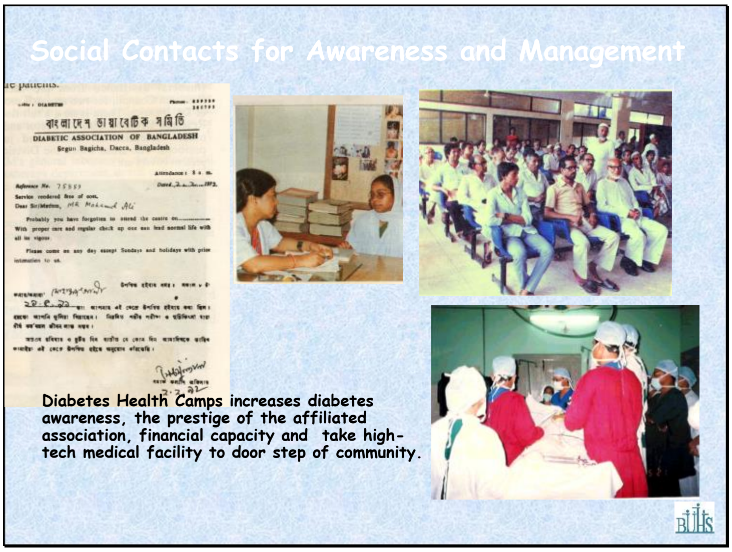


Figure 24. Social Contacts for Awareness and Management.

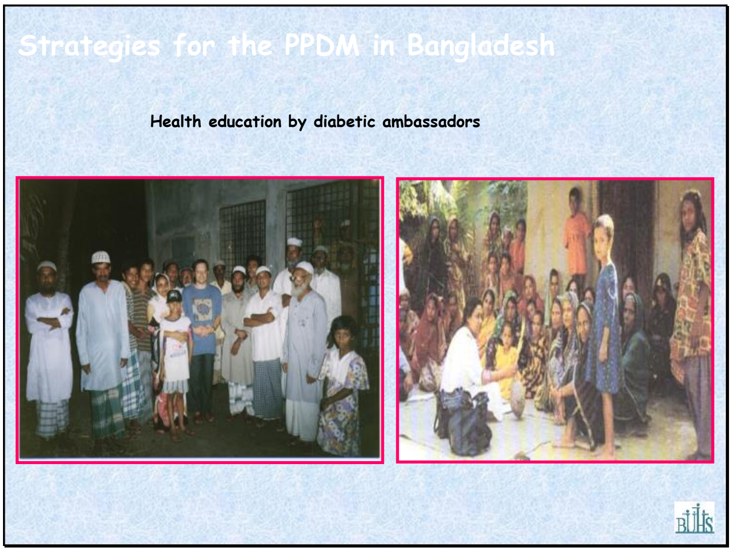


Figure 25. Strategies for the PPDM in Bangladesh: Health education by diabetic ambassadors.

Figure 26. Strategies for the PPDM in Bangladesh: Health education by community leaders.

Figure 27. Strategies for the PPDM in Bangladesh: Health education by folk singers.

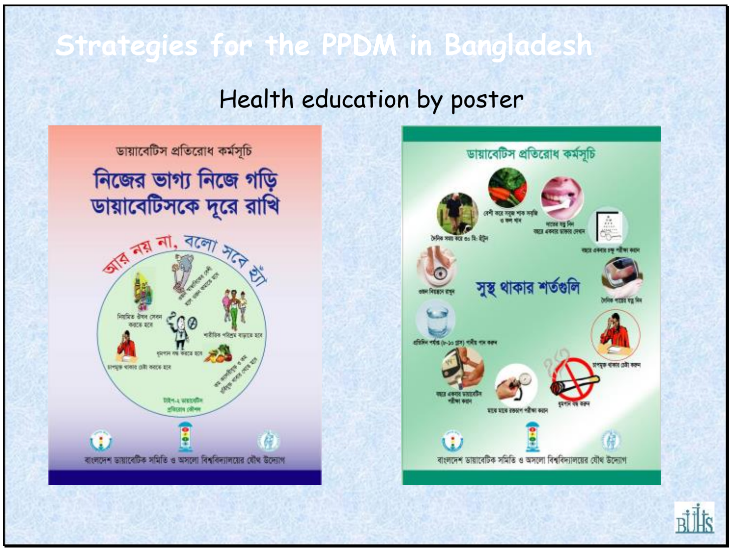


Figure 28. Strategies for the PPDM in Bangladesh: Health education by poster.

Figure 29. Strategies for the PPDM in Bangladesh: Health education by school teachers.

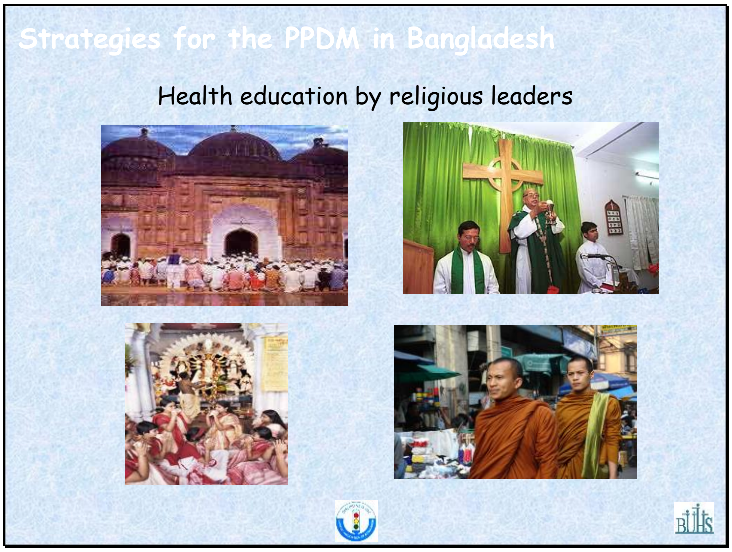


Figure 30. Strategies for the PPDM in Bangladesh: Health education by religious leaders.

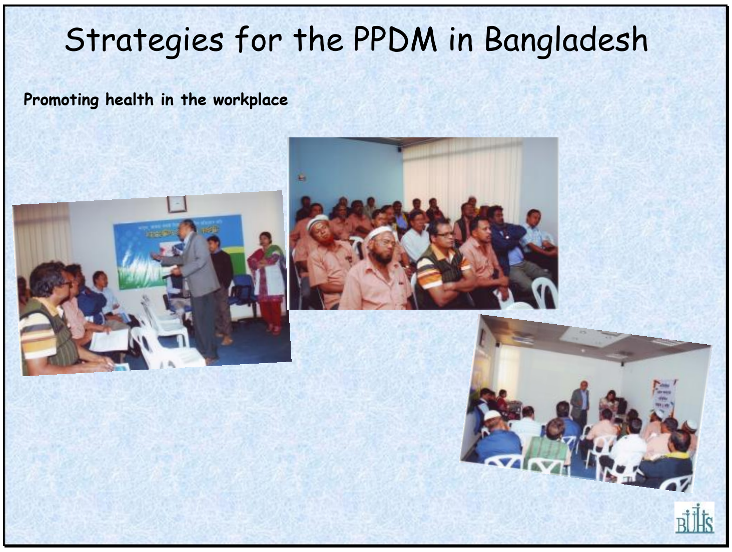


Figure 31. Strategies for the PPDM in Bangladesh: Promoting health in the workplace.

Figure 32. Strategies for the PPDM in Bangladesh: Health education through cinema.

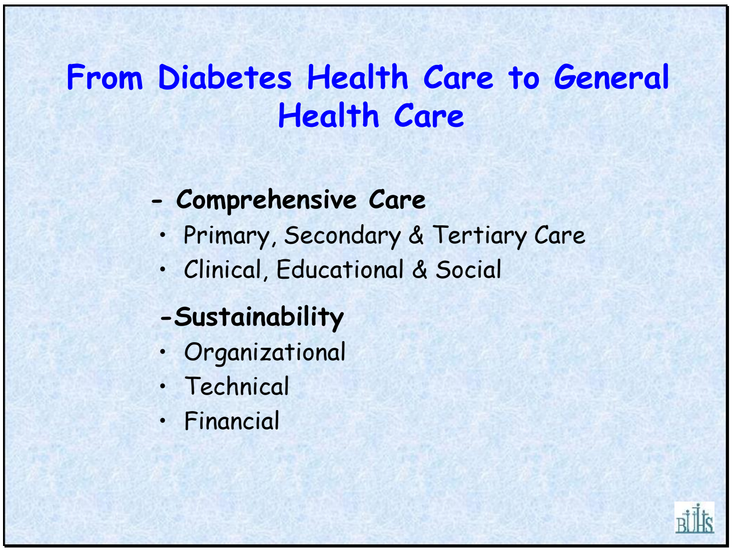


Figure 33. From Diabetes Health Care to General Health Care.

The unique diabetes health care model of BADAS stimulated the idea of developing a general health care model for comprehensive care in a developing country like Bangladesh with organizational, technical and financial sustainability. Comprehensive care means primary, secondary & tertiary as well as clinical, educational & social care.

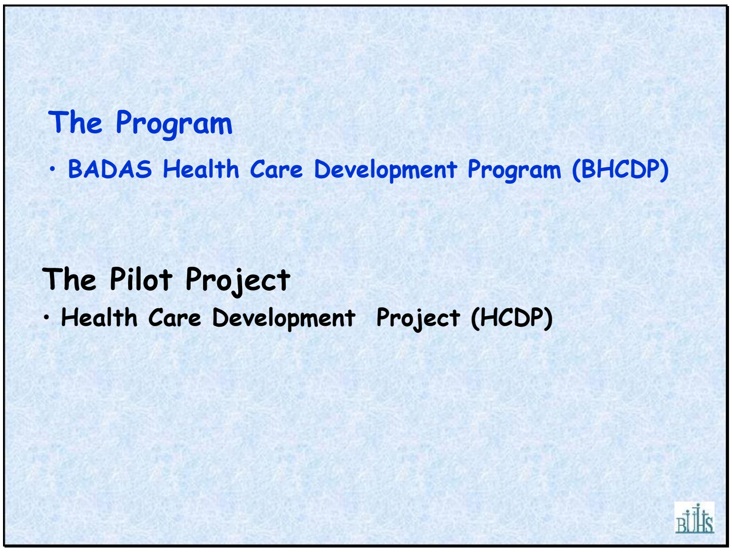


Figure 34. The Program/ Pilot Project.

With this Goal a Program, named as BADAS Health Care Development Program (BHCDP) was designed and it is now being piloted through a Project called Health Care Development Project or HCDP.

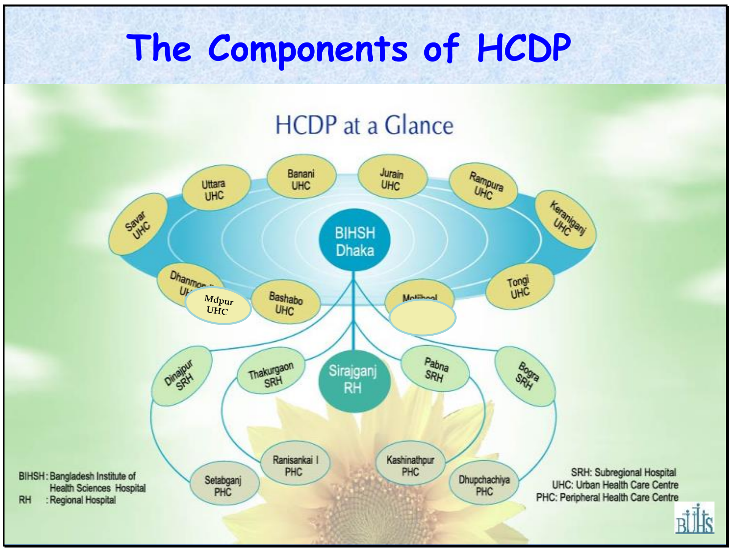


Figure 35. The Components of HCDP.

HCDP has been designed with a 4 Peripheral at sub district level, 10 UHC in an around the Capital of Dhaka city, 4 SRH and 1 RH Hospital at district level and 1 Apex hospital BIHS at Dhaka.

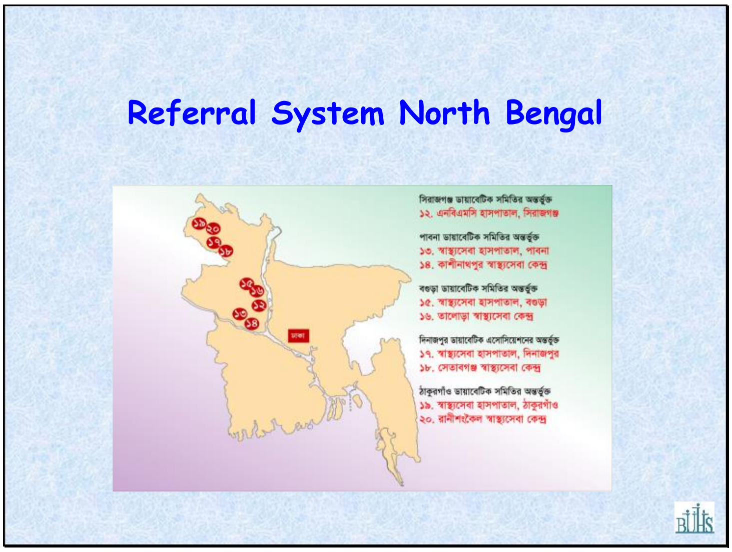


Figure 36. Referral System North Bengal.

These are the locations of Peripheral Health Centre and district level hospital in Northern Bangladesh.

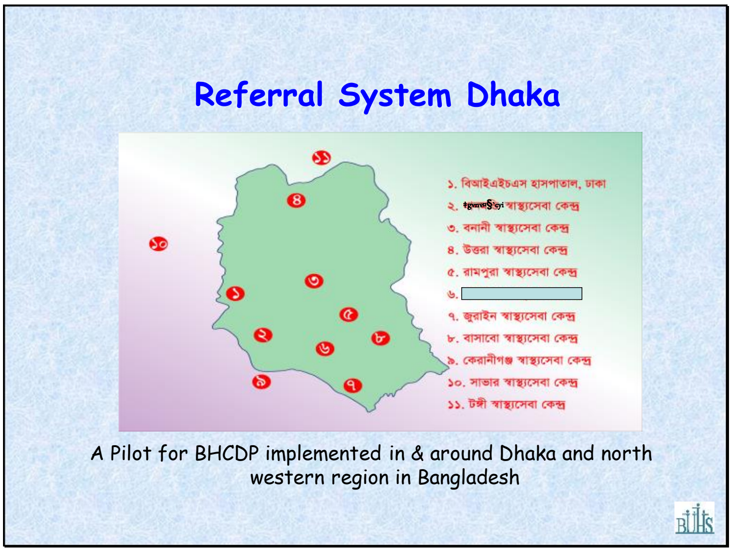
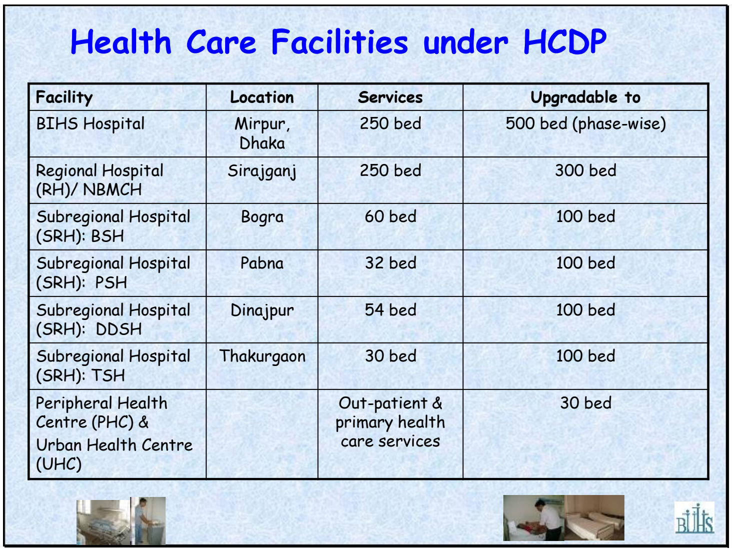


Figure 37. Referral System Dhaka.

These are the locations in and around Dhaka city.



Facility	Location	Services	Upgradable to
BIHS Hospital	Mirpur, Dhaka	250 bed	500 bed (phase-wise)
Regional Hospital (RH)/ NBMCH	Sirajganj	250 bed	300 bed
Subregional Hospital (SRH): BSH	Bogra	60 bed	100 bed
Subregional Hospital (SRH): PSH	Pabna	32 bed	100 bed
Subregional Hospital (SRH): DDSH	Dinajpur	54 bed	100 bed
Subregional Hospital (SRH): TSH	Thakurgaon	30 bed	100 bed
Peripheral Health Centre (PHC) & Urban Health Centre (UHC)		Out-patient & primary health care services	30 bed

Figure 38. Health Care Facilities under HCDP.

Different Categorized Services

- **Primary Care:** Physicians Care, Counseling, Nutrition and Health Education, Dentistry and Dental Services, Eye Care Services, Delivery, Curative care & Pharmacy
- **Secondary Care:** Laboratory Services, X-Ray, USG, Color-Doppler, ECG, ECHO, Endoscopy
- **Tertiary Care:** Surgery, Ambulatory Service, MRI, CT Scan

Figure 39. Different Categorized Services.

Services presently provided in various components of HCDP

PHCs	a) OPD Consultancy by general physicians and specialists in internal medicine, diabetes & endocrinology, gyne & obs, ophthalmology and cardiology
	b) Diagnostic services using advanced analyzers in the laboratory, X-ray, ultrasonography, autoreftractometre and ecg. Labor and delivery services on process
	c) Pharmacy
UHCs	a) OPD Consultancy by general physicians and specialists
	b) Diagnostic services using advanced analyzers in BIHS laboratory, X-ray, ultrasonography, 4D color doppler, echocardiography, autorefractometre, ett and ecg
	c) At Savar: IPD Services (General surgery, Obs & Gyne, Internal Medicine, Endocrinology, Gastroenterology etc)
	c) Pharmacy


Figure 40. Services presently provided in various components of HCDP.

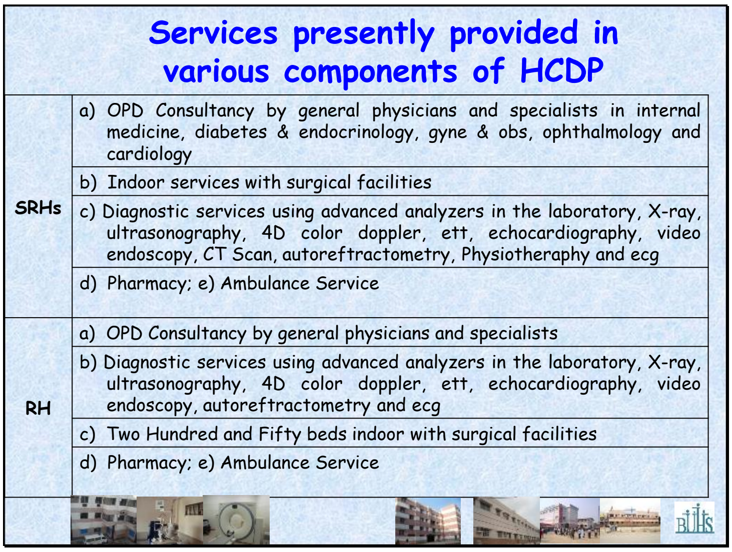


Figure 41. Services presently provided in various components of HCDP.

Figure 42. Services presently provided in various components of HCDP.

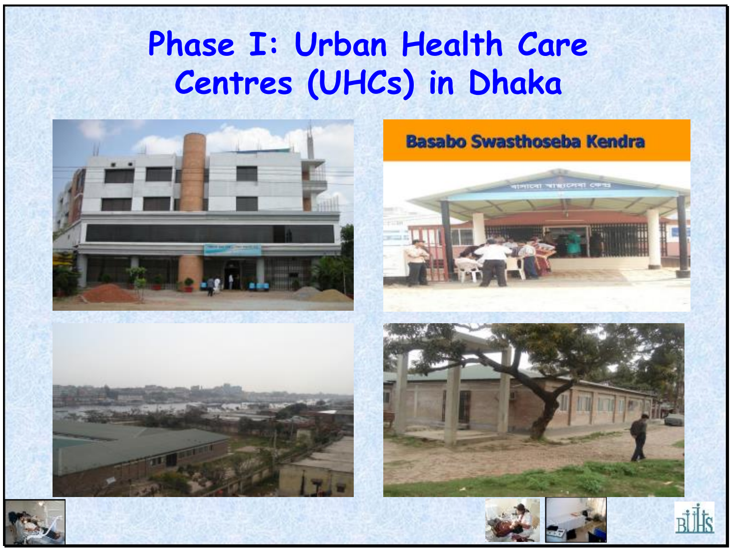


Figure 43. Phase I: Urban Health Care Centres (UHCs) in Dhaka.

Figure 44. Urban Health Centres – Dhaka.

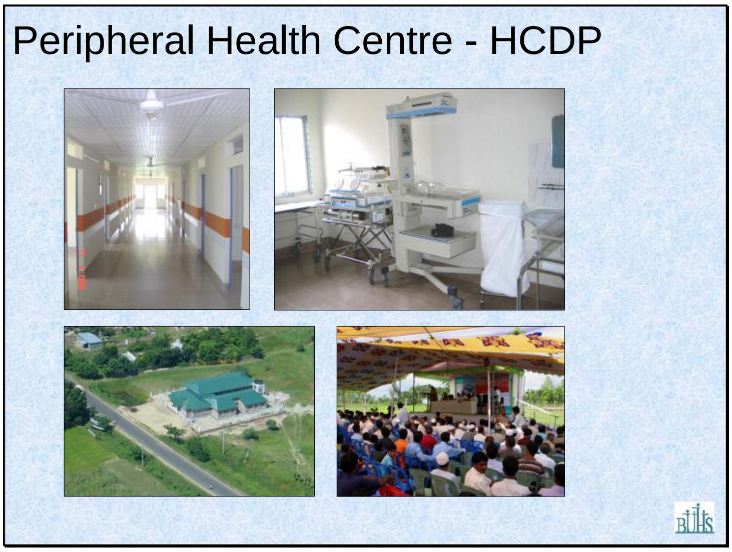


Figure 45. Peripheral Health Centre – HCDP.

Figure 46. Sub regional Hospitals (SRHs) in Northern Bangladesh.

Figure 47. Phase II: SRH Dinajpur.

Figure 48. Phase II: SRH Bogra.

Figure 49. Phase II: SRH Pabna.

Figure 50. Phase III: Regional Hospital (RH) Sirajganj.

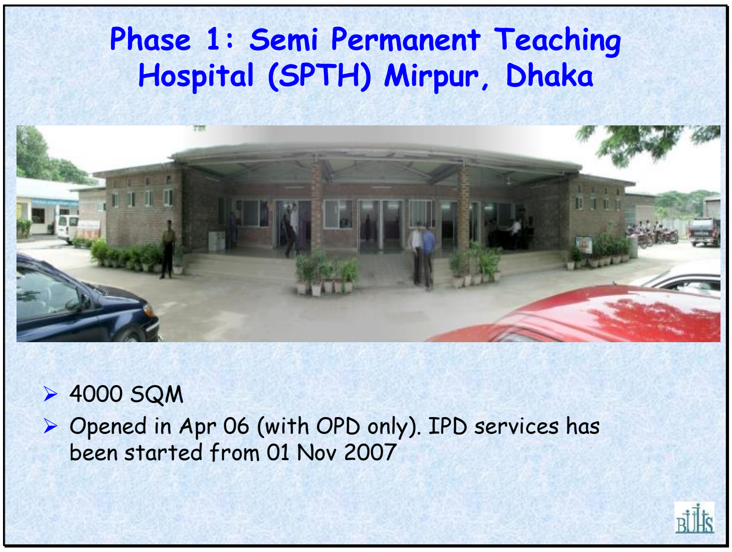


Figure 51. Phase I: Semi Permanent Teaching Hospital (SPTH) Mirpur, Dhaka.

Figure 52. Phase III: BIHS Hospital (under construction).

Figure 53. BIHS Hospital (under construction).

Figure 54. BIHS Hospital (under construction).

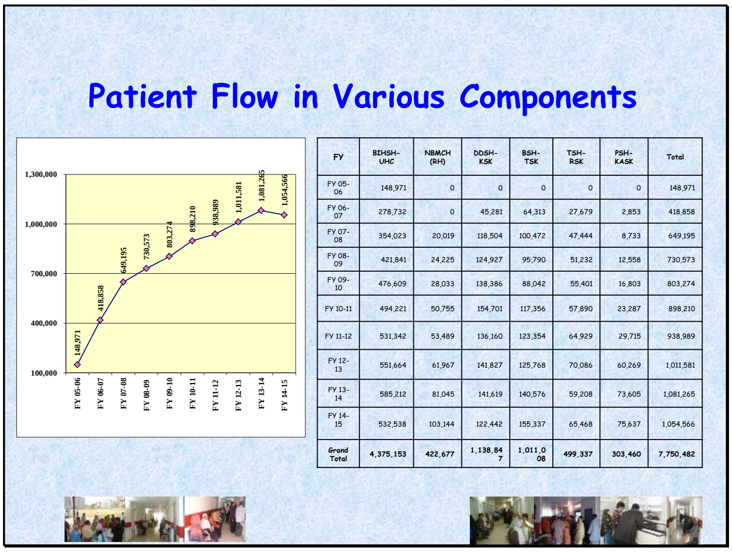
Figure 55. BIHS Hospital (under contruction).

Sources of Fund for Implementation

Sl No	Sources	Amount in Mill Euro
1	ORET Grant	19.30
2	Bank Loan	20.04
3	Internal Source	18.76
Total		**58.10**

Figure 56. Sources of Fund for Implementation.

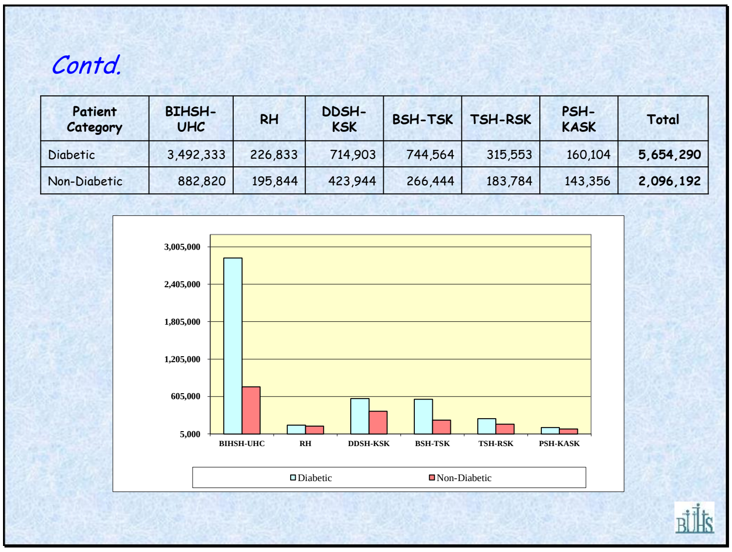
The total implementation cost of the Project is about 58.0 million Euro of which about 33% was supported by the Oret Grant of the Govt of Netherlands.



FY	BIHSH-UHC	NBMCH (RH)	DDSH-KSK	BSH-TSK	TSH-RSK	PSH-KASK	Total
FY 05-06	148,971	0	0	0	0	0	148,971
FY 06-07	278,732	0	45,281	64,313	27,679	2,853	418,858
FY 07-08	354,023	20,019	118,504	100,472	47,444	8,733	649,195
FY 08-09	421,841	24,225	124,927	95,790	51,232	12,558	730,573
FY 09-10	476,609	28,033	138,386	88,042	55,401	16,803	803,274
FY 10-11	494,221	50,755	154,701	117,356	57,890	23,287	898,210
FY 11-12	531,342	53,489	136,160	123,354	64,929	29,715	938,989
FY 12-13	551,664	61,967	141,827	125,768	70,086	60,269	1,011,581
FY 13-14	585,212	81,045	141,619	140,576	59,208	73,605	1,081,265
FY 14-15	532,538	103,144	122,442	155,337	65,468	75,637	1,054,566
Grand Total	**4,375,153**	**422,677**	**1,138,847**	**1,011,008**	**499,337**	**303,460**	**7,750,482**

Figure 57. Patient Flow in Various Components.

The implementation started from mid 2004 and it will finish by 2015. However, limited operation started from some Dhaka centres in October 2005 and it expended and crystallized in a phasic manner in the subsequent years.



Patient Category	BIHSH-UHC	RH	DDSH-KSK	BSH-TSK	TSH-RSK	PSH-KASK	Total
Diabetic	3,492,333	226,833	714,903	744,564	315,553	160,104	**5,654,290**
Non-Diabetic	882,820	195,844	423,944	266,444	183,784	143,356	**2,096,192**

Figure 58. Patient Flow in Various components (contd).

Over these years the number of beneficiaries steadily increased with a cumulated patient visit 7.75 million by Jan 2015. Out of these patients about 44% were from outside Dhaka (i.e. northern Bangladesh). About 73% of the patients visiting HCDP facilities are diabetic and 46% are females.

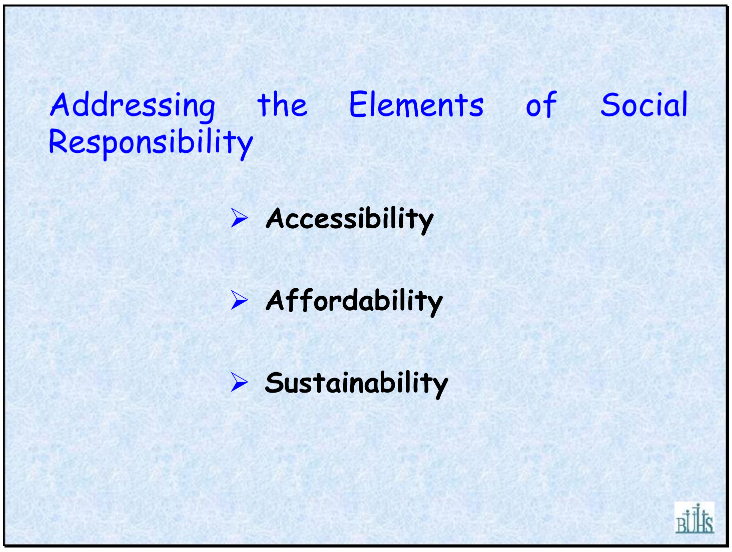


Figure 59. Addressing the Elements of Social Responsibility.

Let us now look at the elements of social responsibility in health care and how much this has been met in the Project. The elements are: Accessibility, Affordability and Sustainability

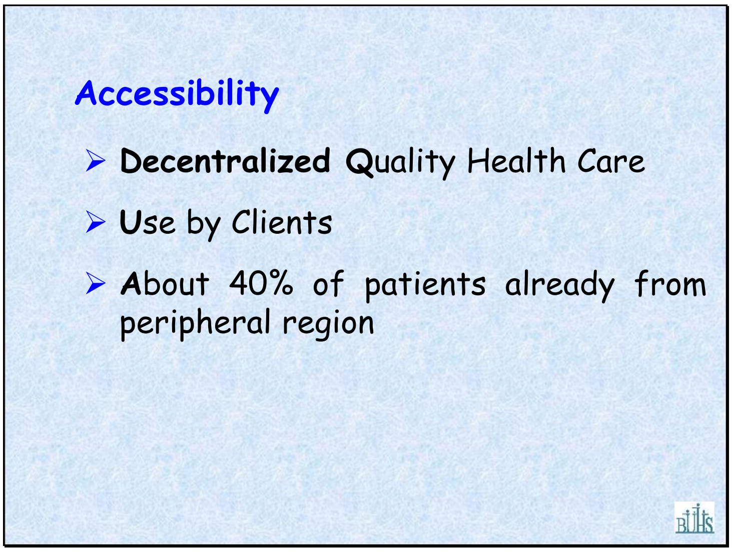
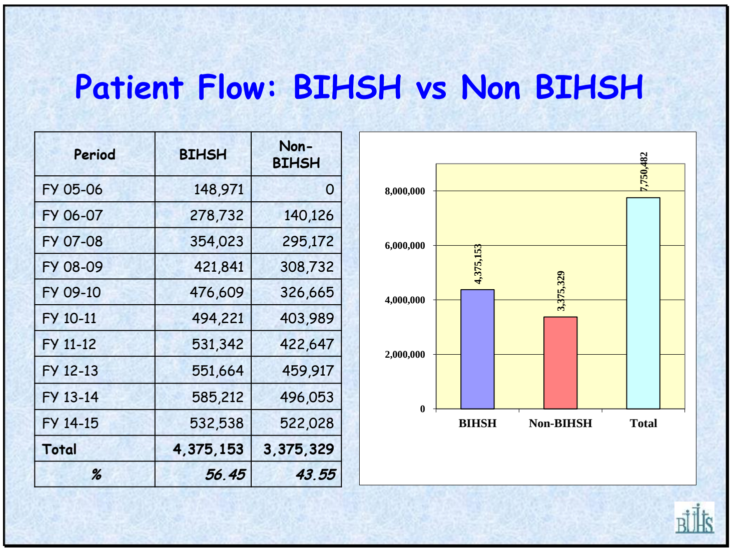


Figure 60. Accessibility.

First, the accessibility. The Project has been able to take quality health care up to the Upazilla and Union levels. The infrastructure for telemedicine has also been created which is visualized to increasing the accessibility to excellent care particularly in remote areas.



Period	BIHSH	Non-BIHSH
FY 05-06	148,971	0
FY 06-07	278,732	140,126
FY 07-08	354,023	295,172
FY 08-09	421,841	308,732
FY 09-10	476,609	326,665
FY 10-11	494,221	403,989
FY 11-12	531,342	422,647
FY 12-13	551,664	459,917
FY 13-14	585,212	496,053
FY 14-15	532,538	522,028
Total	4,375,153	3,375,329
%	56.45	43.55

Figure 61. Patient Flow: BIHSH vs Non BIHSH.

About 44% of subjects were from the rural region. More important, the clients are using the facilities although a lot make remains to be done in near future.

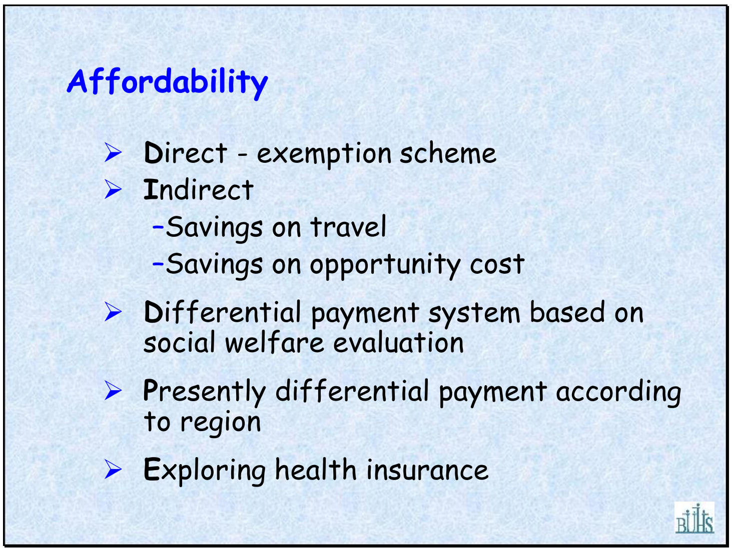


Figure 62. Affordability.

The Project has increased affordability of health care directly and indirectly. The direct contribution is through an exemption scheme based on perceived socioeconomic level of the locality and clients as evaluated by the social welfare unit of each HCDP facility. The indirect contribution is made by the savings on the travel and opportunity cost (for clients as well as attendants) creative through increased accessibility.

Differential service rate in various components

Test	BIHSH	RH	DDSH	BSH	TSH	PSH
Glucose, Fasting	130	80	80	90	60	60
Creatinine	250	300	150	150	120	150
HbA1C	600	450	400	400	400	250
Lipid Profile	1030	800	500	500	500	700
CBC	385	350	200	250	100	170
ALT (SGPT)	265	300	150	150	120	110
AST (SGOT)	265	300	150	150	120	110
Bilirubin (Total)	250	200	120	150	110	110
Whole Abdomen (USG)	900	500	400	400	300	350

Figure 63. Differential service rate in various components.

Social Welfare Service

Financial Year	Total (in Thous.Tk)
FY 05-06	14,782
FY 06-07	52,063
FY 07-08	71,895
FY 08-09	74,007
FY 09-10	78,512
FY 10-11	88,382
FY 11-12	100,678
FY 12-13	103,330
FY 13-14	99,353
FY 14-15	96,830

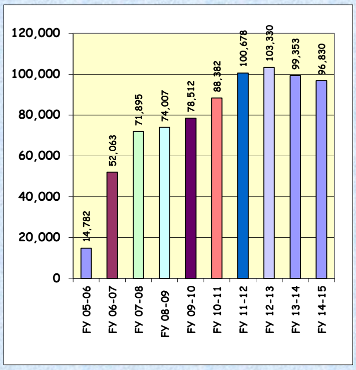


Figure 64. Social Welfare Service.

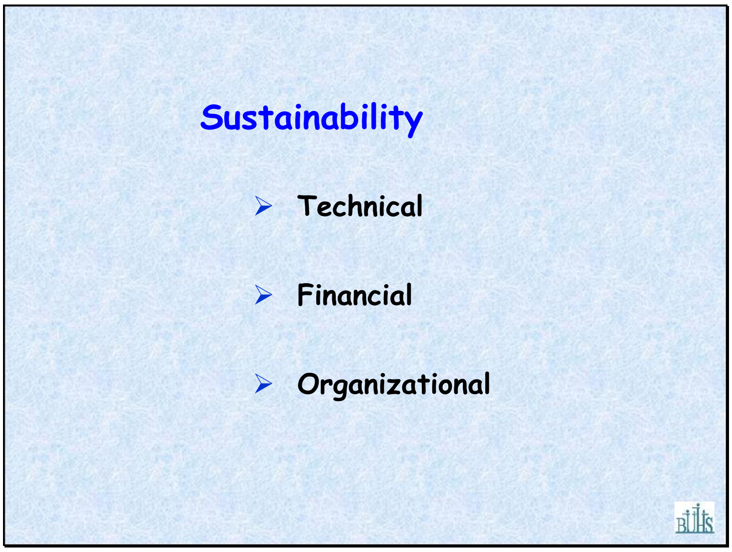


Figure 65. Sustainability.

On the sustainability issue we are concentrating on three aspects: Technical, Financial and Organizational.

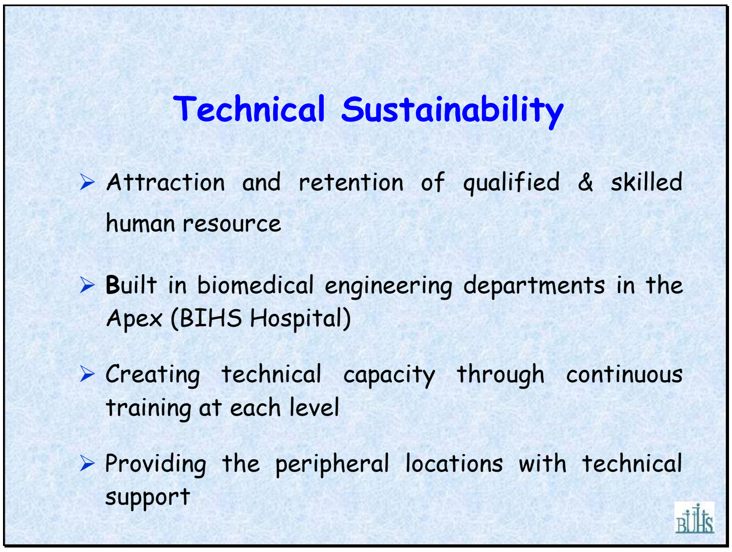


Figure 66. Technical Sustainability.

The technical sustainability was planned to be ensured through a built in biomedical engineering departments in the Apex (BIHS Hospital) of the Project which was also responsible for supporting the peripheral locations with some technical manpower at each level. The plan seems to be a workable one.

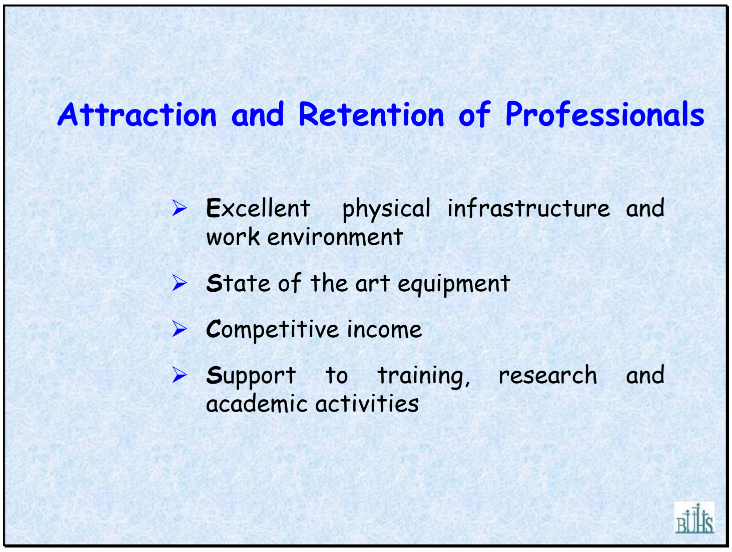
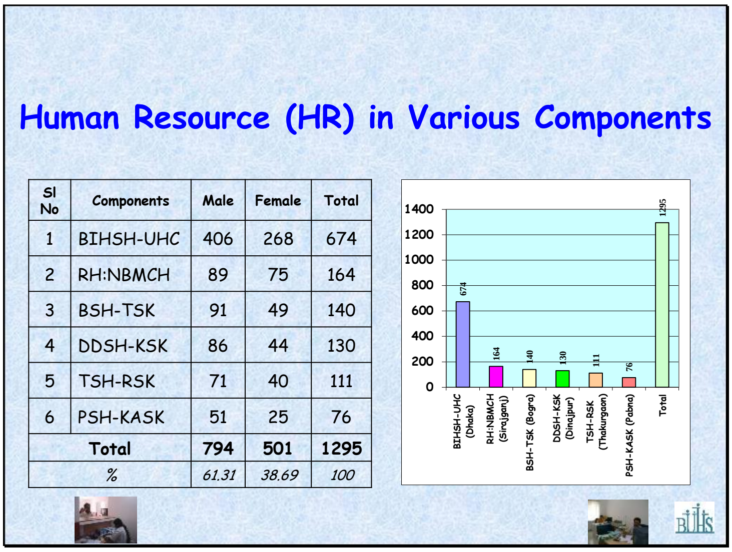


Figure 67. Attraction and Retention of Professionals.



Sl No	Components	Male	Female	Total
1	BIHSH-UHC	406	268	674
2	RH:NBMCH	89	75	164
3	BSH-TSK	91	49	140
4	DDSH-KSK	86	44	130
5	TSH-RSK	71	40	111
6	PSH-KASK	51	25	76
Total		794	501	1295
%		61.31	38.69	100

Figure 68. Human Resource (HR) in Various Components.

About 1295 employees have now been recruited in the Project of which about 48% are in the Periphery. of them about 50.42% are skilled professionals.

Category-wise HR in Various Components

Sl No	Components	Physician	Nurse	Technician	Officer	Other Staff	Grand Total
1	BIHSH-UHC	141	65	135	144	189	674
2	RH (NBMCH)	29	22	46	10	57	164
3	BSH-TSK	17	13	41	14	55	140
4	DDSH-KSK	13	19	40	12	46	130
5	TSH-RSK	8	9	22	17	55	111
6	PSH-KASK	9	7	17	12	31	76
Total		**217**	**135**	**301**	**209**	**433**	**1295**
%		***16.76***	***10.42***	***23.24***	***16.14***	***33.44***	***100.00***

Figure 69. Category-wise HR in Various Components.

Financial Sustainability

- Still a big challenge
- Seems to be sustainable without debt servicing

Figure 70. Financial Sustainability.

Financial sustainability is still a big challenge for HCDP. Mainly due to debt servicing but it appears that it is perfectly sustainable financially if it can be implemented without any bank loan.

Year-wise Revenue Collection & Expenditure (in Hundred Thousand Tk)

Particulars	FY 05-06 to FY08-09	FY 09-10 to FY 11-12	FY 12-13	FY 13-14	FY 14-15	Total
Revenue Collection	7,637.81	11,987.08	4,055.11	5,242.92	5,502.05	**34,424.97**
Operating Expenditure	9,083.13	12,082.36	3,945.27	4,843.75	5,279.20	**35,233.71**
Operating Balance	***(1,445.32)***	***(95.28)***	***109.84***	***399.16***	***222.85***	***(808.74)***

Figure71. Year-wise Revenue Collection & Expenditure (in Hundred Thousand Tk).

Component-wise Financial Position

Sl No	Particulars	BIHSH Component	Non-BIHSH Component	Total
1	Revenue Collection	2,504,341,835	938,154,890	3,442,496,725
2	Operating Expenditure	2,483,643,519	1,039,727,572	3,523,371,090
3	**Operating Balance**	**20,698,316**	**(101,572,682)**	**(80,874,366)**
4	Debt Servicing	446,007,649	230,840,140	676,847,790
5	***Net Balance/(Deficit)***	***(425,309,333)***	***(332,412,822)***	***(757,722,155)***
%	*Collection vs Expenditure (without Debt)*	*100.83*	*90.23*	*97.70*
	Collection vs Expenditure (with Debt)	*85.48*	*73.84*	*81.96*

Figure 72. Component-wise Financial Position.

Figure 73. Organizational Sustainability.

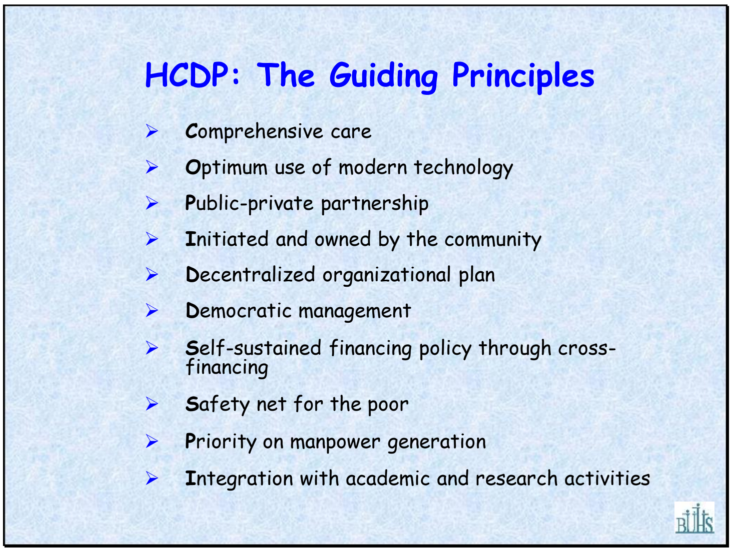


Figure 74. HCDP: The Guiding Principles.

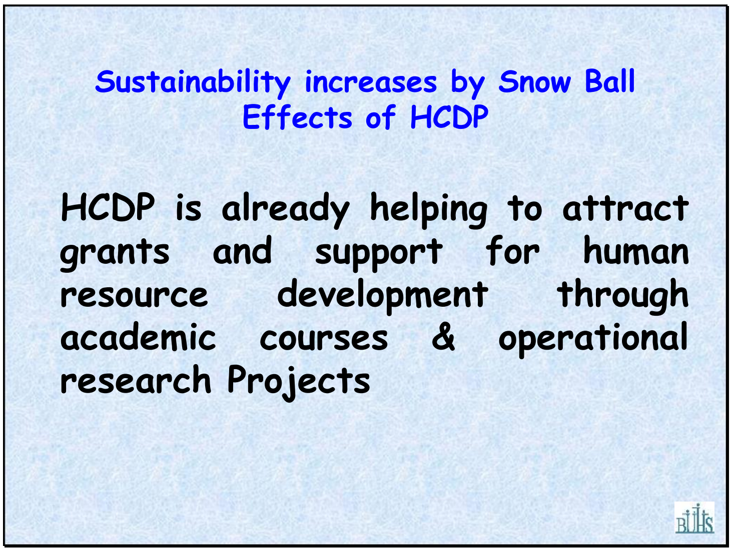


Figure 75. Sustainability increases by Snow Ball Effect of HCDP.

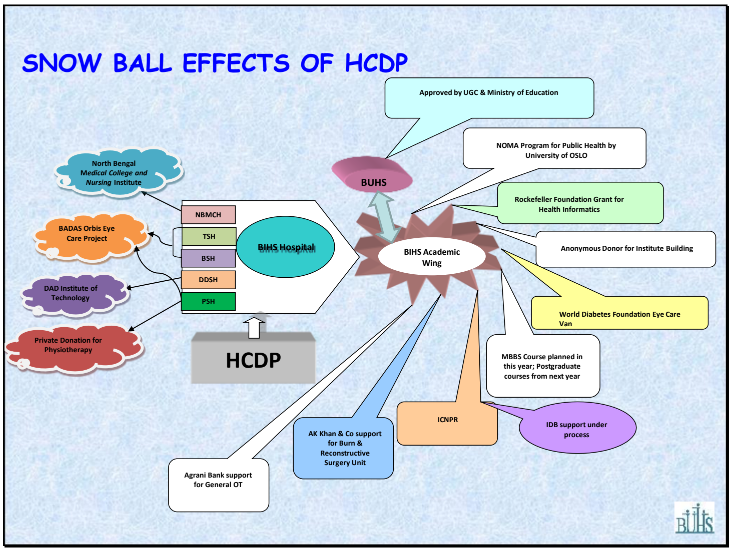


Figure 76. Snow Ball Effect of HCDP.

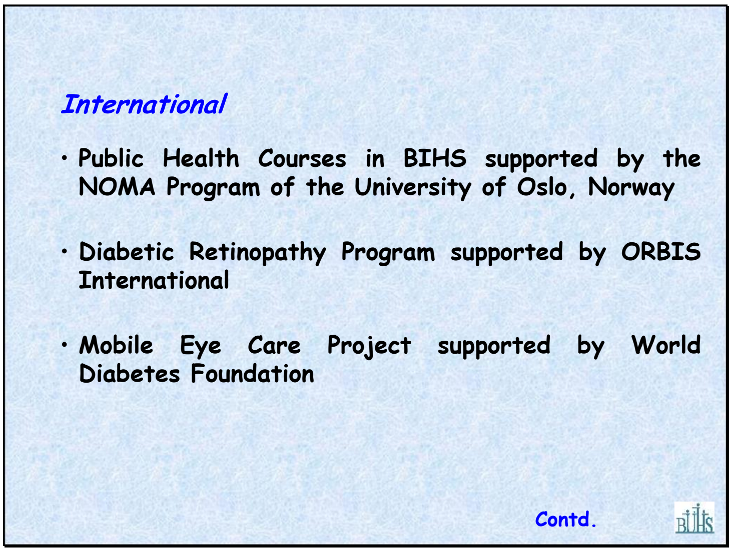


Figure 77. International.

Snow Ball Effects of HCDP is greatly contributing to increased sustainability.

Figure 78.

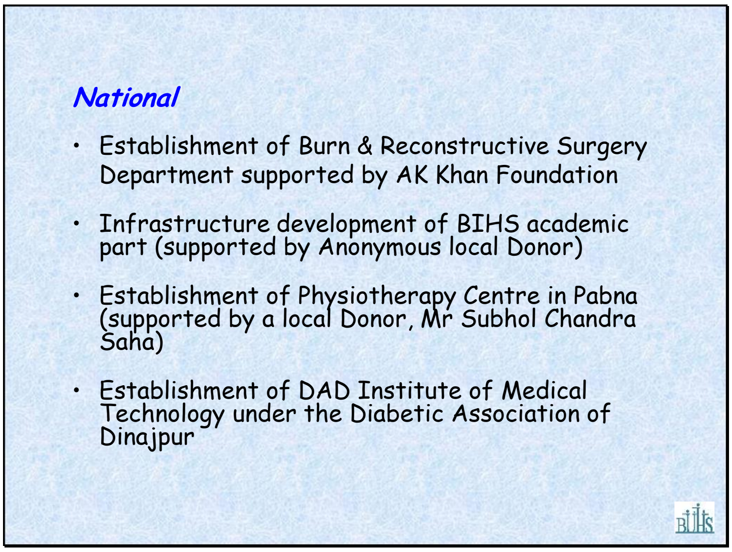
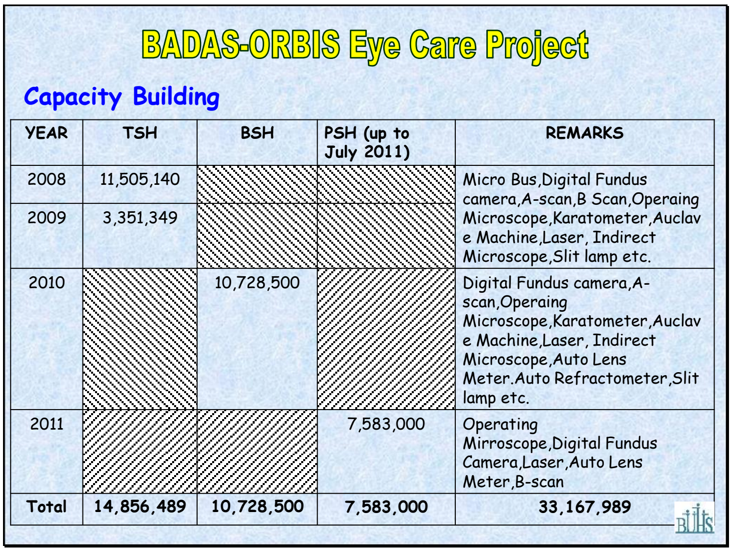


Figure 79. National.



BADAS-ORBIS Eye Care Project

Capacity Building

YEAR	TSH	BSH	PSH (up to July 2011)	REMARKS
2008	11,505,140			Micro Bus,Digital Fundus camera,A-scan,B Scan,Operaing Microscope,Karatometer,Auclave Machine,Laser, Indirect Microscope,Slit lamp etc.
2009	3,351,349			
2010		10,728,500		Digital Fundus camera,A-scan,Operaing Microscope,Karatometer,Auclave Machine,Laser, Indirect Microscope,Auto Lens Meter.Auto Refractometer,Slit lamp etc.
2011			7,583,000	Operating Mirroscope,Digital Fundus Camera,Laser,Auto Lens Meter,B-scan
Total	14,856,489	10,728,500	7,583,000	33,167,989

Figure 80. BADAS-ORBIS Eye Care Project: Capacity Building.

Patient Examination and Treatment

Year	2008	2009	2010	2011 up to July 2011	Total
Total Patient Examined	2,640	8,492	14,350	12,268	37,750

Figure 81. Patient Examination and Treatment.

Ophthalmological Surgery during Jan 2011-July 2011

Cataract	LASER Patient	LASER Session	DCR	Pterygium	Others	Total
1701	189	240	135	75	51	2391

Figure 82. Ophthalmological Surgery during Jan 2011-July 2011.

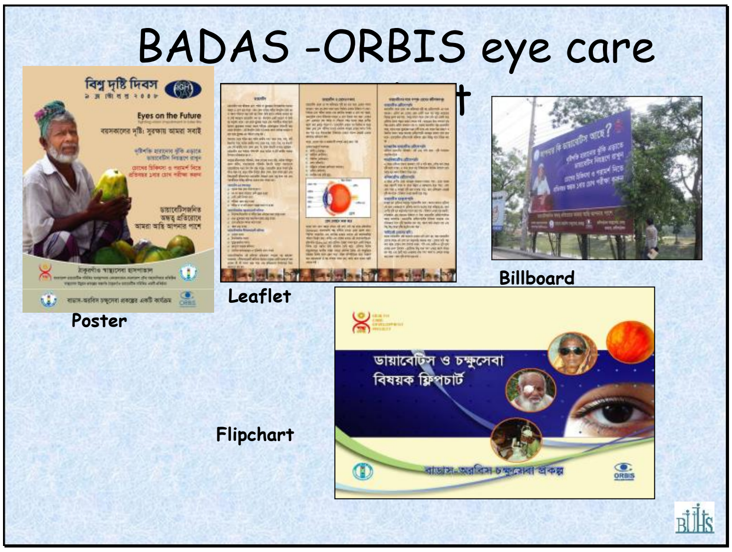


Figure 83. BADAS – ORBIS Eye Care.

Figure 84. BCC Activities.

Human Resource Development

Year	Doctors	Nurse	JTA	Others
2008	1. Refrashers training on Clinical Ophthalmology 2. Refractionist Asst Training	1. Refrashers training on Clinical Ophthalmology 2. OT Asst Training	1. Paramedics Asst Training 2. Spectacle Dispensing	1. India Visit, 2. Community Outreach & Social Marketing of Eye Care Service
2009	Short term fellowship on Vitreo-Retina at LVPEI, Long term on fellowship on Vitreo-Retina 2. Training on SICS at Islamia Eye Hospital 3. HBP 4. Flying Eye Hospital 5.	1. Operation Theater Management Course 2. OT Management 3. Refraction Techniques	1. Short term training on Optical Dispensing	1. training programme to understand Aravind initiatives in Diabetic Retinopathy Project, stuff structure and capacity building for running project 2. Community Outreach and Social Marketing of Eye Care Service 3. Out Reach Camp
2010	1. Long Term Fellowship on Vitreo-Retina 2. Lasers in Diabetic Retinopathy Management" at Lions Arvind Institute of Community Ophthalmology		1. FFA, CEP 2. Spectical Despencing Training 3. Training of DECP	1.Management Training for Eye Care Programme Managers,LAICO, Aravind Eye Hospital, Madurai
2011	1. Long Term Fellowship on Vitreo-Retina	1. OT Management		

BIHS

Figure 85. Human Resource Development.

Mobile Eye Care Project (MECP)

Supported by WDF

BIHS

Figure 86. Mobile Eye Care Project (MECP).

Figure 87. DR Camp & Services.

Ophthalmological Diagnosis/ Treatment Surgery during Dec 2012-August 2015

Particulars	Qty
Diabetes patients screened for DR	42,966
Visits made to fixed diabetes centres by mobile buses	78
Diabetic Patients have received diagnostic and laser therapy in Mobile Buses	8,645
Diabetic patients have undergone laser therapy or surgery	447

Figure 88. Ophthalmological Diagnosis/ Treatment Surgery during Dec 2012-August 2015.

Training

Particulars	Qty
Training on Laser in Diabetic Retinopathy Management	1 Dr at Aravind Eye Hospital, India
Paramedics Asst. Training	22 Paramedics, 29 Technicians and 2 Fundus Photographers
Hands on Training provided	26 Doctors

Figure 89. Training.

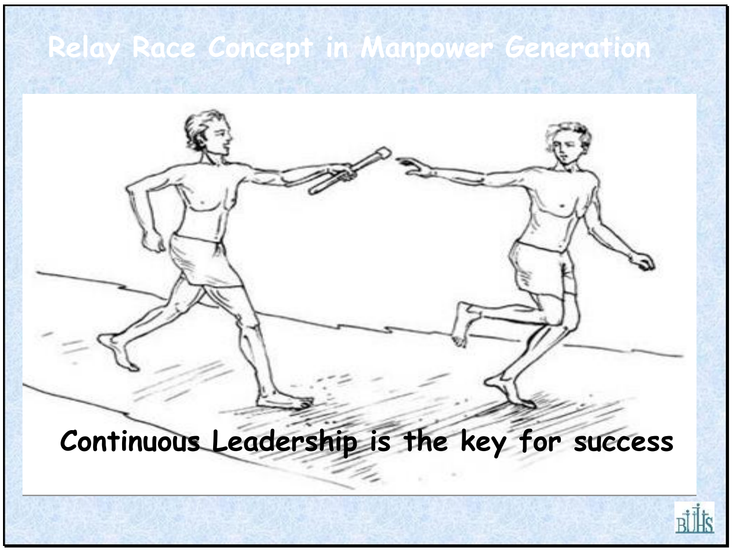


Figure 90. Relay Race Concept in Manpower Generation.

Figure 91. Manpower Development Initiatives of DAB.

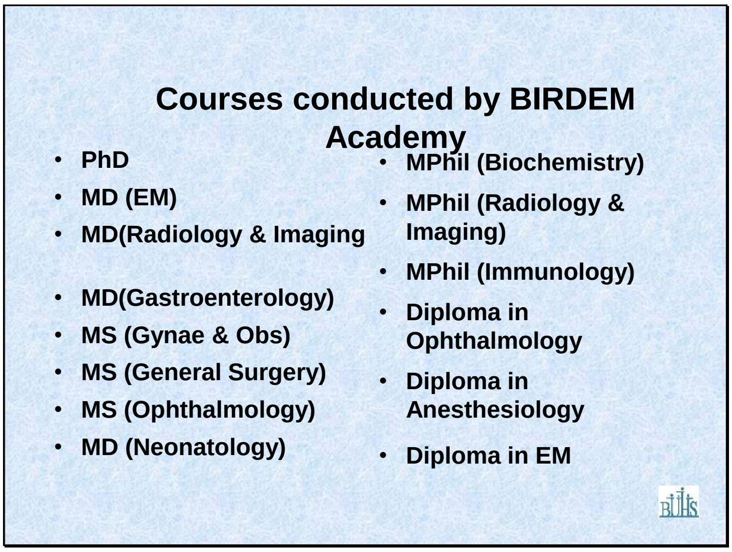


Figure 92. Courses Conducted by BIRDEM Academy.

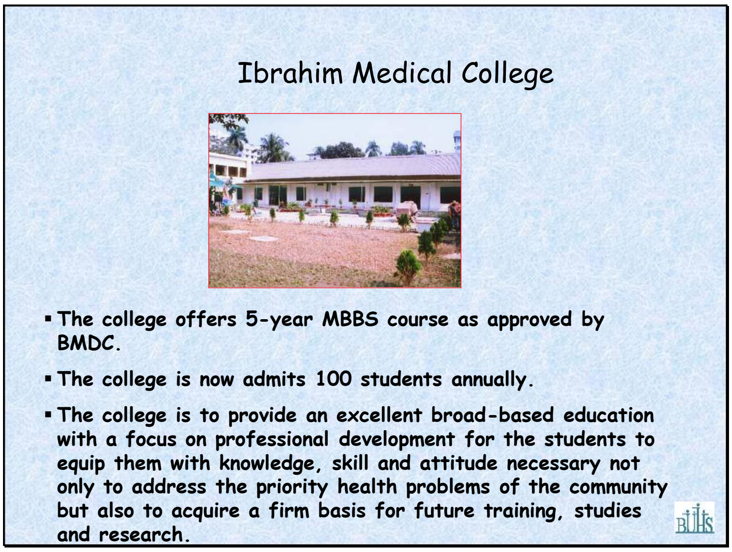


Figure 93. Ibrahim Medical College.

Figure 94. Manpower Development in Affiliated Associations.

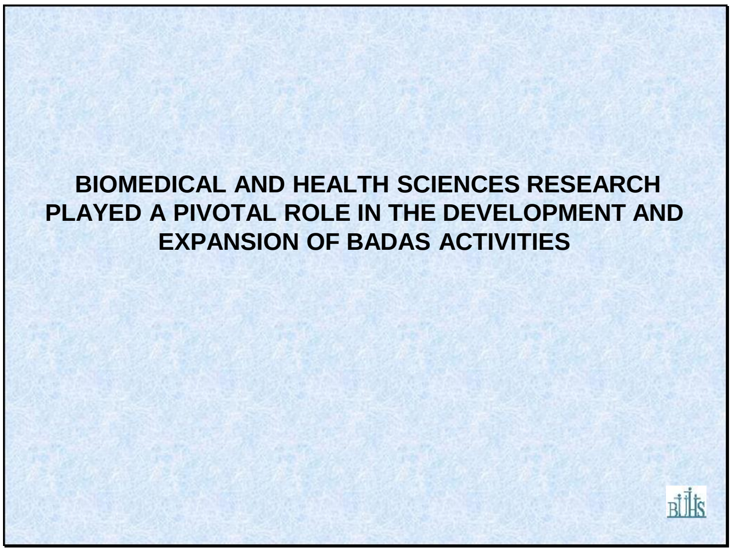


Figure 95.

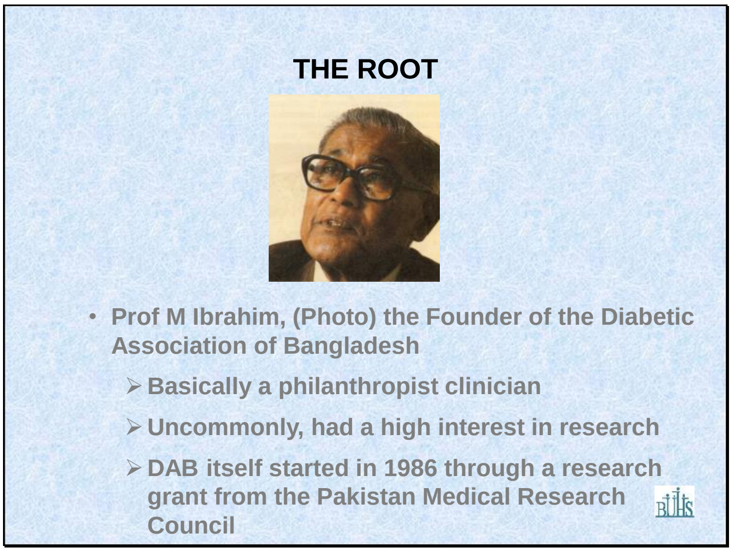


Figure 96. The Root.

INITIATION OF RESEARCH AT BIRDEM

- Research integrated in the name and design of BIRDEM
- A separate Research Division with central air-cooling and some other facilities created
- Capacity almost unutilized due to lack of appropriate human resources and leadership

Figure 97. Initiation of Research at BIRDEM.

Figure 98.

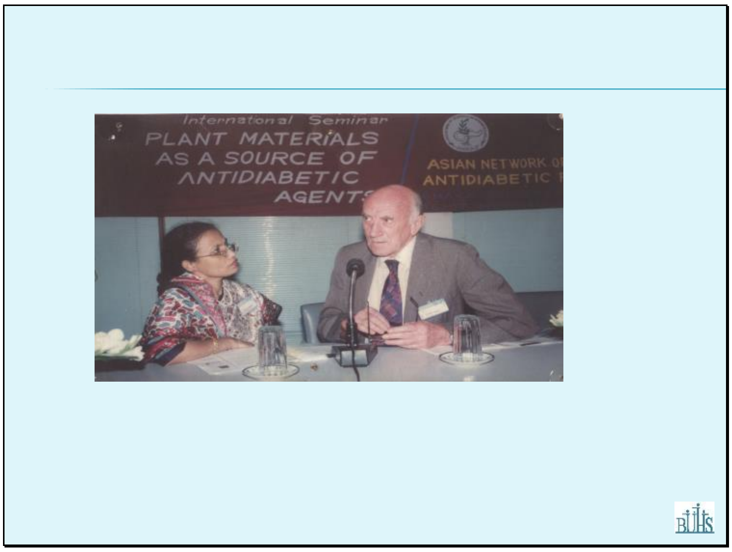


Figure 99.

STUDENTS (UNTIL 2003)

PhD

- Male :11
- Female :15

MD/MS/Mphil/MSc

- Male :48
- Female :97

Figure 100. Students (until 2003).

Figure 101. Publications and Conference Reports (until 2003).

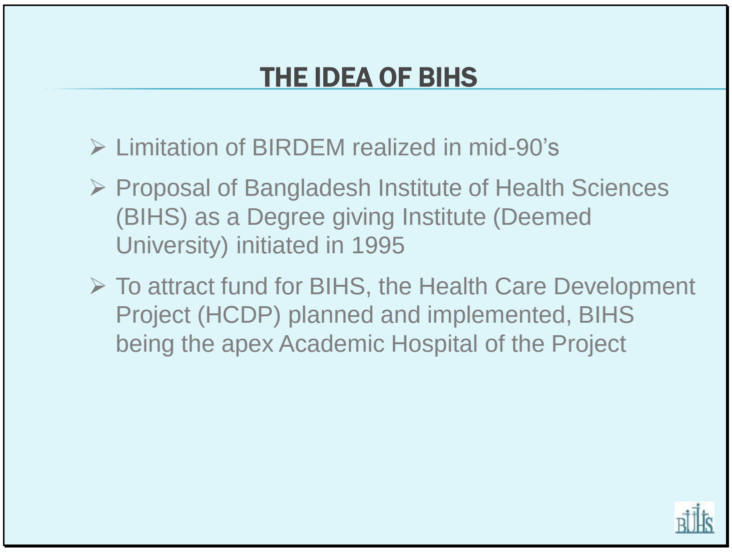


Figure 102. The Idea of BIHS.

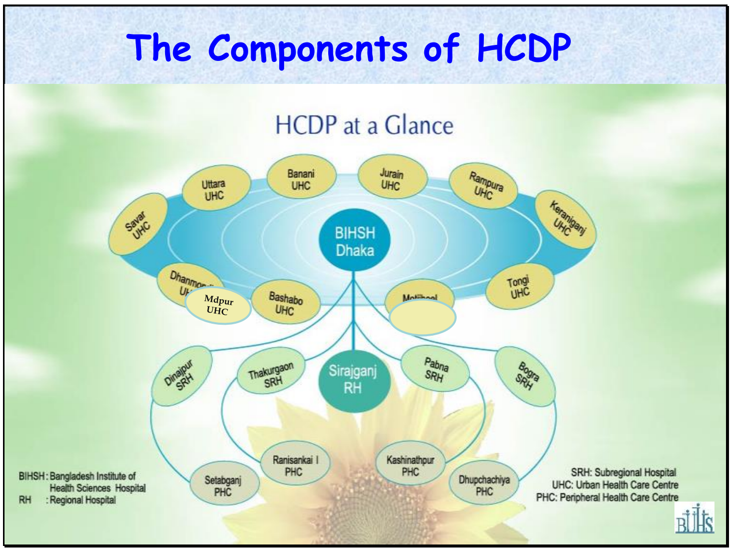


Figure 103. The Components of HCDP.

HCDP has been designed with a 4 Peripheral at sub district level, 10 UHC in an around the Capital of Dhaka city, 4 SRH and 1 RH Hospital at district level and 1 Apex hospital BIHS at Dhaka

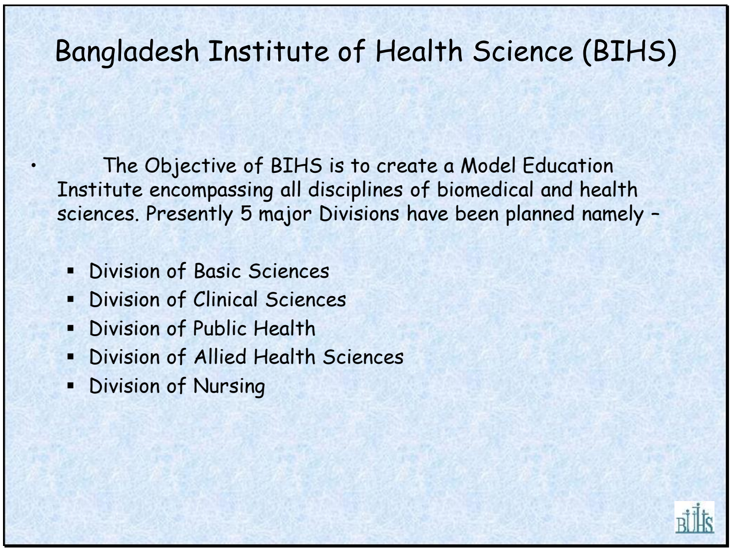


Figure 104. Bangladesh Institute of Health Science (BIHS).

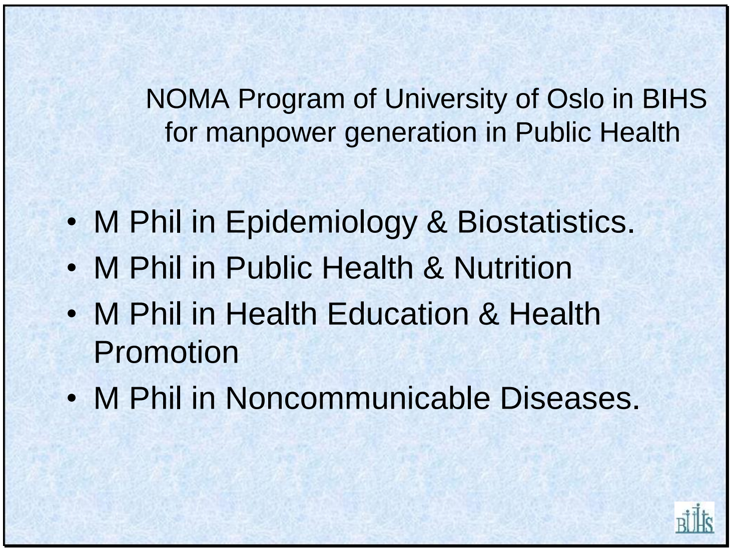


Figure 105. NOMA Program of University of Oslo in BIHS for Manpower Generation in Public Health.

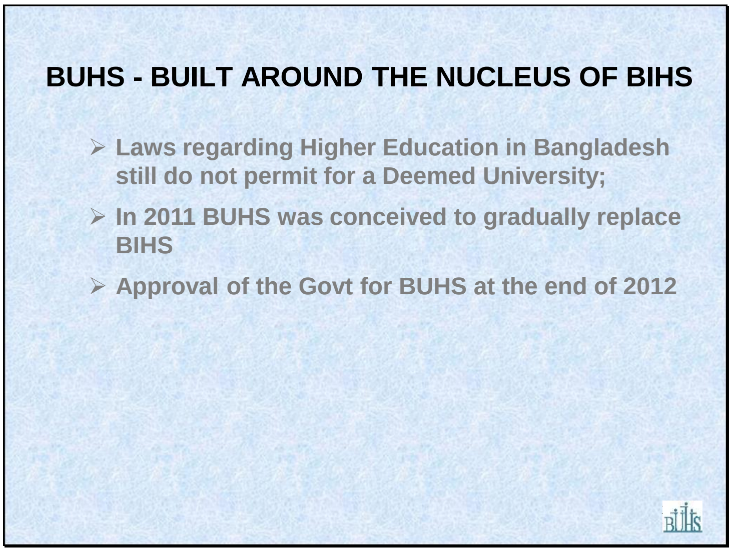


Figure 106. BUHS – Built Around the Nucleus of BIHS.

OBJECTIVES OF BUHS

- To develop qualified and skilled human resources in clinical, basic and allied health sciences & technology with the overall goal for improving health of our population.
- To create multidisciplinary environment in biomedical research involving biological, chemical, clinical as well as social sciences as relevant to health.
- To generate evidence based suggestions which can help the Planners and Policy Makers to develop better health care programs in the country.
- To foster interaction among relevant Institutes/ Universities in home and abroad to improve the academic and research standards in biomedical fields.
- To create a Model for an ideal Private University in Bangladesh.

Figure 107. Objectives of BUHS.

BUHS -THE ORGANIZATION

Although BUHS was initiated and sponsored by DAB, it had to be established under a separate nonprofit organization (Trust) as per Private University Ordinance 2010

Figure 108. BUHS – The Organization.

PROGRAMS UNDER DIFFERENT FACULTIES

A. Faculty of Basic Sciences

Sl No	Degree	Program
Dept of Chemistry		
1	MS	MS in Medicinal Chemistry
Dept of Biochemistry & Cell biology		
2	BSc (Hons)	BSc (Hons) in Biochemistry and Cell Biology
3	MS	MS in Biochemistry
4	MS	MS in Cell Biology
Dept of Genetics & Molecular Biology		
5	BSc (Hons)	BSc (Hons) in Genetics and Molecular Biology
6	MS	MS in Molecular Biology
7	MS	MS in Genetics
Dept of Microbiology & Immunology		
8	BSc (Hons)	BSc (Hons) in Microbiology and Immunology
9	MS	MS in Microbiology
10	MS	MS in Immunology

Figure 109. Programs Under Different Faculties: Faculty of Basic Sciences.

PROGRAMS UNDER DIFFERENT FACULTIES

B. Faculty of Public Health

Sl No	Degree	Program
Dept of Community Medicine		
11	Masters	Masters in Community Medicine
12	Masters	Masters in Noncommunicable Diseases
Dept of Community Nutrition		
13	Bachelor	Bachelor in Community Nutrition
14	Masters	Masters in Community Nutrition
Dept of Health Promotion and Education		
15	Bachelor	Bachelor in Health Promotion and Education
16	Masters	Masters in Health Promotion and Education
Dept of Epidemiology		
17	Masters	Masters in Epidemiology
Dept of Reproductive and Child Health		
18	Bachelor	Bachelor in Reproductive and Child Health
19	Masters	Masters in Reproductive and Child Health

Figure 110. Programs Under Different Faculties: Faculty of Public Health.

PROGRAMS UNDER DIFFERENT FACULTIES

B. Faculty of Public Health (contd)

Sl No	Degree	Program
Dept of Occupational Health and Safety		
20	Bachelor	Bachelor in Occupational Health and Safety
21	Masters	Masters in Occupational Health and Safety
Dept of Environmental Health and Safety		
22	Bachelor	Bachelor in Environmental Health and Safety
23	Masters	Masters in Environmental Health and Safety
Dept of Community Dentistry		
24	Masters	Masters in Community Dentistry
Dept of Community Ophthalmology		
25	Masters	Masters in Community Ophthalmology

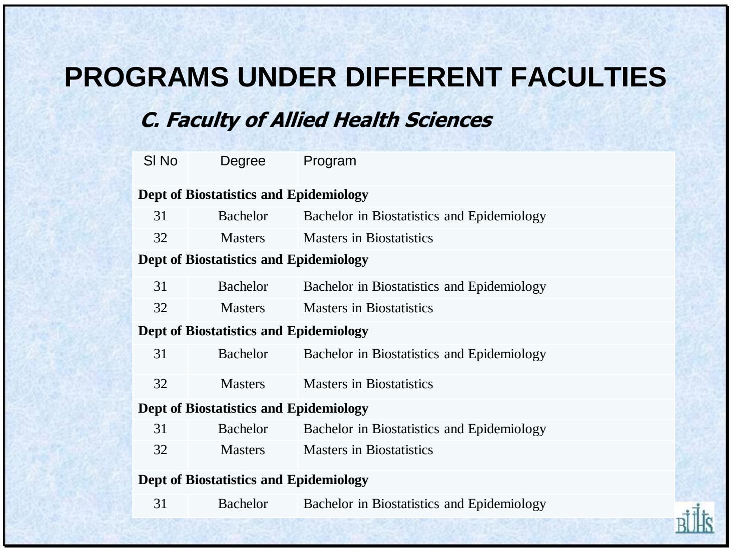
Figure 111. Programs Under Different Faculties: Faculty of Public Health (contd).

PROGRAMS UNDER DIFFERENT FACULTIES

B. Faculty of Public Health (contd)

Sl No	Degree	Program
Dept of Public Health Nursing		
26	Masters	Masters in Public Health Nursing
Dept of Family Medicine		
27	Masters	Masters in Family Medicine
Dept of Podiatrics		
28	Masters	Masters of Podiatrics
Dept of Gereontology		
29	Masters	Masters of Gereontology
Dept of Community Dermatology & Venereology		
30	Masters	Masters of Dermatology & Venereology

Figure 112. Programs Under Different Faculties: Faculty of Public Health (contd).

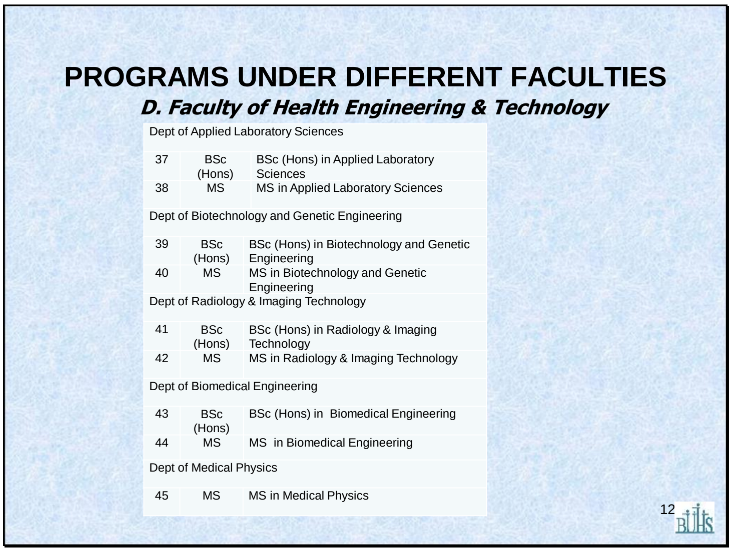


PROGRAMS UNDER DIFFERENT FACULTIES

C. Faculty of Allied Health Sciences

Sl No	Degree	Program
Dept of Biostatistics and Epidemiology		
31	Bachelor	Bachelor in Biostatistics and Epidemiology
32	Masters	Masters in Biostatistics
Dept of Biostatistics and Epidemiology		
31	Bachelor	Bachelor in Biostatistics and Epidemiology
32	Masters	Masters in Biostatistics
Dept of Biostatistics and Epidemiology		
31	Bachelor	Bachelor in Biostatistics and Epidemiology
32	Masters	Masters in Biostatistics
Dept of Biostatistics and Epidemiology		
31	Bachelor	Bachelor in Biostatistics and Epidemiology
32	Masters	Masters in Biostatistics
Dept of Biostatistics and Epidemiology		
31	Bachelor	Bachelor in Biostatistics and Epidemiology

Figure 113. Programs Under Different Faculties: Faculty of Allied Health Sciences.



PROGRAMS UNDER DIFFERENT FACULTIES

D. Faculty of Health Engineering & Technology

Dept of Applied Laboratory Sciences		
37	BSc (Hons)	BSc (Hons) in Applied Laboratory Sciences
38	MS	MS in Applied Laboratory Sciences
Dept of Biotechnology and Genetic Engineering		
39	BSc (Hons)	BSc (Hons) in Biotechnology and Genetic Engineering
40	MS	MS in Biotechnology and Genetic Engineering
Dept of Radiology & Imaging Technology		
41	BSc (Hons)	BSc (Hons) in Radiology & Imaging Technology
42	MS	MS in Radiology & Imaging Technology
Dept of Biomedical Engineering		
43	BSc (Hons)	BSc (Hons) in Biomedical Engineering
44	MS	MS in Biomedical Engineering
Dept of Medical Physics		
45	MS	MS in Medical Physics

12

Figure 114. Programs Under Different Faculties: Faculty of Health Engineering and Technology.

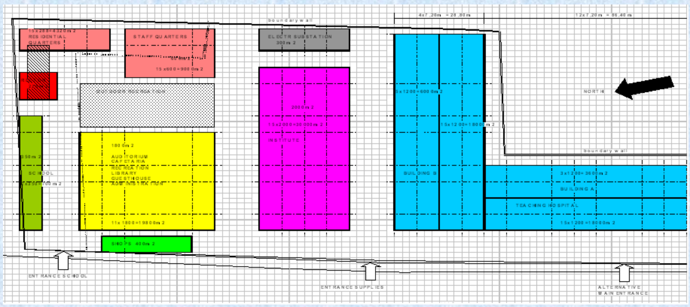
PROGRAMS UNDER DIFFERENT FACULTIES

E. Faculty of Pharmacy

Sl No	Degree	Program
Dept of Pharmacy		
46	BSc (Hons)	BSc (Hons) in Pharmacy
47	MS	MS in Pharmacy

Figure 115. Programs Under Different Faculties: Faculty of Pharmacy.

BUHS Campus



- TEACHING HOSPITAL BUILDING A 3x1200 + 15x1200 = 3600 + 18000 = 21600m2
- TEACHING HOSPITAL BUILDING B 5x 1200 + 15x1200 = 6000 + 18000 = 24000m2
- INSTITUTIONAL SUPPORT SERVICES 11x1800=19800m2
- STAFF QUARTERS 15x600=9000m2
- RESIDENTIAL QUARTERS 15x288=4320m2
- RECTOR BUNGALOW 350m2

Figure 116. BUHS Campus.

INVOLVEMENT OF BIRDEM-BIHS-BUHS RESEARCHERS IN BADAS ACTIVITIES

- Key role in the initiation of ideas, writing of proposals and detailing of implementation plans for all major BADAS Projects like NHN, ICHRI, and IMC
- Active participation, in mid-ninetees, in the future expansion plans of the Affiliated Associations of BADAS
- Active involvement in streamlining the management and branding documents (eg Service and Recruitment Rules and Annual Reports) of BADAS
- Strengthening of the public health approaches of BADAS
- Promoting the international linkage and image of BADAS
- Playing the central role in establishing HCDP, BIHS and finally BUHS

Figure 117. Involvement of BIRDEM-BIHS-BUHS Researchers in BADAS Activities.

KEY LESSONS LEARNED

- In a Developing Country context academic research should be integrated with socioeconomic development in order to sustain and grow
- Creating a research culture is the most challenging task
- It is the scientifically trained and socially motivated critical human mass which is centrally important to drive further development

Figure 118. Key Lessons Learned.

APPENDIX A

2015 CONFERENCE COMMITTEES

Patrons

Abdel Salam Majali **FIAS**	President, IAS (Chair). Former Prime Minister, Jordan.
Sorena Sattari	Vice-President for Science and Technology Affairs, Iran.

IAS Science Committee

Abdel Salam Majali **FIAS**	President, IAS (Chair).
Adnan Badran **FIAS**	Treasurer IAS.
Moneef R Zou’bi	Director General, IAS (Rapporteur).

IAS Organising Committee

Moneef R **Zou'bi**	Director General, IAS (Head).
Taghreed **Saqer** (Ms)	Executive Secretary, IAS.
Lina Jalal **Dadan** (Ms)	Programme Officer, IAS.
Hamza **Dagestani**	Finance Officer, IAS.
Habes **Majali**	Public Relations Officer, IAS.

APPENDIX B

CHAIRPERSONS OF THE 2015 CONFERENCE SESSIONS

Session 1:	Prof. Abdel Salam Majali FIAS	Jordan.
Session 2:	Prof. Omar Abdul Rahman FIAS	Malaysia.
Session 3:	Prof. Adnan Badran FIAS	Jordan.
Session 4:	Prof. Iqbal Parker FIAS	South Africa.
Session 5:	Prof. Rabia Hussain FIAS	Pakistan.

20TH ISLAMIC-WORLD ACADEMY OF SCIENCES CONFERENCE
on
Science, Technology and Innovation: Building Humanity's Common Future

26-27 December 2015
Tehran, Iran

CONFERENCE PARTICIPANTS

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42. Ms Zahra Sahaei, International Affairs and Technology Exchange Department, Tehran, Iran. E-mail: z.sahaei@isti.ir
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APPENDIX D

PATRONS OF THE ISLAMIC WORLD ACADEMY OF SCIENCES

His Excellency the President of the Islamic Republic of Pakistan.
His Royal Highness Prince Al Hassan Ibn Talal of the Hashemite Kingdom of Jordan, Founding Patron.

HONORARY FELLOWS OF THE ISLAMIC WORLD ACADEMY OF SCIENCES

Prof. **Richard R. Ernst**, 1991 Nobel Laureate (Chemistry), Switzerland.
The late Mr **Fouad Alghanim**, President, Alghanim Group, Kuwait.
Prof. Ekmeleddin **Ihsanoglu,** OIC Secretary General, Turkey.
Sheikh **Saleh Kamel**, Chairman, Dallah Elbaraka Group, Saudi Arabia.
Datuk Patinggi Tan Sri Haji Dr **Abdul Taib Mahmud**, Chief Minister, State of Sarawak, Malaysia.
Dr **Adnan M. Mjalli**, Chairman of the Board, President and CEO, TransTech Pharma, Inc., USA.
His Excellency Dato' Seri Dr **Mahathir Mohamad**, Former Prime Minister of Malaysia.
Prof. **Ferid Murad**, 1998 Nobel Laureate (Medicine), USA.
His Excellency **Nursultan Abishevich Nazarbayev**, President of the Republic of Kazakhstan.
H E Mr **Mintimer Shaimiev**, President of the Republic of Tatarstan/ Russian Federation.
His Excellency Sheikh **Hamad Bin Jassim Bin Jabr Al Thani**, Prime Minster of Qatar, Qatar.
Sheikh **Hamad Al-Zamil**, Chairman, Al-Zamil Group, Saudi Arabia.
The late Prof. **Ahmed Zewail**, 1999 Nobel Laureate (Chemistry), Egypt/USA.

FELLOWS OF THE ISLAMIC WORLD ACADEMY OF SCIENCES

1.	Prof. Mohammad **Abdollahi**	Iran
2.	Prof. Zakri **Abdul Hamid**	Malaysia
3.	Prof. Omar **Abdul Rahman**	Malaysia
4.	Prof. Naim **Afgan**	Bosnia-Herzegovina
5.	Prof. Askar **Akayev**	Kyrgyzstan
6.	Prof. Sajjad **Alam**	Bangladesh/USA
7.	Prof. Liaquat **Ali**	Bangladesh
8.	Prof. M Shamsher **Ali**	Bangladesh
9.	Prof. Qurashi Mohammed **Ali**	Sudan
10.	Prof. Huda Saleh Mehdi **Ammash**	Iraq
11.	Prof. Shazia **Anjum**	Pakistan
12.	Prof. Wiranto **Arismunandar**	Indonesia
13.	Prof. Muhammad **Asghar**	France
14.	Prof. Allaberen **Ashyralyev**	Turkmenistan
15.	Prof. Saleh A **Al-Athel**	Saudi Arabia
16.	Prof. Ahmad Abdullah **Azad**	Bangladesh/Australia
17.	Prof. Agadjan **Babaev**	Turkmenistan
18.	Prof. Adnan **Badran**	Jordan
19.	Prof. Shah Nor Bin **Basri**	Malaysia
20.	Prof. Elias **Baydoun**	Lebanon
21.	Prof. Farouk **El-Baz**	USA
22.	Prof. Kazem **Behbehani**	Kuwait
23.	Prof. Azret Yusupovich **Bekkiev**	Balkar/Russia
24.	Prof. Rafik **Boukhris**	Tunisia
25.	Prof. David (Mohamed Daud) A. **Bradley**	UK
26.	Prof. Noor Mohammad **Butt**	Pakistan
27.	Prof. Mohamed Thameur **Chaibi**	Tunisia
28.	Prof. Muhammad Iqbal **Choudhary**	Pakistan
29.	Prof. Abdallah **Daar**	Oman/ Canada
30.	Prof. Ali Al **Daffa'**	Saudi Arabia
31.	Prof. Mamadou **Daffe**	Mali/France
32.	Prof. Ramazan **Demir**	Turkey
33.	Prof. Oussaynou Fall **Dia**	Senegal
34.	Prof. Mehmet **Ergin**	Turkey
35.	Prof. Sehamuddin **Galadari**	UAE
36.	Prof. Nesreen **Ghaddar**	Lebanon
37.	Prof. Mehdi **Golshani**	Iran
38.	Prof. Kadyr G **Gulamov**	Uzbekistan
39.	Prof. Ameenah **Gurib-Fakim**	Mauritius
40.	Prof. Hashim M **El-Hadi**	Sudan
41.	Prof. Mohammad **Hamdan**	Jordan
42.	Prof. Adnan **Hamoui**	Syria

43.	Prof. Kemal **Hanjalic**	Bosnia-Herzegovina
44.	Prof. Mohamed H A **Hassan**	Sudan
45.	Prof. Tasawar **Hayat**	Pakistan
46.	Prof. Ali Ali **Hebeish**	Egypt
47.	Prof. Bambang **Hidayat**	Indonesia
48.	Prof. Rabia **Hussain**	Pakistan
49.	Prof. Abdul Latif **Ibrahim**	Malaysia
50.	Prof. Aini **Ideris**	Malaysia
51.	Prof. Asma **Ismail**	Malaysia
52.	Prof. Mohammad Shamim **Jairajpuri**	India
53.	Prof. Mohammad Qasim **Jan**	Pakistan
54.	Prof. Afaf **Kamal-Edin**	Sudan
55.	Prof. Hamza **El-Kettani**	Morocco
56.	Prof. Idriss **Khalil**	Morocco
57.	Prof. Abdul Qadeer **Khan**	Pakistan
58.	Prof. Hameed Ahmed **Khan**	Pakistan
59.	Prof. M. Ajmal **Khan**	Pakistan
60.	Prof. Mostefa **Khiati**	Algeria
61.	Prof. Hala Jarallah **El Khozondar**	Gaza/ Palestine
62.	Prof. Abdelhafid **Lahlaidi**	Morocco
63.	Prof. Zohra Ben **Lakhdar**	Tunisia
64.	Prof. Malek **Maaza**	Algeria
65.	Prof. Abdel Salam **Majali**	Jordan
66.	Prof. Ahmed **Marrakchi**	Tunisia
67.	Prof. Akhmet **Mazgarov**	Tatarstan/Russia
68.	Prof. Amdoulla **Mehrabov**	Azerbaijan
69.	Prof. Shaher **Al-Momani**	Jordan
70.	Prof. Ali A. Moosavi-**Movahedi**	Iran
71.	Prof. Sami **Al- Mudhaffar**	Iraq
72.	Prof. Zaghloul **El-Naggar**	Egypt
73.	Prof. Ibrahim Saleh **Al- Naimi**	Qatar
74.	Prof. Anwar **Nasim**	Pakistan
75.	Prof. Munir **Nayfeh**	Jordan/ United States
76.	Prof. Robert **Nigmatulin**	Tatarstan/ Russia
77.	Prof. Gulsen **Oner**	Turkey
78.	Prof. Ramdane **Ouahes**	Algeria
79.	Prof. Sinasi **Ozsoylu**	Turkey
80.	Prof. Munir **Ozturk**	Turkey
81.	Prof. Iqbal **Parker**	South Africa
82.	Prof. Syed Muhammad **Qaim**	Germany
83.	Prof. Subhi **Qasem**	Jordan
84.	Prof. Atta-ur-**Rahman**	Pakistan
85.	Prof. Najih Khalil **El-Rawi**	Iraq
86.	Prof. Hussein Samir **Salama**	Egypt
87.	Prof. Eldar Yunisoglu **Salayev**	Azerbaijan
88.	Prof. Jawad A. **Salehi**	Iran

89.	Prof. Boudjema **Samraoui**	Algeria
90.	Prof. Lorenzo **Savioli**	Italy
91.	Prof. Mohammed Musa **Shabat**	Gaza/ Palestine
92.	Prof. Misbah-Ud-Din **Shami**	Pakistan
93.	Prof. Ali **Al-Shamlan**	Kuwait
94.	Prof. Ahmad **Shamsul-Islam**	Bangladesh
95.	Prof. Muthana **Shanshal**	Iraq
96.	Prof. Zabta Khan **Shinwari**	Pakistan
97.	Prof. Ahmedou M **Sow**	Senegal
98.	Prof. Mahmoud **Tebyani**	Iran
99.	Prof. Ahmet Hikmet **Ucisik**	Turkey
100.	Prof. Gulnar **Vagapova**	Tatarstan/ Russia
101.	Prof. Omar M. **Yaghi**	Jordan/USA
102.	Prof. Jackie **Ying**	Singapore/USA
103.	Prof. Bekhzad **Yuldashev**	Uzbekistan
104.	Prof. Khalid **Yusoff**	Malaysia
105.	Prof. Khatijah Mohd **Yusoff**	Malaysia
106.	Prof. Salim **Yusuf**	Canada
107.	Prof. Mikhael **Zalikhanov**	Balkar/Russia

APPENDIX E

LAUREATES OF THE IAS-COMSTECH IBRAHIM MEMORIAL AWARD

Prof. Ugur **Dilmen**	1996	Turkey.
Prof. Mohammad **Abdollahi**	2005	Iran.
Prof. Mohammed Manna **Al-Qattan**	2007	Saudi Arabia.
Dr Faris **Gavrankapetanovic**	2009	Bosnia.
Dr Saima **Riazuddin**	2011	Pakistan.
Prof. Liaquat **Ali**	2013	Bangladesh.
Prof. Jackie **Ying**	2015	Singapore.

APPENDIX F

COUNCIL OF THE ISLAMIC WORLD ACADEMY OF SCIENCES (2017-2021)

President:	**Abdel Salam Majali**	Jordan.
Vice-President:	**Noor M. Butt**	Pakistan.
Vice-President:	**Munir Ozturk**	Turkey.
Vice-President:	**Khatijah Mohd Yusoff**	Malaysia.
Treasurer:	**Adnan Badran**	Jordan.
Secretary General:	**Ahmad Abdullah Azad**	Australia.
Member:	**M. Shamsher Ali**	Bangladesh.
Member:	**Mohammed Asghar**	France.
Member:	**Mostefa Khiati**	Algeria.
Member:	**Amdoulla Mehrabov**	Azerbaijan.
Member:	**Muthana Shanshal**	Iraq.
Member (Ex-officio):	**Moneef R. Zou'bi**	DG- IAS/Jordan.

IAS EXECUTIVE STAFF

Moneef R. Zou'bi	*Director General.*
Lina Jalal Dadan	*Programme Officer.*
Najwa Daghestani	*Programme Officer.*
Taghreed Saqer	*Executive Secretary.*
Hamzah Daghestani	*Finance Officer.*
Habes Majali	*Public Relations Officer.*
Hamdi Bader	*Driver.*

APPENDIX G

DECEASED FELLOWS OF THE ISLAMIC WORLD ACADEMY OF SCIENCES (IAS)

Prof. Mohammad **Ibrahim**	(1911-1988)	Bangladesh.
Prof. Djibril **Fall**	(1930-1992)	Senegal.
Prof. Salimuzzaman **Siddiqui**	(1897-1994)	Pakistan.
Prof. Abdus Salam **Mia**	(1925-1995)	Bangladesh/USA.
Prof. Suleiman Gabir **Hamad**	(1937-1996)	Sudan.
Prof. Mohammad R **Siddiqi**	(1908-1998)	Pakistan.
Prof. Abdullah M **Sharafuddin**	(1930-1998)	Bangladesh.
Prof. Achmad **Baiquni**	(1923-1998)	Indonesia.
Prof. Mumtaz Ali **Kazi**	(1928-1999)	Pakistan.
Prof. Faramaz G **Maksudov**	(1930-2000)	Azerbaijan.
Prof. Ali **Kettani**	(1941-2001)	Morocco.
Prof. Mohamed Kamel **Mahmoud**	(1926-2003)	Egypt.
Prof. Samaun **Samadikun**	(1931-2006)	Indonesia.
Prof. Iftikhar Ahmad **Malik**	(1936-2008)	Pakistan.
Prof. J (Younis) Ario **Katili**	(1929-2008)	Indonesia.
Prof. Ibrahima Mar **Diop**	(1921-2008)	Senegal.
Prof. Syed Zahir **Haider**	(1927-2008)	Bangladesh.
Prof. Muhammad Ilyas **Burney**	(1922-2008)	Pakistan.
Prof. Badri **Muhammad**	(1943-2009)	Malaysia.
Prof. Pulat **Khabibullaev**	(1936-2010)	Uzbekistan.
Prof. Mohammed A **Waqar**	(1941-2010)	Pakistan.
Prof. Souleymane **Niang**	(1929-2010)	Senegal.
Prof. Ahmad Nawawi **Ayoub**	(1937-2010)	Malaysia.
Prof. Kamal H. **Batanouny**	(1936-2011)	Egypt.
Prof. Mohamed B E **Fayez**	(1927-2011)	Egypt.
Prof. Mazhar M **Qurashi**	(1925-2011)	Pakistan.
Prof. Mahmoud **Hafez**	(1912-2012)	Egypt.
Prof. Jamal **Nazrul-Islam**	(1939-2013)	Bangladesh.
Prof. **Riazuddin**	(1930-2013)	Pakistan.
Prof. Naeem Ahmad **Khan**	(1928 -2013)	Pakistan.
Prof. Mehmet Nimet **Ozdas**	(1921-2014)	Turkey.
Prof. Ugur **Dilmen**	(1955-2015)	Turkey.
Prof. Ibrahim Gamil **Badran**	(1924-2015)	Egypt.
Prof. Fakhruddin **Daghestani**	(1936-2016)	Jordan.
Prof. Ibrahima **Wone**	(1926-2016)	Senegal.
Prof. Syed Qasim **Mehdi**	(1941-2016)	Pakistan.
Prof. Korkut **Ozal**	(1929-2016)	Turkey.
Prof. Mohammad Salimullah	(1949-2016)	Bangladesh.
Prof. Attia A Ashour	(1924-2017)	Egypt.

Prof. Mustafa Doruk	(1932-2017)	Turkey.
Prof. Ishfaq Ahmad	(1930-2018)	Pakistan.
Prof. Naci Bor	(1928-2018)	Turkey.
Prof. Salambek Khadjiev	(1941-2018)	Chechnya.
Prof. Makhmud Salakhitdinov	(1933-2018)	Uzbekistan.

APPENDIX H

PUBLICATIONS OF THE ISLAMIC WORLD ACADEMY OF SCIENCES

CONFERENCE PROCEEDINGS

- *The Islamic Academy of Sciences.* Proceedings of the Founding Conference (1986). Published by the Islamic Academy of Sciences, **Editor: A. Kettani (Morocco).**
- *Food Security in the Muslim World.* Proceedings of the first international conference, Amman (Jordan) (1987). Published by the Islamic World Academy of Sciences, **Editor: S. Qasem (Jordan).**
- *Science and Technology Policy for Self-Reliance in the Muslim World.* Proceedings of the second international conference, Islamabad (Pakistan) (1988). Published by the Islamic World Academy of Sciences, **Editors: F. Daghestani (Jordan), H. El-Mulki (Jordan), and M. Al-Halaiqa (Jordan).**
- *New Technologies and Development of the Muslim World.* Proceedings of the third international conference, (Kuwait) (1989). Published by the Islamic World Academy of Sciences, **Editors: F. Daghestani (Jordan), and S. Qasem (Jordan).**
- *Technology Transfer for Development in the Muslim World.* Proceedings of the fourth international conference, Antalya (Turkey) (1990). Published by the Islamic World Academy of Sciences, **Editors: F. Daghestani (Jordan), A. Altamemi (Jordan), and M. Ergin (Turkey).**
- *Science and Technology Manpower Development in the Islamic World.* Proceedings of the fifth international conference, Amman (Jordan) (1991). Published by the Islamic World Academy of Sciences, **Editors: F. Daghestani (Jordan), A. Altamemi (Jordan), and H. El-Mulki (Jordan).**
- *Environment and Development in the Islamic World.* Proceedings of the sixth international conference, Kuala Lumpur (Malaysia) (1992). Published by the Islamic World Academy of Sciences, **Editors: S. Al-Athel (Saudi Arabia), and F. Daghestani (Jordan).**
- *Health, Nutrition and Development in the Islamic World.* Proceedings of the seventh international conference, Dakar (Senegal) (1993). Published by the Islamic World Academy of Sciences, **Editors: N. Bor (Turkey), A. Kettani (Morocco), and Moneef R. Zou'bi (Jordan).**
- *Water in the Islamic World: An Imminent Crisis.* Proceedings of the eighth international conference, Khartoum (Sudan) (1994). Published by the Islamic

World Academy of Sciences, **Editors: M. Ergin (Turkey), H. Dogan Altinbilek (Turkey), and Moneef R. Zou'bi (Jordan).**

- *Science and Technology Education for Development in the Islamic World.* Proceedings of the ninth international conference, Tehran (Iran) (1999). Published by the Islamic World Academy of Sciences, **Editors: M. Ergin (Turkey), M. Doruk (Turkey), and Moneef R. Zou’bi (Jordan) (ISBN 9957-412-7).**
- *Information Technology for Development in the Islamic World.* Proceeding of the tenth international conference, Tunis (Tunisia) (2000). Published by the Islamic World Academy of Sciences, **Editors: M. Ergin (Turkey), M. Doruk (Turkey), and Moneef R. Zou’bi (Jordan) (ISBN 9957-412-03-5).**
- *Biotechnology and Genetic Engineering for Development in the Islamic World.* Proceedings of the eleventh international conference, Rabat (Morocco) (2001). Published by the Islamic World Academy of Sciences, **Editors: A. S. Majali (Jordan), M. Ergin (Turkey), and Moneef R. Zou’bi (Jordan) (ISBN 9957-412-07-8).**
- *Materials Science and Technology and Culture of Science.* Proceedings of the twelfth international conference, Islamabad (Pakistan), (2002). Published by the Islamic World Academy of Sciences, **Editors: M. Ergin (Turkey), and Moneef R. Zou’bi (Jordan) (ISBN 9957-412-06-x).**
- *Energy for Sustainable Development and Science for the Future of the Islamic World and Humanity.* Proceedings of the thirteenth international conference, Kuching, Sarawak (Malaysia), (2003). Published by the Islamic World Academy of Sciences, **Editors: M. Ergin (Turkey), and Moneef R. Zou’bi (Jordan) (ISBN 9957-412-08-6).**
- *Science Technology and Innovation for Socioeconomic Development of OIC-Member Countries Towards Vision 1441.* Proceeding of the fourteenth international conference, Kuala Lumpur (Malaysia), (2005). Published by the Islamic World Academy of Sciences, **Editors: M. Ergin (Turkey), and Moneef R. Zou’bi (Jordan) (ISBN 9957-412-11-6).**
- *Higher Education Excellence for Development in the Islamic World*. Proceeding of the fifteenth international conference, Ankara (Turkey), (2006). Published by the Islamic World Academy of Sciences, **Editors: M. Ergin (Turkey), and Moneef R. Zou’bi (Jordan) (ISBN 978-9957-412-18-0.**
- *Science, Technology and Innovation for Sustainable Development in the Islamic World: The Policies and Politics Rapprochement*. Proceeding of the Sixteenth international conference, Kazan (Tatarstan), (2008). Published by the Islamic World Academy of Sciences, **Editors: M. Ergin (Turkey), and Moneef R. Zou’bi (Jordan) (ISBN 978-9957-412-19-7).**
- *Science and Technology and Innovation for Sustainable Development in the Islamic World: Policies and Politics Rapprochement*, Proceeding of the sixteenth international conference, Kazan (Tatarstan), (2008). Published by

the Islamic World Academy of Sciences, **Editors: M. Ergin (Turkey), and Moneef R. Zou'bi (Jordan) (ISBN 978-9957-412-19-7).**

- *Science and Technology and Innovation for Sustainable Development in the Islamic World: Policies and Politics Rapprochement,* Proceeding of the sixteenth international conference, Kazan (Tatarstan), (2008) - Published by the Islamic World Academy of Sciences, **Editors: M. Ergin (Turkey), and Moneef R. Zou'bi (Jordan) (ISBN 978-9957-412-19-7).**
- *Towards the Knowledge Society in the Islamic World: Knowledge Production, Application and Dissemination,* Proceeding of the seventeenth international conference, Shah Alam *(Malaysia), 2009.* Published by the Islamic World Academy of Sciences, **Editors: M. Ergin (Turkey), and Moneef R. Zou'bi (Jordan) (ISBN 978-9957-412-22-7). Online.**
- *The Islamic World and the West: Rebuilding Bridges through Science and Technology,* Doha (Qatar), 2011**.** Published by the Islamic World Academy of Sciences, **Editor: Moneef R. Zou'bi (Jordan) (ISBN 978-9957-412-24-1). Online.**
- *Achieving Socioeconomic Development in the Islamic World through Science, Technology and Innovation*, Dhaka (Bangladesh), 2013. Published by the Islamic World Academy of Sciences, **Editors: Moneef R. Zou'bi (Jordan), and Najwa F. Daghestani (Jordan) (ISBN 978-9957-412-25-8). Online.**
- *Science, Technology and Innovation: Building Humanity's Common future,* Tehran (Iran), 2015. Published by the Islamic World Academy of Sciences, **Editors: Moneef R. Zou'bi (Jordan), and Najwa F. Daghestani (Jordan) (ISBN). Online.**

BOOKS

- *Islamic Thought and Modern Science.* Published by the Islamic World Academy of Sciences (1997) **- Author: Mumtaz A. Kazi**.
- *Qur'anic Concepts and Scientific Theories.* Published by the Islamic World Academy of Sciences (1999) – **Author: Mumtaz A. Kazi.**
- *Personalities Noble* **Editor: Hakim Mohammed Said**, Second Revised Edition. Published by the Islamic World Academy of Sciences (2000), **Editor: Moneef R. Zou'bi** (Arabic-English). **(ISBN: 9957-412-01-6).**
- *Declarations of the Islamic World Academy of Sciences.* Published by the Islamic World Academy of Sciences (2005), **Editor: Moneef. R. Zou'bi (ISBN: 9957-412-09-4)**.
- *Islamic World Academy of Sciences Outreach.* Published by the Islamic World Academy of Sciences (2005), **Editor: Moneef R. Zou'bi (ISBN: 9957-412-10-8)**.
- *Intellectual Property Rights: An Introduction for Scientists and Technologists.* Published by the Islamic World Academy of Sciences (2006), **Author: Mohamed B. E. Fayez (ISBN: 978-9957-412-18-0)**.

- *The Discoveries in the Islamic Countries* – Arabic Edition Published by the Islamic World Academy of Sciences (2012), **Authors: Ahmed Djebbar, Cecile de Hosson and David Jasmin (ISBN: 978-9957-412-23-4)**.
- *The Essentials of Science, Technology and Innovation Policy* – Published by the Islamic World Academy of Sciences (2013), **Author: Omar Abdel Rahman (ISBN: 978-983-9445-95-4).**

PERIODICALS

- *Medical Journal of the Islamic World Academy of Sciences* (ISSN 1016-3360) – quarterly. Honorary Editor: **Prof**. **Şinasi Özsoylu**, Responsible Editor: **Dr Nedim Aytekin**.
- *Newsletter of the Islamic World Academy of Sciences* – quarterly. Chief Editor: **Moneef R. Zou'bi**.
- *Islamic Thought and Scientific Creativity* (in Arabic) **-** quarterly Journal of the Organisation of the Islamic Conference (OIC) Standing Committee on Scientific and Technological Co-operation (COMSTECH). Arabicised version published by IAS with the support of the Royal Academy for Islamic Civilisation Research (Al-Albait Foundation) (publication ceased in 1996).

OTHER PUBLICATIONS

- An *Overview* of the IAS, Chief Editor: **M. R. Zou'bi.**
- IAS Postcards.

APPENDIX I

IAS SUPPORTERS

The Hashemite Kingdom of Jordan
The Islamic Republic of Pakistan
The State of Kuwait
The Republic of Turkey
Malaysia
The Republic of Senegal
The Republic of Sudan
The Islamic Republic of Iran
The State of Qatar
The Republic of Tunisia
The Kingdom of Morocco
The State of Sarawak/Malaysia
The Republic of Indonesia
The Republic of Tatarstan/ Russian Federation
The State of Selangor/ Malaysia
The Sultanate of Oman
The Republic of Kazakhstan
The Republic of Bangladesh

The OIC Standing Committee on Scientific and Technological Co-operation (COMSTECH), Pakistan.
The Islamic Development Bank (IDB), Saudi Arabia.
The OPEC Fund for International Development, Vienna, Austria.
Arab Fund for Economic and Social Development (AFESD), Kuwait.
Arab Potash Company, Jordan.
United Nations Educational Scientific and Cultural Organisation (UNESCO), France.
Islamic Educational Scientific and Cultural Organisation (ISESCO), Morocco.
The World Bank, USA.
The United Nations Environment Programme (UNEP), Kenya.
Kuwait Foundation for the Advancement of Sciences (KFAS).
Turkish Scientific and Technical Research Council (TUBITAK).
The Royal Scientific Society (RSS), Jordan.
Pakistan Ministry of Science and Technology.
Ministry of Science, Technology and the Environment, Malaysia.
University Cheikh Anta Diop, Dakar, Senegal.
Ministry of Higher Education and Scientific Research, Sudan.
National Centre for Research, Sudan.
Ministry of Culture and Higher Education, Iran.
Iranian Research Organisation for Science and Technology (IROST).

The Academy of Sciences, Tehran, Iran.
The Academy of Medical Sciences, Tehran, Iran.
Saudi Arabian Oil Company, Saudi Arabia (ARAMCO).
Ihlas Holding, Turkey.
Arab Bank, Jordan.
Jordan Kuwait Bank, Jordan.
Rafia Industrial Company, Jordan.
Secretariat of State for Scientific Research and Technology, Tunisia.
Academy of the Kingdom of Morocco.
Petra Private University, Jordan.
Higher Council of Science and Technology (HCST), Jordan.
Pakistan Academy of Sciences.
Majlis Islam Sarawak, Malaysia.
Tabung Baitulmal Sarawak, Malaysia.
Sasakawa Peace Foundation, Japan.
Royal Jordanian Airlines, Jordan.
Arab Jordan Investment Bank, Jordan.
National Centre for Human Resources Development, Jordan.
Al Bukhary Foundation, Malaysia.
Bilkent University, Turkey.
US National Academy of Sciences, USA.
International Islamic Charity Organisation, Kuwait.
Perdana Leadership Foundation, Putrajaya, Malaysia.
Arab Gulf Programme for United Nations Development Organisations (AGFUND), Riyadh, Saudi Arabia.
Fouad Alghanim & Sons Group of Companies, Safat, Kuwait.
Saudi Basic Industries Corporation (SABIC), Riyadh, Saudi Arabia.
World Islamic Call Society, Tripoli, Libya.
Tatarstan Academy of Sciences, Tatarstan, Russian Federation.
Jordan Phosphate Mines Company, Amman, Jordan.
University of Industry of Selangor (UNISEL), Shah Alam, Malaysia.
International Islamic Academy of Science and Biotechnology (IIALSB), Shah Alam, Malaysia.
Ministry of Foreign Affairs of Qatar: The Permanent Committee for Organizing Conference, Qatar.
Doha International Centre for Interfaith Dialogue (DICID), Qatar.
R.B. Suleimenov Institute of Oriental Studies, Kazakhstan.
Prime Ministry of Bangladesh, Bangladesh.
Foreign Ministry of Bangladesh; Bangladesh.
University Grants Commission of Bangladesh, Bangladesh.
Bangladesh Academy of Sciences, Bangladesh.
Sheikh Mohammed bin Hamad Al Thani, Qatar.
Eng. Awni Shaker Al Aseer, Saudi Arabia.
Eng. Amjad Abu Aisheh, Jordan.
Jordan Islamic Bank, Jordan.
Dr Mahmood Abdel Razzak Abu Shaireh, Jordan.

Necmettin Erbakan Üniversitesi, Konya, Turkey.
Turkish Academy of Sciences (TÜBA), Ankara, Turkey.

APPENDIX J

IAS Waqf	IAS Endowment Fund
Islamic World Academy of Sciences Jordan Islamic Bank Shemeisani Branch Account No.: 809/$91 Telephone : +962 6 5677107 Facsimile: +962 6 5691700 PO Box 925997 Amman 11110 Jordan.	Islamic World Academy of Sciences Arab Bank Fifth Circle Branch Account No : 0134/034765-5/710 Telephone : +962 6 5526870 Facsimile: +962 6 5526874 PO Box 141107 Amman Jordan.

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http://www.iasworld.org

Medical Journal of the IAS on the Internet
http://www.medicaljournal-ias.org